TOWARDS EFFECTIVE AI ADOPTION IN HIGHER EDUCATION: A COMPREHENSIVE CONCEPTUAL MODEL

Y. Al-Hammadi [1, *]
A. K. Alhazmi [2]

Received: 03/01/2025
Revised: 10/01/2025
Accepted: 18/01/2025

[1] YonderKen Education, Kaula Lumpur, Malaysia
[2] University of Science and Technology, Aden, Yemen
* Corresponding Author's Email: yousraalhammadi@gmail.com

Towards Effective AI Adoption in Higher Education: A Comprehensive Conceptual Model

Y. Al-Hammadi
YonderKen Education
Kaula Lumpur, Malaysia
yousraalhammadi@gmail.com

A. K. Alhazmi
University of Science and Technology
Aden, Yemen
abdulsalamkaed@gmail.com

Abstract— The adoption of Artificial Intelligence (AI) in higher education has revolutionized student learning and administrative processes. This research explores the key factors that enable the successful integration of AI technologies, addressing gaps in the literature, where most studies have primarily focused on technological aspects. Factors such as digital literacy, cultural acceptance, data availability and quality, funding, infrastructure, user readiness, and ethical and privacy concerns are identified as essential for developing a unified conceptual framework. This study highlights the interdependence of these factors, providing a systematic foundation for AI integration in higher education. Thus, through the inclusion of multiple perspectives on the integration of AI into education, this study develops a multi-perspective model for AI implementation in higher education, serving as a structured theoretical framework for institutions to adopt AI while considering the critical factors affecting its implementation and as a foundational reference for researchers conducting more applied studies on AI integration.

Keywords— Artificial Intelligence (AI), Higher Education, Digital Literacy, User Readiness, Ethical Concerns.

I. INTRODUCTION

The integration of artificial intelligence in higher learning education has enhanced learning and administration. Artificial intelligence is crucial for creating learning environments that can change their content based on the individual need, which in turn increases the effectiveness of education. [1], [2]. Several studies have also stressed the role of AI to enhance learning and teaching processes and organizational effectiveness [3]. Nonetheless, despite significant advancements, the adoption of AI remains a challenge. Studies have identified the challenges for successful AI integration at the individual and institutional level [3], [4]. Although most studies have focused on the technical capabilities and potential benefits of AI in education, few have addressed the complex and interrelated factors that influence its successful implementation [5], [6], [7].

Many factors, such as digital literacy, cultural acceptance, data availability and quality, funding availability, infrastructure, user readiness, and ethical and privacy concerns associated with the integration of AI in higher education, have not been addressed comprehensively. Users of artificial intelligence (AI) in higher education, including both teachers and students, are crucial for the successful implementation of AI in this setting [3]. Users must be willing to engage in AI technologies to enhance learning outcomes [8], [9], [10]. Although AI offers numerous benefits, challenges such as resistance to change, inadequate training, and insufficient digital literacy continue to impede its widespread adoption in educational settings [11], [12]. Furthermore, ethical and privacy concerns as well as cultural acceptance also impact user readiness, which can directly influence AI integration in higher education.

Data availability and quality is considered an important factor in higher education; it has not yet been tested along with other variables, such as shaping user readiness (teacher and students) [13], [14]. Although ethical and privacy concerns of AI have been explored in the past literature, they have not been tested along with the other variables discussed in this study. The potential for bias in AI algorithms and safeguarding sensitive student data are critical issues that require rigorous investigation [15], [16].

In addition, funding affects AI integration, especially infrastructure and technology development, along with scalability and customization. However, the relationship between infrastructure and AI adoption remains unexplored, particularly in diverse educational contexts [17], [18]. Infrastructural requirements are important and effective for the deployment of AI in the higher educational context. Robust infrastructure is a fundamental requirement for supporting AI-driven educational technologies [19], [20]. Disparity in technological infrastructure across institutes can lead to significant challenges in implementing AI, especially in institutes with limited resources [21].

To address this research gap, this study provides a comprehensive analysis of the factors that influence AI adoption in higher learning institutions. The aim is to identify the critical factors that play a central role in the dynamics of AI use in education and integrate them into a single unified framework that is typically lacking in prior literature. This research will help to understand these challenges by considering factors such as digital literacy, cultural acceptance, data availability and quality, funding availability, infrastructure, user readiness, and ethical concerns. This will be one of the initial studies to conceptualize and enable insights into the relationships between these variables and their combined influence on AI adoption. By doing this, the present research endeavors to provide an improved understanding of the interrelationships between the aforementioned factors in terms of implementing AI strategies

that would benefit the overall learning environments in the higher education system.

II. LITERATURE

AI has the ability to play a significant role in education and enhance the students' learning experience [22]. The integration of AI into education emphasizes personalized learning through adaptive technologies [2]. The integration of technology and personalized learning in higher education has become crucial because of rapid pedagogical changes. Personalized learning encompasses both personal and customized strategies. AI has transformed higher education pedagogy, progressing from simple content delivery to the continuous identification of adaptive learning needs. Numerous factors influence personalized learning in higher education, including content quality and AI-derived data quality in pedagogical systems [1]. As [5] states, inconsistent terminology hampers adaptive learning implementation. Defining adaptive learning is challenging owing to the various technologies involved. Adaptive learning technologies aim to scale personalized learning by assessing skills, providing feedback, and monitoring progress with real-time tools; creating individualized paths based on strengths, weaknesses, and learning pace; and offering instructors timely feedback tools and data [5]. The research [23] described adaptive systems as understanding learners' needs and adjusting their behavior. An adaptive learning environment monitors user activities, interprets them using domain-specific models, and infers user needs and preferences.

According to [24], various technological and non-technological factors such as learners' abilities, support systems, and learning outcomes play a significant role in shaping adaptive learning. Moreover, the distribution of outcomes, content, and data quality is critical for integrating AI and enhancing learning in higher education. Conducting a comprehensive review of the existing literature on adaptive AI models is essential for gaining a better understanding of Personalized Learning Experiences (PLE) and their determinants.

A. Funding Availability

Advancements in artificial intelligence have facilitated the creation of personalized teaching models that cater to individual learning capacities in higher education, resulting in improved student performance [25]. However, developing adaptable AI models that meet the diverse needs of students and institutions requires significant capital, time, and resources. These costs include hiring experts such as data scientists, AI researchers, and developers, as well as expenses for hardware, software, integration with educational technologies, and teacher training [26], [27], [28], [29]. Moreover, the ongoing maintenance and sustainable use of AI pose financial challenges [30]. Institutions with limited budgets may be unable or unwilling to invest in AI technology, further exacerbating these issues [9].

To address these financial barriers, innovative funding models such as public-private partnerships, grants, and government subsidies are required to ensure access to AI-based learning technologies. Adequate government funding is crucial for institutions to maximize the potential of AI in areas such as lecture planning, curriculum efficiency, and student readiness [31]. This study proposes that, by overcoming these financial constraints, higher education institutions can harness the full potential of AI to improve teaching and learning outcomes.

***H1**: Funding availability affects infrastructure and technology in higher education.*

***H2**: Funding availability affects the scalability and customization of AI technologies in higher education.*

B. Government Policies

Governments play a crucial role in promoting AI through supportive policies and regulations [32]. Funding research, providing tax incentives, and enacting favorable policies can further AI integration in education [33]. Developed countries, such as those in the EU, have initiated AI implementation, with the Horizon 2020 program investing significantly in AI research, including educational technologies, to foster innovation in learning contexts.

Effective and ethical AI implementation in education requires national and international policies that comply with data-protection regulations and educational standards. Luckin and Holmes [34] suggest these policies should include funding for AI research, adoption incentives, and educator training. For instance, the US has a national educational technology plan that emphasizes AI integration.

Challenges in implementing AI-supportive education policies include incoherence, poor coordination, insufficient funding, and the slow pace of policy development compared to the rapid advancement of AI [35]. In addition, political, economic, and social disparities across regions hinder implementation. A robust policy and regulatory framework is essential to address technical, ethical, cultural, and resource challenges and to realize the potential of AI in higher education [36].

***H3**: Government policies impact funding availability in higher education.*

C. Infrastructure and Technology

Infrastructure is crucial for technological integration, development, and productivity enhancement [19]. Broadband Internet has a transformative impact on education, highlighting its role in enhancing infrastructure [20]. Smart grids optimize sustainability and service delivery [37]. Research has emphasized the importance of infrastructure in technology adoption, education, connectivity, and affordability [17], [18]. Robust infrastructure supports diverse systems in higher education institutions, including learning platforms [38], enterprise resource planning [39], cloud computing technologies [40], and AI applications and tools [22] to enhance student engagement, participation, collaboration, interaction, and progress monitoring. Brazilian higher education dropout rates depend on adequate technological infrastructure and continuous teacher training [41]. Maximizing AI's potential requires institutional infrastructure improvements [36]. Infrastructure is needed to support skill acquisition in Saudi Arabia [42]. Despite AI's potential benefits, its adoption in higher education is limited due to infrastructure gaps [43]. Effective personalized learning depends on a robust technological infrastructure, ensuring access to necessary tools and resources, and

supporting tailored learning approaches. Without proper infrastructure, integrating AI into education and realizing its potential to revolutionize personalized learning and teaching is challenging.

H4*: Infrastructure and technology impact AI integration in higher education.*

D. Scalability and Customization

Scalability enables AI solutions to manage more users and increasingly complex entities, thereby meeting the rising demands of education. AI systems can cater to various subjects, learning methods, and educational levels through customization, making them vital for institutions to handle diverse student groups without compromising educational quality. Flexibility supports AI integration in higher education, adapts to users' evolving needs, and improves outcomes while efficiently using resources to develop related techniques [44]. Scalability also involves managing users and supporting large-scale personalized learning, with AI's capacity to tailor learning materials that are crucial for enhancing academic performance [45]. Individualized learning experiences through AI improve students' learning effectiveness [46]. ChatGPT can handle multiple tasks simultaneously, respond effectively to natural language input, aid self-directed students, and promote open education. AI's customized support and feedback can boost motivation and engagement with the subject matter [47]. Hence, scalability is considered to be an important factor in AI integration in higher education. Therefore, it is hypothesized that:

H5*: Scalability and Customization Impact AI Integration in Higher Education*

E. User Readiness

User readiness is critical for effective AI integration in education, encompassing preparedness, willingness, and the ability to engage with AI technologies. Teacher Training and Readiness for AI Integration: Successful AI implementation requires trained staff. Yue et al. [33] found that teachers' readiness and attitudes toward AI are crucial for their preparedness. Kessler [8] highlights the need for educators to stay updated on AI advancements and their educational uses. Teacher preparedness significantly influences the effective use of AI tools in schools. Author [48] noted that university teachers, while understanding AI, need support to effectively integrate it into their teaching. Scherer and Teo [11] emphasized ongoing professional development and support for sustained AI integration in education. At King Faisal University, faculty members showed average AI readiness, influenced by their perceptions of its benefits, attitudes, intentions to use it, and supportive conditions [49]. Researchers [50] stressed enhancing teachers' professional levels through AI, with support systems showing promising results in predicting indicators of teacher education.

Integrating AI into education, including Case-Based Reasoning (CBR) [3], is challenging. Barriers include limited access to quality training, insufficient professional development, and resistance to change. Addressing these requires accessible, flexible training, fostering a continuous learning culture, and promoting AI benefits through peer support and success stories while ensuring equitable access to technology and training [51].

AI learning tools personalize lessons, identify learning styles, administer tests, and provide feedback, leading to improved learning and increased engagement [52], [53], [54]. AI incorporates technology and data science to understand student learning behaviors to improve teaching and learning [55]. Technology enhances engagement and promotes deeper learning and retention [56]. Tech-savvy students who favor AI benefit from personalized lessons and achieve better academic outcomes [57]. However, student preference for AI tools does not always correlate with improved performance [58]. Digital proficiency and literacy programs are vital for preparing students [10], [59]. Digital literacy is crucial for student readiness and AI integration, and familiarity is essential for effective utilization [57]. Teaching methods, such as GenAI, simplify AI comprehension and application [60]. Programs focusing on critical thinking, problem solving, and technological skills prepare students for AI integration and should be incorporated into the curriculum.

Factors hindering students' AI readiness include ethical concerns and data privacy [61]. Addressing these issues involves ensuring universal technological access, digital literacy training, and a supportive learning environment. Robust systems and data security are crucial due to the risks associated with handling personal information in AI systems [62].

F. Digital Literacy

Integrating digital skills into curricula is essential for students to effectively utilize AI tools. Research has highlighted the importance of practical digital literacy programs that immerse students in AI technology. Buckingham (2015) asserts that embedding these skills into education prepares students for the contemporary tech landscape. AI tools, when implemented effectively and ethically, enhance students' educational performance, engagement, and academic success in higher education [54]. Although AI tools improve motor skill learning outcomes [64] and support personalized learning experiences [65], they do not replace traditional academic writing courses, which remain vital for teaching irreplaceable skills. Additionally, the use of technology, including AI, correlates with better academic performance and computer literacy among elementary students [66]. Based on the literature, the following hypothesis is proposed.

H6*: Digital Literacy impacts User Readiness*

G. Cultural Acceptance

Cultural acceptance is vital for AI, with education as the primary focus. Regional perceptions and AI implementation methods vary, thus affecting successful integration. Various cultural constraints impede AI incorporation into educational systems. For instance, acceptance issues affect adaptive AI in university students [67]. Researcher [68] emphasized the significance of cultural and contextual factors in AI's educational use. Thus, cultural attitudes profoundly impact AI self-learning models that are intended to enhance students' learning experiences.

In many Western nations, AI is seen as a tool for innovation and educational enhancement, becoming culturally ingrained. For example, parts of Europe have extensively integrated AI into classrooms to create personalized learning environments. Research indicates that

these regions value technological advancement and individualized learning paths [69]. Students and educators perceive AI as improving learning efficiency and effectiveness by tailoring the content to individual needs and pace. Conversely, [70] identified the challenges in AI adoption in specific cultural contexts. For instance, Nigerian academic libraries face resistance to change and lack a supportive culture, mirroring broader cultural attitudes toward AI in education.

AI integration in traditional education systems often elicits skepticism regarding its impact on pedagogical values and the teacher's role despite offering personalized learning opportunities [71], [72]. Technological disparities, especially in developing countries with limited access to affordable internet and modern technologies, may hinder AI adoption. Moreover, [73] emphasized the digital divide between the global North and South, highlighting the challenges faced by students and academics in less-developed regions due to inadequate infrastructure and AI resources.

Social influence significantly impacts attitudes toward AI in education, which is crucial for its acceptance in higher education [74]. Collectivist cultures rely on collective opinions, whereas individualistic societies depend on personal experiences for decision-making. Sallam et al. [75] found that positive social perceptions, reduced risk perceptions, and decreased anxiety influenced ChatGPT adoption among higher education students. Cultural factors are critical when implementing adaptive AI models in higher education learning analytics [76]. Educator guidelines should address ethical considerations and cultural relevance in AI integration [77] and align AI design with cultural values, beliefs, and educational practices. AI systems should be adapted to local teaching models to address cultural issues. For example, in cultures where teachers have significant authority, AI should enhance rather than replace teachers, respect norms, and improve tool implementation. AI acceptance in education is tied to cultural factors and requires an understanding of these aspects to foster an inclusive environment for new technologies in higher education. This leads to the following hypothesis.

***H7**: Cultural acceptance impacts user readiness.*

H. Ethical and Privacy Concerns

Safeguarding information is crucial in the current technological era. Privacy is defined as freedom from interference from others [78]. Concerns about security and privacy significantly influence user adoption of new technologies. The increasing use of digital tools has led to a higher volume of collected data, necessitating robust data-protection measures to address privacy and security concerns. [79] emphasized the need for educational institutions to establish comprehensive data governance policies covering data collection, storage, sharing, and disposal. Key measures, such as data encryption, anonymization, and access control, should be well defined and integrated into protection protocols. Despite the benefits of AI in education, careful implementation of safe practices is vital to prevent overreliance on convenience at the expense of privacy. [16] examined the ethical and societal impacts of sharing educational data online, suggesting enhanced data privacy through better data management training. Privacy remains a significant concern, necessitating the overcoming of technical, ethical, and cultural barriers [36].

Well-designed and well-implemented AI can mitigate bias and ensure equal opportunities for all learners. Bias in AI systems stems from biased training data, flawed algorithms, and poor implementation of best practices. [80] called for cautious AI deployment owing to data privacy and algorithmic bias concerns, while [81] highlighted ethical issues in Moroccan universities. Ensuring fairness in AI-powered educational models requires extensive testing and validation using a wide range of diverse datasets. [12] emphasized the need for transparency in AI decision-making to help users identify and mitigate biases. AI algorithms in education often exhibit ethnic, gender, and economic biases, thus underscoring the need for transparency and accountability. Accountability ensures that AI developers and deployers share responsibility and address critical security and privacy concerns in AI-based educational systems. The inclusion of diverse stakeholder perspectives in AI development promotes equitable educational systems by balancing insights [82]. Teaching ethical data practices to students is essential for fostering reliable AI to enhance learning. AI also poses challenges like reduced academic integrity and creativity [83].

Therefore, this study hypothesizes the following.

***H8**: Ethical and privacy concerns impact user readiness.*

***H9**: User readiness impacts the data availability and quality.*

***H10**: User readiness impacts AI integration in higher education.*

I. Data Availability and Quality

Data quality and availability are essential for effective integration of AI in higher education. Originally defined by [84] as "fitness for use," data quality indicates its suitability for specific applications, such as ensuring that AI-enhanced learning systems produce dependable results. Moreover, the data should be user-friendly to meet personalized learning objectives. Research on data quality often involves intuitive, theoretical, and empirical methods [13], [85].

[86] used an ontological approach to identify data quality attributes based on contradictions between real-world observations and their representations in information systems. In contrast, [87] employed an empirical approach to gather data from consumers to identify essential attributes for data fitness, emphasizing customer behavior patterns, real-time market responsiveness, and data-driven market efficiency. The empirical approach captures direct user feedback, potentially revealing overlooked attributes, although these findings may not always be verified through fundamental principles [88]. High-quality data are crucial for AI accuracy and reliability in personalized learning in higher education, enabling precise algorithm decisions and enhancing graduation rates [89]. Data availability and quality also impact AI effectiveness in improving education quality, teaching, learning, and streamlining administrative tasks [14], [90], [91]. Consequently, it can be hypothesized that

***H11**: Data availability and quality impact AI integration in higher education.*

J.Policy and Regulatory Framework

AI implementation in higher education requires suitable policies and regulations [92] to personalize learning experiences [93]. Schools must provide resources for effective AI use, including access to technology, teacher training, and innovative teaching methods [94], [95]. Investing in AI infrastructure and establishing robust support and policies are crucial for successful technological integration [96], with school leaders driving innovation and facilitating the adoption of new technologies, such as AI.

Compliance with local and international data protection and educational standards is essential for the ethical and effective application of AI in education [97]. Adhering to regulatory frameworks concerning data protection and privacy underpins responsible AI use in higher education and improves digital competence. The General Data Protection Regulation (GDPR) in Europe addresses data protection, impacting the handling of sensitive educational data by AI systems. Extensive data requirements raise concerns regarding data collection, storage, and use. [98] advocated for stringent privacy guidelines for educational institutions using technologies. Compliance is crucial for protecting student information and maintaining their trust in AI systems. AI developers and educational institutions must align with these laws to safeguard student privacy and avoid legal liability [99], [100]. AI systems in education must adhere to educational standards and learning objectives to protect educational and privacy rights and serve users' best interests [101]. The rapid adoption of AI in higher education necessitates governance [32] and strategic integration that addresses quality and privacy through appropriate policies [102].

Government policies and regulatory frameworks are vital for balancing innovation with ethical and responsible technology use in education. Based on the literature, several recommendations can improve the policy and regulatory frameworks for AI in education. These include:

- Developing comprehensive national AI strategies that focus on education. This ensures coordination and coherence among different policy initiatives to avoid fragmentation [35].
- It provides adequate funding and resources for AI research, development, and implementation in education [34].
- Promoting stakeholder involvement in policy development ensures that policies are inclusive and address the needs of all affected parties [103].

Effective AI implementation in education needs vigorous policy and regulatory frameworks, supportive government policies, regulatory compliance, and clear institutional guidelines. Addressing the challenges and opportunities within these frameworks requires coordinated efforts from various stakeholders. Based on a detailed literature review, the following hypothesis can be formulated:

***H12**: Policies and regulatory frameworks impact the integration of AI in higher education.*

Therefore, the framework shown in Figure 1 was developed based on the factors mentioned in the literature and supported by the theories mentioned in the next section.

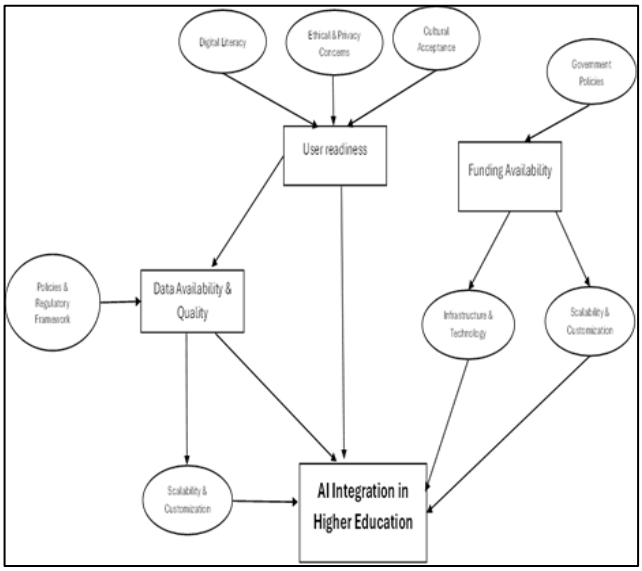

Fig. 1. Conceptual Model showing factors affecting AI Integration in Higher Education.

III. Theoretical Foundations of the Study

This study was supported by two key theories. 1) The Unified Theory of Acceptance and Use of Technology (UTAUT) and 2) Technology Acceptance Model (TAM). According to Venkatesh et al. [104], the Unified Theory of Acceptance and Use of Technology, social influence, performance expectancy, effort expectancy, and facilitating conditions are the key factors in technology acceptance. Performance expectancy encompasses AI technology that offers exceptional outcomes, including improved student engagement and enhanced teacher performance. The significance of digital literacy and user-friendly AI tools in higher education is highlighted by the concept of effort expectancy, which focuses on the perceived ease of technology use. Social influence plays a significant role in shaping attitudes towards technology adoption, including AI adoption in academia. The availability of technological support is a critical factor in facilitating adoption. Higher education institutions must provide conducive conditions, while government policies should support AI integration. The study also employs the Technology Acceptance Model (TAM) framework, focusing on perceived ease of use and perceived usefulness as key drivers of technology adoption [105]. Perceived usefulness involves the belief that AI will boost learning and teaching efficacy, underscoring AI's potential to enhance personalized learning and educational outcomes. Perceived ease of use considers the simplicity of interacting with AI technologies, digital literacy programs, and ongoing training to enhance accessibility and effectiveness.

IV. Methodology

This study adopts a conceptual research approach, which is well-suited for identifying key concepts and their dimensions in AI integration in higher education. Conceptual research aims to develop models that provide a comprehensive understanding of a phenomenon; in this case, the implementation of AI technologies in higher education.

This methodology involved examining peer-reviewed journal articles, conference proceedings, books, and authoritative reports from educational and technological organizations to gather diverse perspectives on AI adoption in higher education.

A. Inclusion Criteria for the Literature Review

The literature review systematically identifies and evaluates relevant research to construct a coherent theoretical framework. The key inclusion areas are:

1. Applications of AI in Education—Investigating how AI technologies enhance educational outcomes, personalize learning experiences, and optimize administrative efficiency.
2. Factors Influencing AI Integration—Examining key elements such as data quality, infrastructure, educator and student preparedness, and ethical considerations essential for effective AI integration in higher education.
3. Challenges of AI Adoption—Identifying barriers such as resistance to change, insufficient digital literacy, and budget constraints that hinder AI implementation.

The current study adopts the conceptual research approach, which is quite suitable where the focus is on the identification of the concept and its different dimensions with regard to AI integration in higher education. Hence, conceptual research aims at making models to give a noble account of a phenomenon; in this case, the implementation of AI technologies in influenced higher learning contexts. This research method involved examining peer-reviewed journal articles, conference proceedings, books, and authoritative reports from educational and technological organizations to gather diverse perspectives on the factors that influence the adoption of AI in higher education.

V. Discussion

The successful integration of AI technology in higher education can ensure transformative development in educational pedagogy and improve student engagement and performance by developing a personalized learning environment. AI technology offers numerous benefits to higher education yet remains underutilized due to various constraints and challenges. To fully harness its potential, it is essential to address these issues. The integration of AI into higher education is a complex, multifaceted process influenced by multiple factors. Understanding these factors can help stakeholders navigate challenges and leverage opportunities presented by AI. This study focuses on exploring all the potential factors that directly or indirectly affect AI integration in higher education. A literature review identified user readiness, data availability and quality, and funding availability as the main factors affecting AI integration. Additionally, cultural acceptance, ethical and privacy concerns, and digital literacy affect user readiness. Whereas user readiness and policies and regulatory frameworks impact data availability and quality. Government policies affect funding availability, which in turn affects scalability and customization and infrastructure and technology. The study also hypothesizes that Scalability and Customization and Infrastructure and Technology impact AI integration in higher education.

The integration of AI in higher education presents a complex challenge, as illustrated by various factors identified in this study. The established comprehensive framework underscores the interplay between digital literacy, cultural acceptance, data availability and quality, funding, infrastructure, user readiness, and ethical and privacy concerns. These elements are essential for determining the successful implementation of AI technology in educational contexts.

Effective AI integration in education depends on user readiness, which includes both teachers and students. This study identifies digital literacy, ethical and privacy concerns, and cultural acceptance as key factors. Enhancing user readiness through comprehensive training and support systems is crucial. Ethical and privacy issues, such as biases in AI algorithms and the protection of sensitive student data, pose significant barriers. Transparent and equitable AI systems that uphold ethical standards and data privacy are essential to gaining user trust and ensuring responsible AI applications. Digital literacy is a fundamental requirement for educators and students. Without adequate digital skills, the benefits of AI remain unrealized. The existing literature underscores the need for ongoing professional development and digital literacy programs tailored to specific institutional and cultural contexts [8], [9], [10]. In addition, cultural acceptance significantly affects AI adoption. Positive attitudes towards AI among educators and students facilitate smoother integration, especially in technologically receptive regions. Thus, promoting positive cultural attitudes through awareness campaigns and inclusive policies is necessary for AI adoption.

Data availability and quality are crucial for AI systems that depend on large volumes of accurate data for effective operation. This study highlights the need for robust data management practices to ensure the reliability and accuracy of data used by AI technologies. This factor is closely linked to user readiness, as educators and students must trust the security and accuracy of data.

Funding availability considerably affects AI integration, especially in infrastructure and technology development. Insufficient financial resources impede institutions' capacity to implement and maintain AI technologies, confirming prior studies on the importance of strategic investments in AI infrastructure [19], [20]. The connection between funding and scalability requires long-term financial planning for sustainable AI integration. Physical and technological infrastructure are vital to AI-driven educational technologies, and disparities across institutions can obstruct AI adoption. A robust and dependable infrastructure is essential for deploying and operating AI systems, particularly in resource-constrained environments.

This study underscores the group of interrelated factors that influence AI integration in higher education. By thoroughly examining these elements, this study provides a comprehensive view of the challenges and opportunities of AI adoption. The insights gained can inform strategies to address these issues effectively and ensure successful AI implementation in higher education.

VI. Implications and Contributions

This study provides significant contributions to the field of educational technology and AI integration by constructing a comprehensive framework for AI adoption in higher education. Its implications extend across theoretical, policy, institutional, and technological dimensions, offering valuable insights for researchers, policymakers, educational administrators, and technology developers.

A. Theoretical Contributions:

Developing the model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM), this study constructs a framework that identifies the critical factors influencing AI adoption in higher education. The conceptual framework highlights performance expectancy, effort expectancy, social influence, and facilitating conditions, providing a strong foundation for future empirical research. Additionally, by integrating multiple factors—such as data quality, infrastructure, readiness, and ethical considerations—rather than analyzing them in isolation, this study advances a more holistic and nuanced understanding of AI adoption, paving the way for further theoretical developments in educational technology.

B. Policy Implications:

From a policy perspective, this study serves as a foundational reference for policymakers, emphasizing the need for well-defined regulations that support responsible AI adoption in education. It highlights key areas requiring attention, including data protection, ethical concerns, and distributive justice, to ensure AI is deployed in a manner that benefits all stakeholders equitably.

C. Institutional Implications:

Educational administrators can utilize these findings to enhance institutional preparedness for AI integration. This includes strengthening technological support systems, ensuring accurate data collection, and fostering professional development for educators and students. Institutions that encourage adaptability and innovation will be better positioned to optimize AI's potential in education, ultimately improving teaching effectiveness and student learning experiences.

D. Technological Implications

For technology developers, this study emphasizes the importance of designing AI systems that align with the needs of educators and learners. A user-centric approach, combined with a strong focus on ethical and privacy considerations during development, testing, and validation, is essential for ensuring trust, adoption, and effective AI implementation in educational settings. Ensuring AI systems are transparent, explainable, and adaptable to diverse educational needs will enhance their acceptance and usability.

VII. Directions for Future Research

Given the conceptual nature of this study, future research should focus on empirically testing and expanding the proposed framework through case studies, longitudinal studies, and cross-cultural comparisons. Specific areas requiring further exploration include ethical and privacy considerations in AI adoption, the effectiveness of teacher and student training programs, and the role of institutional policies in shaping AI implementation. Investigating these aspects will contribute to the ongoing development of AI as a transformative tool in higher education.

VIII. Future Research Directions

Further research should focus on testing and expanding the proposed conceptual framework through empirical studies and case analyses that allow for quantitative comparisons. Longitudinal studies could provide deeper insights into the evolving dynamics of AI integration in higher education. Additionally, cross-cultural and cross-context comparative analyses would help tailor AI initiatives to specific institutional conditions, enhancing their effectiveness.

A critical gap in existing research is the examination of ethical and privacy issues arising from AI use in education. Future studies should focus on developing appropriate recommendations and policies to address data privacy and protection measures in educational settings.

Another essential research area is the development of strategies to enhance teacher and student readiness for AI adoption. Identifying the most effective training programs and professional development opportunities, particularly in digital literacy, is crucial for facilitating AI implementation. Further investigation into existing technologies, such as intelligent tutoring systems and personalized learning environments, could provide valuable insights into their potential applications in education.

Finally, fostering a supportive institutional environment is key to AI integration. Future research should explore the role of policies, regulations, and international standards in shaping AI adoption in educational institutions. Examining policy initiatives and their impact on organizational adoption will help identify the best strategies for ensuring ethical and effective AI implementation. Addressing these research directions will contribute to making AI a transformative tool for global educational advancement.

IX. Conclusion

The integration of artificial intelligence (AI) in higher education offers personalized learning, reduced administrative burdens, and context-sensitive teaching. This study constructs a framework identifying key factors essential for successful AI implementation, including data quality, IT infrastructure, teacher and student preparedness, and ethical and privacy concerns.

By highlighting the intricate relationships between these factors, the study presents a comprehensive perspective on AI adoption in educational contexts, incorporating multiple viewpoints to ensure a well-rounded understanding. The theoretical foundations of the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM) have been instrumental in explaining technology adoption dynamics in higher education. This research addresses gaps in prior studies by

considering the multifaceted influences on AI integration, which have often been overlooked.

Beyond theoretical advancements, this framework provides structured guidelines for policymakers, educational administrators, and technology developers to support AI adoption in practice. By fostering a more effective, efficient, and ethically responsible approach to AI integration, this study aims to enhance the learning experience and institutional preparedness for AI-driven transformations in higher education.

X. References

[1] L. Chen, P. Chen, and Z. Lin, "Artificial Intelligence in Education: A Review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020, doi: 10.1109/ACCESS.2020.2988510.

[2] D. L. Taylor, M. Yeung, and A. Z. Bashet, "Personalized and Adaptive Learning," in *Innovative Learning Environments in STEM Higher Education*, 2021, pp. 17–34, doi: 10.1007/978-3-030-58948-6_2.

[3] S. Sallu, S. M. Novdin, P. Bambang, Y. Herliansyah, and M. A. Manuhutu, "Learning in Higher Education Based on Artificial Intelligence (AI) with Case Based Reasoning (CBR)," *Journal of Namibian Studies: History Politics Culture*, vol. 34, pp. 1049–1064, 2023.

[4] X. O'Dea and M. O'Dea, "Is Artificial Intelligence Really the Next Big Thing in Learning and Teaching in Higher Education? A Conceptual Paper," *Journal of University Teaching and Learning Practice*, vol. 20, no. 5, May 2023, doi: 10.53761/1.20.5.05.

[5] T. Cavanagh, B. Chen, R. A. M. Lahcen, and J. Paradiso, "Constructing a Design Framework and Pedagogical Approach for Adaptive Learning in Higher Education: A Practitioner's Perspective," *The International Review of Research in Open and Distributed Learning*, vol. 21, no. 1, pp. 172–196, Jan. 2020, doi: 10.19173/IRRODL.V21I1.4557.

[6] Z. Chen and B. Liu, "Lifelong Machine Learning," *Synthesis Lectures on Artificial Intelligence and Machine Learning*, pp. 1–125, 2017, doi: 10.1017/9781139061773.016.

[7] A. J. Moreno-Guerrero, J. López-Belmonte, J. A. Marín-Marín, and R. Soler-Costa, "Scientific development of educational artificial intelligence in web of science," *Future Internet*, vol. 12, no. 8, p. 124, Jul. 2020, doi: 10.3390/FI12080124.

[8] G. Kessler, "Technology and the future of language teaching," *Foreign Language Annals*, vol. 51, no. 1, pp. 205–218, Mar. 2018, doi: 10.1111/flan.12318.

[9] N. Selwyn, "Making sense of young people, education and digital technology: The role of sociological theory," *Digital Technologies in the Lives of Young People*, pp. 81–96, Oct. 2016, doi: 10.4324/9781315779577-6.

[10] W. Ng, "Can we teach digital natives digital literacy?," *Computers and Education*, vol. 59, no. 3, pp. 1065–1078, Nov. 2012, doi: 10.1016/j.compedu.2012.04.016.

[11] R. Scherer and T. Teo, "Unpacking teachers' intentions to integrate technology: A meta-analysis," *Educational Research Review*, vol. 27, pp. 90–109, Jun. 2019, doi: 10.1016/j.edurev.2019.03.001.

[12] A. D. Selbst, D. Boyd, S. A. Friedler, S. Venkatasubramanian, and J. Vertesi, "Fairness and abstraction in sociotechnical systems," in *FAT* 2019 - Proceedings of the 2019 Conference on Fairness, Accountability, and Transparency*, pp. 59–68, Jan. 2019, doi: 10.1145/3287560.3287598.

[13] R. Y. Wang and D. M. Strong, "Beyond accuracy: What data quality means to data consumers," *Journal of Management Information Systems*, vol. 12, no. 4, pp. 5–34, 1996, doi: 10.1080/07421222.1996.11518099.

[14] A. F. Markus, J. A. Kors, and P. R. Rijnbeek, "The role of explainability in creating trustworthy artificial intelligence for health care: A comprehensive survey of the terminology, design choices, and evaluation strategies," *Journal of Biomedical Informatics*, vol. 113, p. 103655, Jan. 2021, doi: 10.1016/j.jbi.2020.103655.

[15] D. W. Joyce, A. Kormilitzin, K. A. Smith, and A. Cipriani, "Explainable artificial intelligence for mental health through transparency and interpretability for understandability," *npj Digital Medicine*, vol. 6, no. 1, pp. 1–7, Jan. 2023, doi: 10.1038/s41746-023-00751-9.

[16] A. Olteanu, C. Castillo, F. Diaz, and E. Kıcıman, "Social Data: Biases, Methodological Pitfalls, and Ethical Boundaries," *Frontiers in Big Data*, vol. 2, no. 13, p. 456527, Jul. 2019, doi: 10.3389/fdata.2019.00013.

[17] A. Lahiya and S. Mokodenseho, "Examining the Relationship between Technological Infrastructure and the Quality of Online Education Programs," *West Science*

Interdisciplinary Studies, vol. 1, no. 02, pp. 74–83, Feb. 2023, doi: 10.58812/WSIS.V1I2.90.

[18] M. K. Shahid, A. A. Khin, L. C. Seong, O. H. M. Alkharabsheh, and Y. Arfat, "Examining the factors affecting technology continuance and its role in economic growth of emerging economies," *Brazilian Journal of Development*, vol. 10, no. 3, p. e67831, Mar. 2024, doi: 10.34117/bjdv10n3-013.

[19] D. A. Aschauer, "Is public expenditure productive?," *Journal of Monetary Economics*, vol. 23, no. 2, pp. 177–200, Mar. 1989, doi: 10.1016/0304-3932(89)90047-0.

[20] K. Toyama, "Technology as amplifier in international development," in *ACM International Conference Proceeding Series*, pp. 75–82, 2011, doi: 10.1145/1940761.1940772.

[21] N. Warraich, N. Caidi, B. Mehra, C. Ekmekcioglu, and I. Ali, "Digital Inequalities to Digital Inclusion in Online Learning: Viewpoints of LIS Educators Seeking to Bridge the Disparities," *Proceedings of the Association for Information Science and Technology*, vol. 60, no. 1, pp. 850–852, Oct. 2023, doi: 10.1002/pra2.876.

[22] A. K. Alhazmi, F. Alhammadi, A. A. Zain, E. Kaed, and B. Ahmed, "AI's Role and Application in Education: Systematic Review," in *Lecture Notes in Networks and Systems*, 2023, doi: 10.1007/978-981-19-7660-5_1.

[23] A. Mavroudi, M. Giannakos, and J. Krogstie, "Supporting adaptive learning pathways through the use of learning analytics: developments, challenges and future opportunities," *Interactive Learning Environments*, vol. 26, no. 2, pp. 206–220, Feb. 2018, doi: 10.1080/10494820.2017.1292531.

[24] H. Xie, H.-C. Chu, G.-J. Hwang, and C.-C. Wang, "Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017," *Computers & Education*, vol. 140, p. 103599, Oct. 2019, doi: 10.1016/j.compedu.2019.103599.

[25] T. Kabudi, I. Pappas, and D. H. Olsen, "AI-enabled adaptive learning systems: A systematic mapping of the literature," *Computers and Education: Artificial Intelligence*, vol. 2, p. 100017, 2021, doi: 10.1016/j.caeai.2021.100017.

[26] W. Holmes, "The Unintended Consequences of Artificial Intelligence and Education," *Education International*, Oct. 2023.

[27] A. Delgado, L. Wardlow, K. O'Malley, and K. McKnight, "Educational Technology: A Review of the Integration, Resources, and Effectiveness of Technology in K-12 Classrooms," *Journal of Information Technology Education: Research*, vol. 14, pp. 397–416, 2015, doi: 10.28945/2298.

[28] R. Nishant, M. Kennedy, and J. Corbett, "Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda," *International Journal of Information Management*, vol. 53, p. 102104, Aug. 2020, doi: 10.1016/j.ijinfomgt.2020.102104.

[29] P. Westwood, *Inclusive and adaptive teaching: Meeting the challenge of diversity in the classroom*, 2nd ed. Routledge, 2018, doi: 10.4324/9781351061261.

[30] T. Chklovski, R. Jung, and K. Young, "Engaging families in a 10-week, AI global competition," in *Proceedings of the 2nd ACM SIGSOFT International Workshop on Education through Advanced Software Engineering and Artificial Intelligence*, in ESEC/FSE '20, ACM, Nov. 2019, doi: 10.1145/3412453.3423199.

[31] N. J. Ogunode and C. U. Ukozor, "Curriculum Revolution in Higher Education: The Mighty Role of Artificial Intelligence," *Indonesian Journal of Innovation Studies*, vol. 25, Sep. 2023, doi: 10.21070/ijins.v25i.971.

[32] A. Taeihagh, "Governance of artificial intelligence," *Policy and Society*, vol. 40, no. 2, pp. 137–157, Apr. 2021, doi: 10.1080/14494035.2021.1928377.

[33] M. Yue, M. S.-Y. Jong, and D. T. K. Ng, "Understanding K–12 teachers' technological pedagogical content knowledge readiness and attitudes toward artificial intelligence education," *Education and Information Technologies*, Mar. 2024, doi: 10.1007/s10639-024-12621-2.

[34] R. Luckin and W. Holmes, *Intelligence Unleashed: An argument for AI in Education*. UCL Knowledge Lab, 2016.

[35] N. Selwyn, *Should robots replace teachers?: AI and the future of education*. John Wiley & Sons, 2019.

[36] K. S. Tarisayi, "Strategic leadership for responsible artificial intelligence adoption in higher education," *CTE Workshop Proceedings*, vol. 11, pp. 4–14, Mar. 2024, doi: 10.55056/cte.616.

[37] M. Shahidehpour, Z. Li, and M. Ganji, "Smart cities for a sustainable urbanization: Illuminating the need for establishing smart urban infrastructures," *IEEE*

Electrification Magazine, vol. 6, no. 2, pp. 16–33, Jun. 2018, doi: 10.1109/mele.2018.2816840.

[38] A. K. Alhazmi, A. Imtiaz, F. Al-Hammadi, and E. Kaed, "Success and Failure Aspects of LMS in E-Learning Systems," *International Journal of Interactive Mobile Technologies*, vol. 15, no. 11, pp. 133–147, Jun. 2021, doi: 10.3991/ijim.v15i11.20805.

[39] A. K. Alhazmi, N. Alsakkaf, M. Motahar, and G. Alqubati, "ERPs in Higher Education Institutions: Motivations, Challenges, and Success Factors," *Journal of Science and Technology*, vol. 27, no. 2, pp. 1–8, Mar. 2023, doi: 10.20428/jst.v27i2.2051.

[40] A. K. Alhazmi, "Cloud Adoption in HEIs: A Multi-Theoretical Framework Integrating TOE, TRA, and FVT," *Journal of Science and Technology*, vol. 29, no. 1, pp. 1–10, Jul. 2024, doi: 10.20428/jst.v29i1.2359.

[41] M. B. das N. Meroto et al., "Combating school dropout with Artificial Intelligence in Brazilian higher education," *CONTRIBUCIONES A LAS CIENCIAS SOCIALES*, vol. 17, no. 2, p. e5182, Feb. 2024, doi: 10.55905/revconv.17n.2-147.

[42] N. S. Alotaibi and A. H. Alshehri, "Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Institutions—The Potential of AI-Based Learning Outcomes," *Sustainability*, vol. 15, no. 13, p. 10723, Jul. 2023, doi: 10.3390/su151310723.

[43] X. O'Dea and M. O'Dea, "Is Artificial Intelligence Really the Next Big Thing in Learning and Teaching in Higher Education? A Conceptual Paper," *Journal of University Teaching and Learning Practice*, vol. 20, no. 5, May 2023, doi: 10.53761/1.20.5.05.

[44] S. Siminto, A. Akib, H. Hasmirati, and D. S. Widianto, "Educational Management Innovation by Utilizing Artificial Intelligence in Higher Education," *al-fikrah: Jurnal Manajemen Pendidikan*, vol. 11, no. 2, p. 284, Dec. 2023, doi: 10.31958/jaf.v11i2.11860.

[45] S. G. Abdujabbarovna, "The Importance of Artificial Intelligence in Modern Media Education Technologies in Institutions of Higher Education," *International Journal of Current Science Research and Review*, vol. 06, no. 12, Dec. 2023, doi: 10.47191/ijcsrr/v6-i12-50.

[46] N. Bobro, "APPLICATION OF ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION INSTITUTIONS: FOREIGN EXPERIENCE," *Three Seas Economic Journal*, vol. 5, no. 1, pp. 19–23, Apr. 2024, doi: 10.30525/2661-5150/2024-5-3.

[47] M. Firat, "How Chat GPT Can Transform Autodidactic Experiences and Open Education?," Jan. 2023, doi: 10.31219/osf.io/9ge8m.

[48] A. Shirin, "Artificial Intelligence Technology on Teaching-Learning: Exploring Bangladeshi Teachers' Perceptions," *Embedded Selforganising Systems*, vol. 9, no. 4, pp. 3–9, Nov. 2022, doi: 10.14464/ess.v9i4.553.

[49] B. N. M. Alnasib, "Factors Affecting Faculty Members' Readiness to Integrate Artificial Intelligence into Their Teaching Practices: A Study from the Saudi Higher Education Context," *International Journal of Learning, Teaching and Educational Research*, vol. 22, no. 8, pp. 465–491, Aug. 2023, doi: 10.26803/ijlter.22.8.24.

[50] H. Deng, W. Jia, and D. Chai, "Discussion on Innovative Methods of Higher Teacher Education and Training Based on New Artificial Intelligence," *Security and Communication Networks*, vol. 2022, pp. 1–10, Aug. 2022, doi: 10.1155/2022/3899413.

[51] H. Rakuasa, "Integration of Artificial Intelligence in Geography Learning: Challenges and Opportunities," *Sinergi International Journal of Education*, vol. 1, no. 2, pp. 75–83, Aug. 2023, doi: 10.61194/education.v1i2.71.

[52] A. W. Fazil, M. Hakimi, A. K. Shahidzay, and A. Hasas, "Exploring the Broad Impact of AI Technologies on Student Engagement and Academic Performance in University Settings in Afghanistan," *RIGGS: Journal of Artificial Intelligence and Digital Business*, vol. 2, no. 2, pp. 56–63, Jan. 2024, doi: 10.31004/riggs.v2i2.268.

[53] E. Mousavinasab, N. Zarifsanaiey, S. R. N. Kalhori, M. Rakhshan, L. Keikha, and M. G. Saeedi, "Intelligent tutoring systems: a systematic review of characteristics, applications, and evaluation methods," *Interactive Learning Environments*, vol. 29, no. 1, pp. 142–163, Dec. 2018, doi: 10.1080/10494820.2018.1558257.

[54] N. Abbas, I. Ali, R. Manzoor, T. Hussain, and M. H. A. L. i Hussain, "Role of Artificial Intelligence Tools in Enhancing Students' Educational Performance at Higher Levels," *Journal of Artificial Intelligence, Machine Learning and Neural Network*, no. 35, pp. 36–49, Aug. 2023, doi: 10.55529/jaimlnn.35.36.49.

[55] G.-J. Hwang, H. Xie, B. W. Wah, and D. Gašević, "Vision, challenges, roles and research issues of Artificial

Intelligence in Education," *Computers and Education: Artificial Intelligence*, vol. 1, p. 100001, 2020, doi: 10.1016/j.caeai.2020.100001.

[56] E. Lee and M. J. Hannafin, "A design framework for enhancing engagement in student-centered learning: own it, learn it, and share it," *Educational Technology Research and Development*, vol. 64, no. 4, pp. 707–734, Jan. 2016, doi: 10.1007/s11423-015-9422-5.

[57] K. Seo, J. Tang, I. Roll, S. Fels, and D. Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning," *International Journal of Educational Technology in Higher Education*, vol. 18, no. 1, Oct. 2021, doi: 10.1186/s41239-021-00292-9.

[58] N. Moussa, R. Bentoumi, and T. Saali, "Promoting Student Success with Neutrosophic Sets: Artificial Intelligence and Student Engagement in Higher Education Context," *International Journal of Neutrosophic Science*, vol. 23, no. 1, pp. 238–248, 2024, doi: 10.54216/ijns.230121.

[59] M. Spante, S. S. Hashemi, M. Lundin, and A. Algers, "Digital competence and digital literacy in higher education research: Systematic review of concept use," *Cogent Education*, vol. 5, no. 1, p. 1519143, Jan. 2018, doi: 10.1080/2331186x.2018.1519143.

[60] A. O. Tzirides et al., "Combining human and artificial intelligence for enhanced AI literacy in higher education," *Computers and Education Open*, vol. 6, p. 100184, Jun. 2024, doi: 10.1016/j.caeo.2024.100184.

[61] T. K. Vashishth, V. Sharma, K. K. Sharma, B. Kumar, R. Panwar, and S. Chaudhary, "AI-Driven Learning Analytics for Personalized Feedback and Assessment in Higher Education," in *Using Traditional Design Methods to Enhance AI-Driven Decision Making*, IGI Global, 2024, pp. 206–230, doi: 10.4018/979-8-3693-0639-0.ch009.

[62] L. Huang, "Ethics of Artificial Intelligence in Education: Student Privacy and Data Protection," *Science Insights Education Frontiers*, vol. 16, no. 2, pp. 2577–2587, Jun. 2023, doi: 10.15354/sief.23.re202.

[63] D. Buckingham, "Defining digital literacy - What do young people need to know about digital media?," *Nordic Journal of Digital Literacy*, vol. 10, no. Jubileumsnummer, pp. 21–35, Oct. 2015, doi: 10.18261/issn1891-943x-2015-jubileumsnummer-03.

[64] K. Anam, M. Sadli, and H. Wijaya, "Analysis of Artificial Intelligence (AI) Utilization for Improving Motor Skills Learning Outcomes among Elementary School Teacher Education (PGSD) Students," *DIAJAR: Jurnal Pendidikan dan Pembelajaran*, vol. 3, no. 2, pp. 202–209, 2024, doi: 10.54259/diajar.v3i2.2492.

[65] R. Hasibuan and A. Azizah, "Analyzing the Potential of Artificial Intelligence (AI) in Personalizing Learning to Foster Creativity in Students," *Enigma in Education*, vol. 1, no. 1, pp. 6–10, 2023, doi: 10.61996/edu.v1i1.2.

[66] J. Dixon and L. Shen, "Technology-Integrated Curriculum and Students' Academic Performance," in *Handbook of Research on Technology Tools for Real-World Skill Development*, pp. 96–131, Jan. 2016, doi: 10.4018/978-1-5225-5519-3.ch005.

[67] S. Rizvi, B. Rienties, J. Rogaten, and R. Kizilcec, "Culturally adaptive learning design," in *Open World Learning*, Routledge, 2022, pp. 103–115, doi: 10.4324/9781003177098-9.

[68] C. H. Flores-Velásquez et al., "A Bibliometric Review of Studies about the Acceptance of Artificial Intelligence Technologies in Teaching and Learning in Higher Education," *International Journal of Learning, Teaching and Educational Research*, vol. 23, no. 3, pp. 275–292, Mar. 2024, doi: 10.26803/ijlter.23.3.14.

[69] Srite and E. Karahanna, "The Role of Espoused National Cultural Values in Technology Acceptance," *MIS Quarterly*, vol. 30, no. 3, p. 679, 2006, doi: 10.2307/25148745.

[70] S. A. Akinola, "Capabilities and Apparent Implications of Artificial Intelligence (AI) Adoption in Nigerian Academic Libraries," *University Library at a New Stage of Social Communications Development. Conference Proceedings*, no. 8, pp. 283–289, Dec. 2023, doi: 10.15802/unilib/2023_293813.

[71] L. A. de O. Lima et al., "Education 4.0 and the application of Artificial Intelligence (AI) in teaching," in *Navigating through the knowledge of education*, Seven Editora, 2024, doi: 10.56238/sevened2024.002-044.

[72] V. Singh and S. Ram, "Impact of Artificial Intelligence on Teacher Education," *Shodh Sari-An International Multidisciplinary Journal*, vol. 03, no. 01, pp. 243–266, Jan. 2024, doi: 10.59231/sari7669.

[73] N. Warraich, N. Caidi, B. Mehra, C. Ekmekcioglu, and I. Ali, "Digital Inequalities to Digital Inclusion in Online Learning: Viewpoints of LIS Educators Seeking to Bridge the Disparities," *Proceedings of the Association for Information*

Science and Technology, vol. 60, no. 1, pp. 850–852, Oct. 2023, doi: 10.1002/pra2.876.

[74] C. S. Chai, P. Y. Lin, M. S. Y. Jong, Y. Dai, T. K. F. Chiu, and B. Huang, "Factors Influencing Students' Behavioral Intention to Continue Artificial Intelligence Learning," in *Proceedings - 2020 International Symposium on Educational Technology, ISET 2020*, IEEE, Aug. 2020, pp. 147–150, doi: 10.1109/ISET49818.2020.00040.

[75] M. Sallam et al., "ChatGPT Usage and Attitudes are Driven by Perceptions of Usefulness, Ease of Use, Risks, and Psycho-Social Impact: A Study among University Students in the UAE," Feb. 2024, doi: 10.21203/rs.3.rs-3905717/v1.

[76] S. G. Essa, T. Celik, and N. E. Human-Hendricks, "Personalized Adaptive Learning Technologies Based on Machine Learning Techniques to Identify Learning Styles: A Systematic Literature Review," *IEEE Access*, vol. 11, pp. 48392–48409, 2023, doi: 10.1109/access.2023.3276439.

[77] K. Nikolopoulou, "Generative Artificial Intelligence in Higher Education: Exploring Ways of Harnessing Pedagogical Practices with the Assistance of ChatGPT," *International Journal of Changes in Education*, vol. 1, no. 2, pp. 103–111, Apr. 2024, doi: 10.47852/bonviewijce42022489.

[78] J. Leubsdorf and A. F. Westin, "Privacy and Freedom," *Harvard Law Review*, vol. 81, no. 6, p. 1362, Apr. 1968, doi: 10.2307/1339271.

[79] E. Zeide, "Unpacking Student Privacy," in *Handbook of Learning Analytics*, Society for Learning Analytics Research (SoLAR), 2017, pp. 327–335, doi: 10.18608/hla17.028.

[80] S. Ou, "Transforming Education: The Evolving Role of Artificial Intelligence in The Students Academic Performance," *International Journal of Education and Humanities*, vol. 13, no. 2, pp. 163–173, Apr. 2024, doi: 10.54097/cc1x7r95.

[81] G. Moukhliss, K. Lahyani, and G. Diab, "The impact of artificial intelligence on research and higher education in Morocco," *Journal of Education and Learning (EduLearn)*, vol. 18, no. 4, pp. 1292–1300, Nov. 2024, doi: 10.11591/edulearn.v18i4.21511.

[82] K. Holstein, V. Aleven, and N. Rummel, "A conceptual framework for human–AI hybrid adaptivity in education," in *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 12163 LNAI, Springer International Publishing, 2020, pp. 240–254, doi: 10.1007/978-3-030-52237-7_20.

[83] B. B. Khatri and P. D. Karki, "Artificial Intelligence (AI) in Higher Education: Growing Academic Integrity and Ethical Concerns," *Nepalese Journal of Development and Rural Studies*, vol. 20, no. 01, pp. 1–7, Dec. 2023, doi: 10.3126/njdrs.v20i01.64134.

[84] W. E. Deming, *Out of Crisis - Deming's 14 Points for Management*. 2000.

[85] S. Watts, G. Shankaranarayanan, and A. Even, "Data quality assessment in context: A cognitive perspective," *Decision Support Systems*, vol. 48, no. 1, pp. 202–211, Dec. 2009, doi: 10.1016/j.dss.2009.07.012.

[86] R. Zhang, M. Indulska, and S. Sadiq, "Discovering Data Quality Problems: The Case of Repurposed Data," *Business & Information Systems Engineering*, vol. 61, no. 5, pp. 575–593, Jul. 2019, doi: 10.1007/s12599-019-00608-0.

[87] L. M. De Luca, D. Herhausen, G. Troilo, and A. Rossi, "How and when do big data investments pay off? The role of marketing affordances and service innovation," *Journal of the Academy of Marketing Science*, vol. 49, no. 4, pp. 790–810, Aug. 2021, doi: 10.1007/s11747-020-00739-x.

[88] H. Ta, T. L. Esper, A. Rossiter Hofer, and A. Sodero, "Crowdsourced delivery and customer assessments of e-Logistics Service Quality: An appraisal theory perspective," *Journal of Business Logistics*, vol. 44, no. 3, pp. 345–368, Jan. 2023, doi: 10.1111/jbl.12327.

[89] Y. Teng, J. Zhang, and T. Sun, "Data-driven decision-making model based on artificial intelligence in higher education system of colleges and universities," *Expert Systems*, vol. 40, no. 4, Jan. 2022, doi: 10.1111/exsy.12820.

[90] J. E. Chukwuere, "Developing generative AI chatbots conceptual framework for higher education," *arXiv*, Mar. 2024, doi: 10.48550/ARXIV.2403.19303.

[91] W. Liang et al., "Advances, challenges and opportunities in creating data for trustworthy AI," *Nature Machine Intelligence*, vol. 4, no. 8, pp. 669–677, Aug. 2022, doi: 10.1038/s42256-022-00516-1.

[92] P. G. R. de Almeida, C. D. dos Santos, and J. S. Farias, "Artificial Intelligence Regulation: a framework for governance," *Ethics and Information Technology*, vol. 23, no. 3, pp. 505–525, Apr. 2021, doi: 10.1007/s10676-021-09593-z.

[93] C. Stokel-Walker, "AI bot ChatGPT writes smart essays — should professors worry?," *Nature*, Dec. 2022, doi: 10.1038/d41586-022-04397-7.

[94] M. Jiang, "The Impact and Potential of Educational Technology: A Comprehensive Review," *Research and Advances in Education*, vol. 2, no. 7, pp. 32–49, Jul. 2023, doi: 10.56397/rae.2023.07.05.

[95] A. Raman and R. Thannimalai, "Importance of Technology Leadership for Technology Integration: Gender and Professional Development Perspective," *SAGE Open*, vol. 9, no. 4, p. 215824401989370, Jul. 2019, doi: 10.1177/2158244019893707.

[96] N. Selwyn, "Making sense of young people, education and digital technology: the role of sociological theory," *Oxford Review of Education*, vol. 38, no. 1, pp. 81–96, Feb. 2012, doi: 10.1080/03054985.2011.577949.

[97] P. Maznev, C. Stützer, and S. Gaaw, "AI in higher education: Booster or stumbling block for developing digital competence?," *Zeitschrift für Hochschulentwicklung*, vol. 19, no. 1, Mar. 2024, doi: 10.21240/zfhe/19-01/06.

[98] P. Prinsloo and S. Slade, "An evaluation of policy frameworks for addressing ethical considerations in learning analytics," in *ACM International Conference Proceeding Series*, in LAK '13, ACM, Apr. 2013, pp. 240–244, doi: 10.1145/2460296.2460344.

[99] K. Drabiak, S. Kyzer, V. Nemov, and I. El Naqa, "AI and machine learning ethics, law, diversity, and global impact," *The British Journal of Radiology*, vol. 96, no. 1150, May 2023, doi: 10.1259/bjr.20220934.

[100] K. Tripathi and U. Mubarak, "Protecting Privacy in the Era of Artificial Intelligence," *SSRN Electronic Journal*, 2020, doi: 10.2139/ssrn.3560047.

[101] D. Mhlanga, "Open AI in Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning," in *Sustainable Development Goals Series*, Springer Nature Switzerland, 2023, pp. 387–409, doi: 10.1007/978-3-031-37776-1_17.

[102] B. George and O. Wooden, "Managing the Strategic Transformation of Higher Education through Artificial Intelligence," *Administrative Sciences*, vol. 13, no. 9, p. 196, Aug. 2023, doi: 10.3390/admsci13090196.

[103] L. Floridi et al., "AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations," *Minds and Machines*, vol. 28, no. 4, pp. 689–707, Nov. 2018, doi: 10.1007/s11023-018-9482-5.

[104] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly*, vol. 27, no. 3, p. 425, 2003, doi: 10.2307/30036540.

[105] F. D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, vol. 13, no. 3, p. 319, Sep. 1989, doi: 10.2307/249008.