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Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications

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The increasing prevalence of Artificial Intelligence (AI) in higher education underscores the necessity to explore its implications on ethical, social, and educational dynamics within the sector. This study aims to comprehensively investigate the impact of AI on higher education in Saudi Arabia, delving into stakeholders' attitudes, perceptions, and expectations regarding its implementation. The research hones in on key facets of AI in higher education, encompassing its influence on teaching and learning, ethical and social implications, and the anticipated role of AI in the future. Employing a quantitative approach through an online survey questionnaire ($N = 1113$), this study reveals positive attitudes toward AI in higher education. Stakeholders recognize its potential to enhance teaching and learning, streamline administration, and foster innovation. Emphasis is placed on ethical considerations and guidelines for AI implementation, highlighting the imperative need to address issues such as privacy, security, and bias. Participants envision a future characterized by personalized learning experiences, ethically integrated AI, collaboration, and ongoing support for lifelong learning. Furthermore, the results illuminate the intricate interplay between AI usage, purposes, difficulties, and their impact on attitudes, perceptions, and future implications. Accordingly, the research underscores the necessity for a comprehensive understanding of AI integration, considering not only its technical aspects but also the ethical, social, and educational dimensions. By acknowledging the role of AI uses, AI usage purposes, and addressing associated difficulties, educational stakeholders can work towards harnessing the benefits of AI while ensuring responsible and effective implementation in teaching and learning contexts.

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Introduction

Artificial Intelligence (AI) has become a transformative force, reshaping various industries such as communication systems, software applications, data storage, business operations, analytics, interactive platforms, cybersecurity, and social media (Al-Zahrani, 2023; Creely, 2022; Doncieux et al. 2022). Recent advancements in AI have profoundly impacted multiple aspects of life, including education and business. These advancements have fundamentally altered how we think, learn, operate, and thrive in an increasingly intelligent and interconnected world (Doncieux et al. 2022; Hassan et al. 2022; Jiang and Pang, 2023; Kuo et al. 2021; Vendraminelli et al. 2022; Zheng et al. 2023). Molenaar (2022) notes an ongoing fusion between humans and AI, resulting in the emergence of hybrid systems.

AI technologies have the potential to personalize learning experiences, automate administrative tasks, reduce workloads, offer instant feedback, tailor courses to individual progress, enhance student engagement, and optimize decision-making (Al-Zahrani, 2024a; Chu et al. 2022; Dai and Ke, 2022; McKinsey and Company, 2022; UNESCO, 2021; Zheng et al. 2023). While the adoption of AI-powered tools in higher education initially progressed slowly, educators anticipate a future increase in their usage (McKinsey and Company, 2022).

In the realm of higher education, AI holds promise for addressing significant challenges and driving innovation in teaching and learning practices (Al-Zahrani, 2023; Al-Zahrani, 2024a; Chu et al. 2022; Dai and Ke, 2022; McKinsey and Company, 2022; UNESCO, 2021). Educational settings, increasingly embracing AI technologies, include intelligent tutoring systems, adaptive learning platforms, chatbots, automated grading systems, and data analytics tools (Hassan et al. 2022; Jiang and Pang, 2023; Kuo et al. 2021; Vendraminelli et al. 2022; Zhao et al. 2022). To unlock these potential benefits, stakeholders in higher education and beyond must possess fundamental AI literacy to interact effectively with AI technology (Laupichler et al. 2022).

However, alongside these benefits, AI in higher education introduces several challenges and concerns, such as data privacy and security (Al-Zahrani, 2024b; Carmody et al. 2021; Elliott and Soifer, 2022), algorithmic bias and discrimination (Bigman et al. 2022; Johnson, 2021; Kordzadeh and Ghasemaghahi, 2021; Wang et al. 2022), and various ethical considerations (Farisco et al. 2020; Kerr et al. 2020; Owe and Baum, 2021; Resseguier and Rodrigues, 2020; Ryan and Stahl, 2020; Stahl et al. 2021).

The research on AI in higher education is a dynamic and ever-evolving field. As AI gains prominence, it becomes essential to explore its impact on the educational, ethical, and social dynamics of the sector (e.g., Al-Zahrani, 2024b; Chu et al. 2022; Dai and Ke, 2022; Zawacki-Richter et al. 2019). A significant knowledge gap exists regarding how various stakeholders in higher education, including students, faculty, and administrators, perceive the use of AI and envision its future role in the sector. Therefore, this study aims to thoroughly examine and understand the impact of AI on higher education, focusing on the following key aspects:

1. Attitudes and perceptions of students, faculty, and administrators: Investigating their attitudes, beliefs, and perspectives towards AI in higher education, exploring their concerns and expectations.
2. Impact on teaching and learning: Exploring how AI influences teaching and learning processes, assessing potential benefits and drawbacks in enhancing instructional approaches, personalizing learning experiences, and improving academic outcomes.
3. Ethical and social implications: Examining ethical considerations and social implications arising from AI

implementation, including data privacy, algorithmic bias, fairness, transparency, and accountability.

4. Envisioned role of AI: Gaining insights into stakeholders' visions for the future role of AI in higher education, exploring their expectations, aspirations, and concerns regarding integration and expansion.

By addressing these objectives, the study contributes to the understanding of AI's impact on higher education and sheds light on the ethical, social, and educational dynamics that emerge. The research questions provide a framework to explore various aspects of AI in higher education, aligning with the study's aim and scope:

- RQ1: What are participants' attitudes and perceptions towards the implementation of AI in higher education?
- RQ2: What is the role of AI in teaching and learning in higher education?
- RQ3: What ethical and social implications arise from the implementation of AI in higher education?
- RQ4: How do participants envision the future role of AI in higher education?
- RQ5: How do participants' demographic characteristics impact their perspectives in terms of the ethical, social, and educational dynamics associated with AI implementation?

The remainder of this manuscript is organized as follows: Literature review presents a comprehensive review of the existing literature, covering key research areas related to AI in higher education, including pedagogical innovations, learning analytics and student support, assessment and grading, educators' professional development, and ethical and social implications. Significance and novelty of the research describes the methodological approach employed in this study, detailing the research design, data collection procedures, and analytical methods. Methodology sheds light on the significance and novelty of this study, highlighting its holistic and comprehensive investigation of the multifaceted impact of AI on higher education. Results presents the study's findings, organized according to the research questions, offering insights into participants' attitudes and perceptions, the role of AI in teaching and learning, ethical and social implications, and envisioned future roles. Discussion provides a detailed discussion of the findings, situating them within the broader context of AI in higher education and drawing connections to existing literature. The final two sections (Conclusions and implications & Limitations and future research) conclude the manuscript by highlighting the study's contributions, implications, limitations, and recommendations for future research.

Literature review

Research examining the impact of AI on higher education has witnessed substantial growth in recent years, as highlighted by notable studies (Al-Zahrani, 2023; Al-Zahrani, 2024a; Bozkurt et al. 2021; Chu et al. 2022; Dai and Ke, 2022; Laupichler et al. 2022; Zawacki-Richter et al. 2019). Scholars from diverse fields, including education, computer science, psychology, and ethics, have explored various facets of AI implementation in higher education settings. Chu et al. (2022) scrutinized the top 50 AI studies in higher education from the Web of Science (WoS) database. Their analysis revealed a prevalent focus on predicting learners' learning status, particularly dropout and retention rates, student models, and academic achievement. However, there is a noticeable lack of emphasis on higher-order thinking skills, collaboration, communication, self-efficacy, and AI skills in higher

education studies (Chu et al. 2022). Laupichler et al. (2022) stress that research on AI in higher education is still in its early stages, necessitating refinement in defining AI literacy and determining appropriate content for non-experts to enhance their understanding of AI. This literature review provides an overview of key research areas and offers insights into existing knowledge.

Pedagogical innovations. One pivotal research domain explores the pedagogical implications of AI in higher education, recognizing its potential to revolutionize the educational process and enhance efficiency (Al-Zahrani, 2023; Al-Zahrani, 2024a; Kuleto et al. 2021; Zheng et al. 2023). AI integration in transnational higher education, including distance and online education, holds the promise of improving efficiencies and transforming management, administration, student recruitment, and pedagogical processes, leading to enhanced sustainability and development (El-Ansari, 2021). Huang (2018) emphasizes AI's role in innovating education, noting its ability to transform learning interactions from machine-focused to knowledge-centered approaches based on learner needs.

Numerous studies delve into how AI-powered technologies, such as intelligent tutoring systems and adaptive learning platforms, enhance personalized learning experiences, promote student engagement, and improve academic outcomes (Al-Zahrani, 2023; Al-Zahrani, 2024a; Chu et al. 2022; Dai and Ke, 2022). Kuleto et al.'s (2021) findings demonstrate the significance of AI in improving learning outcomes, particularly in enhancing students' skills, promoting collaborative learning, and providing a more accessible research environment. Additionally, Seo et al. (2021) highlight the potential of incorporating AI systems in online learning to facilitate personalized learner-instructor interactions on a large scale. Kochmar et al. (2022) present experimental results showing that AI tutoring systems lead to significant overall improvements in student performance outcomes.

Furthermore, AI has the potential to transform higher education by enhancing teaching and learning, improving assessment and feedback, increasing access and retention, reducing costs and time, and supporting administration and management (Abdous, 2023; Al-Zahrani, 2024a; Bates et al. 2020; Chu et al. 2022; Popenici and Kerr, 2017; UNESCO, 2021). Almaiah et al.'s (2022) study suggests a positive inclination towards integrating AI into educational environments, attributing it to AI being recognized as an innovative teaching tool. Huang (2018) observes positive effects of AI teaching systems on environmental education for college students.

Moreover, AI can revolutionize social interactions within higher educational settings, impacting learners, teachers, and technological systems (Al-Zahrani, 2023; Al-Zahrani, 2024a; Dai and Ke, 2022). Crown et al. (2011) demonstrate the positive impact of an interactive chatbot on engineering students' engagement and motivation. Essel et al. (2022) find that students engaging with a virtual teaching assistant (chatbot) show improved academic performance. Kumar (2021) observes the positive impacts of chatbots on learning performance and teamwork.

Learning analytics and student support. AI's potential for innovation in education is prominent in the realm of learning analytics and student support. There has been a shift towards utilizing student data and analytics to enhance the educational experience and improve learning outcomes (André Renz, 2021; Huang et al. 2021; Zheng et al. 2023). AI technologies enable real-time analysis of vast amounts of data not limited to students' learning but about their emotions as well, offering advantages in

identifying at-risk students, recommending personalized interventions, and facilitating timely feedback and assessment (Zhi Liu et al. 2024; X. Liu et al. 2023). Learning analytics and AI-driven student support systems can provide actionable insights to educators and enhance student success (André Renz, 2021; MET, 2022; Ouyang et al. 2023; Gallagher, 2020).

For example, Dong and Hu's (2019) study successfully identified contextual factors differentiating high-achieving and low-achieving students in reading literacy using machine learning techniques. Li et al.'s (2022) optimized AI-based genetic algorithm grouping method for collaborative groups in higher education outperformed traditional grouping methods. Ouyang et al. (2023) utilized AI algorithms and learning analytics to analyze groups' collaboration patterns in online interaction settings.

Assessment and grading. AI's role in automating assessment and grading processes is another significant area of interest. Scholars investigate the reliability and validity of AI-based grading systems, comparing them to traditional human grading methods, and explore the potential benefits and limitations of automated grading (Lockwood, 2014; CTL, 2023; CUPA, 2023; McNulty, 2023; Chen, 2023). AI in assessment, including Natural Language Processing (NLP) and plagiarism detection, can automate grading, reduce workload, and enable data-driven decision-making (Lockwood, 2014; CTL, 2023; CUPA, 2023; McNulty, 2023; Chen, 2023).

While the potential benefits of AI in assessment and grading are significant, it's also important to consider its practical applications and impact on student outcomes. For instance, Susilawati et al.'s (2022) study explored the positive influence of digital assessment and trust on student character and academic performance. Additionally, Hooda et al.'s (2022) examination of AI-driven assessment and feedback practices revealed positive impacts on students' learning outcomes. Learning analytics, in this context, enables higher education institutions to support the learning environment at multiple levels.

Educators' professional development. AI contributes to pedagogical innovation in the domain of educators' professional development. Research explores the implications of AI for educators' professional development, focusing on how AI technologies can support instructors in developing positive perceptions and attitudes, adaptive teaching strategies, and personalized learning experiences (Al-Zahrani, 2023; Al-Zahrani, 2024a; CTL, 2023; Chen, 2023; Seo et al. 2021).

As AI integration in education progresses, it becomes increasingly important to address the concerns and training needs of educators. Educational institutions, policymakers, and AI developers must collaboratively address concerns regarding AI integration and provide the necessary support and training for educators to effectively implement AI technologies in their teaching practices (Al-Zahrani, 2024a).

One example of how AI can be applied to enhance educators' professional development is through the use of machine learning to analyze student feedback. Esparza et al.'s (2018) 'SocialMining' model utilizes machine learning algorithms to enhance teaching techniques based on student comments on teacher performance. Integrating AI into educators' professional development holds promise for improving instructional practices and the overall quality of education, providing targeted support and personalized learning resources.

Ethical and social implications. The ethical and social dimensions of AI in higher education are critical considerations. AI's

Table 1 Summary of Gaps in Existing Literature on AI in Higher Education.		
Research Area	Existing Focus	Identified Gaps
Pedagogical Innovations	<ul style="list-style-type: none">- AI's potential for personalized learning- Enhancing student engagement	<ul style="list-style-type: none">- Higher-order thinking skills- Collaboration and communication
Learning Analytics and Student Support	<ul style="list-style-type: none">- Improving academic outcomes- Identifying at-risk students- Personalized interventions	<ul style="list-style-type: none">- Development of AI skills- Large-scale implementation- Integration with instructional practices
Assessment and Grading	<ul style="list-style-type: none">- Feedback and assessment- Automated grading- Plagiarism detection- Reliability and validity	<ul style="list-style-type: none">- Ethical considerations- Transparency and accountability
Educators' Professional Development	<ul style="list-style-type: none">- Supporting adaptive teaching strategies- Personalized learning resources	<ul style="list-style-type: none">- Addressing concerns about AI integration- Training and support needs
Ethical and Social Implications	<ul style="list-style-type: none">- Privacy and security- Algorithmic bias and fairness- Transparency and accountability	<ul style="list-style-type: none">- Comprehensive exploration of ethical concerns- Societal impact and workforce transformation

advancement introduces ethical challenges and concerns, necessitating further research to explore the social implications of AI, including accountability in AI-mediated practices and its influence on teaching and learning relationships (Al-Zahrani, 2024b; Bearman et al. 2022). Challenges related to privacy, ethics, and morality in AI-driven approaches require interdisciplinary collaborations for comprehensive research and development (Al-Zahrani, 2024b; Hu et al. 2023; Zhang and Aslan, 2021).

Scholars delve into issues of algorithmic bias, discrimination, fairness, transparency, and accountability in AI-driven educational systems (Al-Zahrani, 2024b; UNESCO, 2021; Abdous, 2023; Schiff, 2022). Ethical considerations in deploying AI technologies, ensuring equity and inclusivity, and balancing human instructors' roles with AI tools are explored. The societal impact of AI, including changes in employment patterns and the transformation of the workforce, requires careful consideration (Bates et al. 2020; Popenici and Kerr, 2017; Lo Piano, 2020; Seo et al. 2021; Chen, 2023).

Ethical considerations in integrating AI into everyday environments should be thoroughly addressed (Al-Zahrani, 2024b; Doncieux et al. 2022). This includes examining AI's impact on human life and societies. Dignum (2017) emphasizes the importance of upholding societal values, considering moral and ethical implications, and ensuring transparency in AI reasoning processes. In Seo et al.'s (2021) study, concerns arise regarding responsibility, agency, surveillance, and potential privacy violations by AI systems. Raising awareness about human-centered values and responsible, ethical AI development is crucial in addressing these concerns (Al-Zahrani, 2024b; André Renz, 2021).

Table 1 summarizes the existing focus areas within each research domain related to AI in higher education and highlights the identified gaps that warrant further investigation. These gaps include aspects such as higher-order thinking skills, collaboration and communication, development of AI skills, large-scale implementation of learning analytics, ethical considerations in assessment and grading, addressing educators' concerns and training needs, and a comprehensive exploration of ethical concerns and societal impacts.

Significance and novelty of the research

The novelty of this study lies in its holistic and comprehensive investigation of the multifaceted impact of AI on higher education in Saudi Arabia. It makes a unique contribution by capturing the perspectives of diverse stakeholders, including students, faculty, and administrators, through a robust quantitative approach with a large sample size (N = 1113).

While previous research has explored specific aspects of AI in education, this study offers a comprehensive examination of stakeholders' attitudes, perceptions, and expectations regarding AI implementation. Notably, it delves into the influence of AI on teaching and learning processes. Additionally, it explores the ethical and social implications arising from AI integration—an area that warrants further exploration.

Furthermore, the study sheds light on stakeholders' visions for the future role of AI in higher education, providing valuable insights into their aspirations and concerns. By addressing these objectives within the Saudi Arabian context, the study contributes to the growing body of knowledge on AI in higher education and i.

Methodology

In this study, a quantitative approach was employed using a survey questionnaire to comprehensively explore the multifaceted impact of AI on higher education.

Research design. To gather insights into the attitudes, perceptions, and experiences of students and faculty members regarding AI in higher education, an online survey questionnaire was meticulously developed. The questionnaire comprised two main sections. The first section delved into participant demographics, encompassing age, gender, current occupation, education level, subjective AI expertise, utilized AI tools and services, frequency of usage, and purpose of usage.

The second section of the questionnaire consisted of 32 items designed to explore participants' perspectives on AI in higher education, encompassing attitudes, perceptions, the role of AI in teaching and learning, ethical and social implications, and the envisioned future role of AI. These items were carefully developed based on an extensive review of the literature and aligned with the study's research questions and objectives. The item development process involved identifying relevant constructs and themes, input from subject matter experts, and rigorous refinement to ensure clarity and relevance (see Appendix 1).

Validity and reliability. To ensure the questionnaire's validity, three experts in the educational technology field meticulously reviewed it, providing suggestions and endorsing modifications.

The Cronbach's alpha coefficient, a measure of internal consistency and reliability, was calculated to assess the questionnaire items. For the overall questionnaire, comprising all 32 items in the second section, the responses from the entire sample (N = 1113) were coded and analyzed using SPSS (v. 22). This software computed the average inter-item

Table 2 Reliability Statistics.	
Sub-scale	α
1. Attitudes and Perceptions	0.92
2. Role of AI in Teaching and Learning	0.92
3. Ethical and Social Implications	0.89
4. The Future Role of AI	0.93
Total	0.96

Table 3 Participants Demographics (N = 1,113).			
Group		N	%
Age Group	24 or less	867	77.9
	25 to 34	105	9.4
	35 to 44	96	8.6
	45 or more	45	4.0
Gender	Male	498	44.7
	Female	615	55.3
Current occupation	Student	931	83.6
	Faculty	112	10.1
	Administrator	70	6.3
Education level	Bachelor	946	85.0
	Master	69	6.2
	PhD	98	8.8
Major	Medicine, engineering, or computer science	710	63.8
	Literary, humanities, or education	242	21.7
	Business, commerce, or law	161	14.5
Subjective AI expertise	Low	517	46.5
	Medium	489	43.9
	High	107	9.6
Usage frequency	Rarely	330	29.6
	Monthly	182	16.4
	Weekly	236	21.2
	Daily	365	32.8

correlation among the 32 items and used this to calculate the Cronbach’s alpha coefficient, yielding a robust value of $\alpha = 0.96$. Furthermore, the Cronbach’s alpha was calculated separately for the sub-scales (attitudes and perceptions, role of AI in teaching and learning, ethical and social implications, and the future role of AI), following the same process of analyzing inter-item correlations within each subset of items. Table 2 shows detailed reliability statistics of the survey and its sub-scales.

Sampling. The sampling strategy employed in this study aims to secure a representative sample that mirrors the diversity present in higher education institutions across Saudi Arabia. To achieve this objective, both public and private universities are included, thereby ensuring a comprehensive representation of various institutional contexts. The snowball technique, a method where existing participants recruit future participants from among their acquaintances, is employed to systematically identify participants for the current study.

By incorporating individuals from diverse disciplines, programs, and academic levels, our research endeavors to encompass a wide array of perspectives and experiences concerning the influence of AI in higher education. This inclusivity enhances the generalizability of our findings and contributes to a more thorough comprehension of the topic at hand. In total, a total of 1,113 participants were involved in the study.

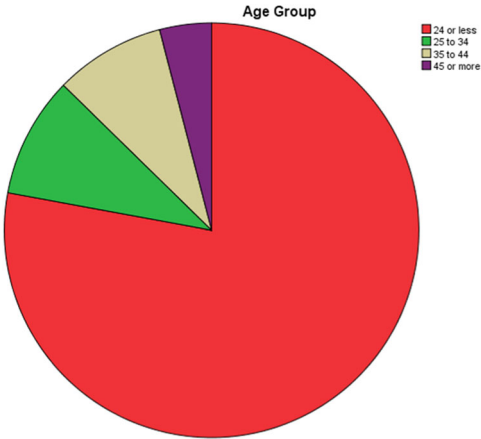


Fig. 1 Sample Distribution based on Age.

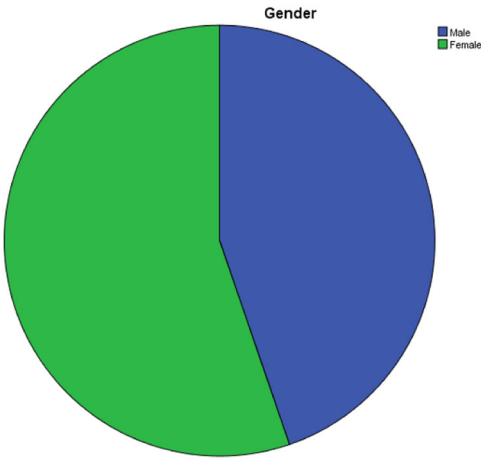


Fig. 2 Sample Distribution based on Gender.

Results

Demographics. Table 3 presents an overview of the demographic characteristics of our study participants.

A significant majority (77.9%) falls within the age bracket of 24 years or younger, with comparatively smaller proportions in older age groups (Fig. 1).

Gender distribution reveals that females constitute a slightly higher percentage (55.3%) than males (44.7%). See Fig. 2.

Examining the current occupations of participants, the predominant group (83.6%) identifies as students, followed by faculty members (10.1%) and administrators (6.3%) as shown in Fig. 3.

Educational attainment varies (Fig. 4), with the majority (85.0%) holding a Bachelor’s degree, while a smaller percentage possess a Master’s degree (6.2%) or a PhD (8.8%).

Participants’ academic pursuits are diverse, with the most prevalent fields of study being Medicine, Engineering, or Computer Science (63.8%), followed by Literary, Humanities, or Education (21.7%), and Business, Commerce, or Law (14.5%). See Fig. 5.

In terms of self-perceived AI expertise, a significant portion (46.5%) rates their proficiency as low, while a slightly smaller percentage (43.9%) considers it to be medium, and a smaller fraction (9.6%) deems their AI expertise as high. See Fig. 6.

Lastly, examining usage frequency, a noteworthy segment of participants (32.8%) engages with AI on a daily basis, while others utilize it on a weekly (21.2%), monthly (16.4%), or infrequent basis (29.6%). See Fig. 7.

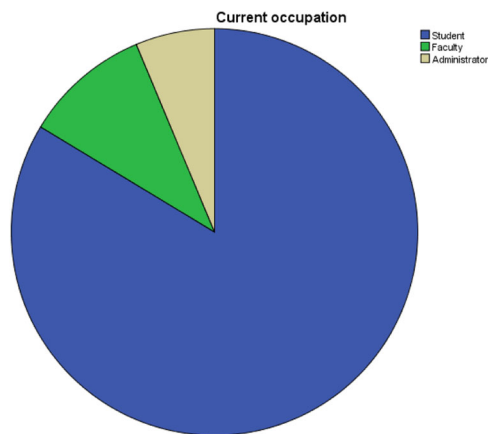


Fig. 3 Sample Distribution based on Occupation.

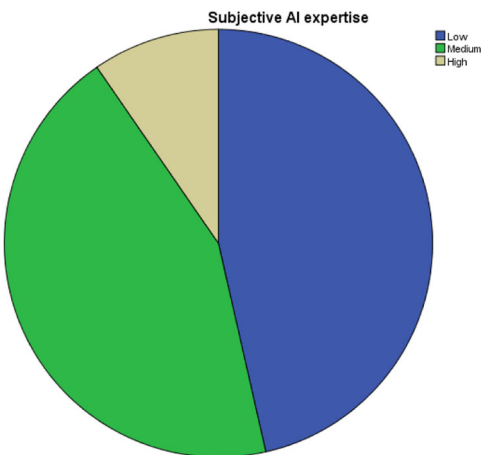


Fig. 6 Sample Distribution based on Subjective AI Expertise.

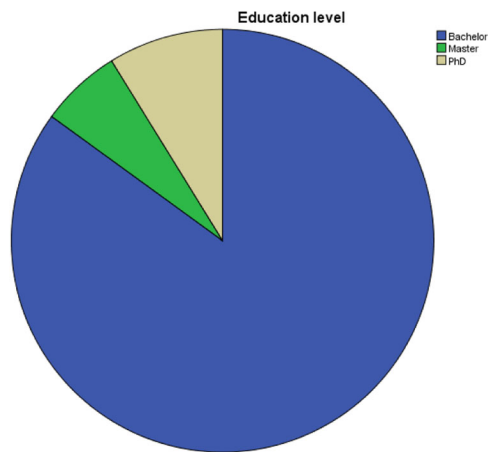


Fig. 4 Sample Distribution based on Education Level.

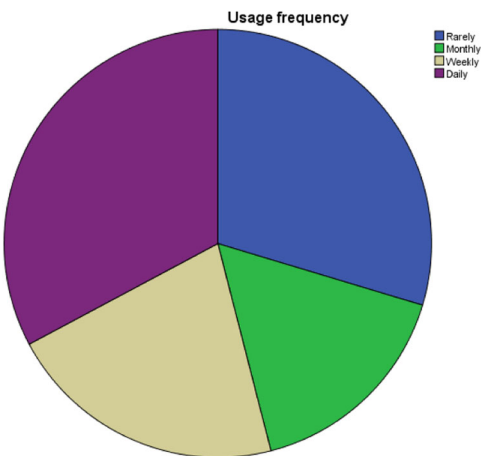


Fig. 7 Sample Distribution based on Usage Frequency.

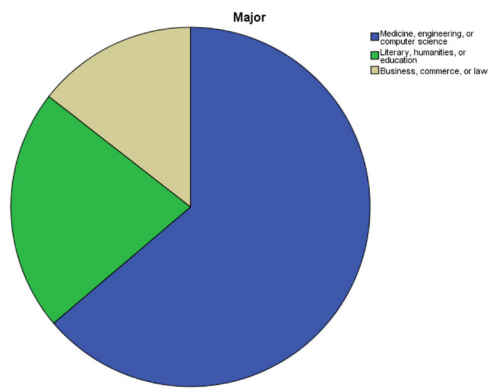


Fig. 5 Sample Distribution based on Major.

Table 4 presents a comprehensive overview of participant evaluations concerning AI tools, their purposes, and encountered negative experiences. When it comes to AI tools and services, face recognition services garnered the highest mean score of 4.32, signifying a positive evaluation among participants. Speech recognition services also received favorable ratings, boasting a mean score of 3.92. AI-Chatting tools obtained a commendable mean score of 3.85, reflecting a positive perception. On the other hand, AI-powered design, and creativity tools, along with Google AI services, received slightly lower mean scores of 3.60 each.

Table 4 AI Tools, Usage Purposes, and Negative Experiences (N = 1113).				
Groups	Items	M	SD	
AI Tools and Services	Face recognition services	4.32	1.11	
	Speech recognition services	3.92	1.18	
	AI-chatting tools	3.85	1.25	
	AI-powered design and creativity tools	3.60	1.37	
Purpose of Usage	Google AI services	3.60	1.30	
	General purposes	4.38	0.80	
	Educational purposes	4.35	0.90	
	Research purposes	4.18	1.06	
	Entertainment purposes	3.96	1.07	
	e-Government purposes	3.49	1.38	
Negative Experiences	Commercial purposes	3.34	1.36	
	Privacy and security issues	3.57	1.25	
	Technical issues during usage	3.35	1.16	
	Technical issues during installation	3.35	1.27	
	Financial costs	3.27	1.30	
	Usage difficulties	3.02	1.27	

Table 5 Attitudes and Perceptions (N = 1113).		
Items	M	SD
1. The use of AI in higher education has the potential to enhance learning experience	4.43	0.84
2. AI can improve access to educational resources and materials	4.42	0.83
3. Integrating AI technologies in higher education can improve student outcomes	4.34	0.90
4. AI can help identify areas where students may need additional support	4.33	0.88
5. AI technologies should be integrated into the curriculum to prepare students for the future workforce	4.33	0.91
6. AI technologies can help optimize administrative processes in higher education institutions	4.32	0.87
7. AI has the potential to revolutionize the way higher education institutions operate	4.25	0.90
8. AI can assist in providing personalized feedback to students	4.19	0.98
Total	4.33	0.71

Table 6 Role of AI in Teaching and Learning (N = 1113).		
Items	M	SD
1. AI has the potential to improve the accessibility of higher education for diverse learners.	4.31	0.83
2. AI technologies have facilitated personalized learning experiences for students.	4.30	0.88
3. AI can help automate administrative tasks, allowing faculty to focus more on teaching.	4.27	0.91
4. AI can help create adaptive learning environments tailored to individual student needs.	4.26	0.90
5. AI can provide real-time insights into student performance, allowing for timely interventions.	4.20	0.95
6. The use of AI in higher education has improved student engagement and participation.	4.15	0.97
7. AI technologies have positively influenced the teaching methods employed by faculty.	4.13	0.981
8. AI can support the development of critical thinking and problem-solving skills in students.	4.10	1.04
Total	4.21	0.75

Table 7 Ethical and Social Implications (N = 1113).		
Items	M	SD
1. Ethical guidelines and regulations should be established to govern the use of AI in higher education	4.47	0.80
2. AI should be developed and used in a manner that respects student autonomy and agency	4.45	0.79
3. AI should be used responsibly to avoid exacerbating societal inequalities	4.42	0.84
4. AI should not replace human interaction and support in the educational process	4.40	0.88
5. AI algorithms should be designed to address potential biases and ensure fairness in higher education	4.37	0.86
6. The use of AI in higher education should prioritize the ethical collection and use of student data	4.33	0.90
7. The use of AI in higher education should be transparent and accountable	4.29	0.88
8. There are concerns about data privacy and security when using AI technologies in higher education	4.24	0.94
Total	4.37	0.64

Examining the purposes of usage, general purposes received the highest mean score of 4.38, indicating strong positive evaluations. Educational purposes were also highly rated, achieving a mean score of 4.35. Research purposes garnered a positive evaluation with a mean score of 4.18, while entertainment purposes scored slightly lower at 3.96. e-Government and commercial purposes obtained lower mean scores of 3.49 and 3.34, respectively.

Delving into negative experiences, privacy and security concerns received a mean score of 3.57, indicating a moderate level of concern among participants. Technical issues during usage and installation both scored mean scores of 3.35, reflecting moderate challenges. Financial costs were rated with a mean score of 3.27, indicating a moderate level of cost-related concerns. Additionally, participants reported usage difficulties, which received a mean score of 3.02, suggesting a moderate level of difficulty encountered.

Attitudes and perceptions towards the use of AI in higher education (RQ1). Table 5 reveals positive attitudes and perceptions towards the use of AI in higher education. Participants recognized AI’s potential to enhance the learning experience, improve access to resources, optimize administrative processes, and revolutionize higher education institutions. The mean scores ranged from 4.43 to 4.19, indicating strong agreement with these

statements. These findings demonstrate participants’ openness and optimism towards integrating AI technologies in higher education.

Role of AI in Teaching and Learning in Higher Education (RQ2). Table 6 highlights participants’ positive perceptions regarding the Role of AI in teaching and learning in higher education. They acknowledged AI’s potential to improve accessibility, facilitate personalized learning experiences, automate administrative tasks, create adaptive learning environments, provide real-time insights into student performance, enhance engagement and participation, influence teaching methods, and support the development of critical thinking and problem-solving skills. The mean scores ranged from 4.31 to 4.10, indicating strong agreement with these statements. Overall, participants recognized the positive effects of AI in higher education settings.

Ethical and social implications of AI in higher education (RQ3). Table 7 reveals participants’ strong agreement regarding the ethical and social implications of using AI in higher education. They emphasized the need for ethical guidelines, respect for student autonomy, avoidance of societal inequalities, preservation of human interaction, addressing biases, prioritizing data ethics, ensuring transparency and accountability, and addressing privacy and security concerns. The mean scores

Table 8 The Future Role of AI (N = 1113).		
Items	M	SD
1. AI can contribute to the development of intelligent tutoring systems.	4.36	0.85
2. The future integration of AI in should prioritize ethical considerations and human values.	4.35	0.89
3. AI will play a significant role in transforming teaching and learning in higher education in the future.	4.33	0.87
4. AI will create new opportunities for collaboration and interdisciplinary research in higher education.	4.30	0.89
5. AI can assist in developing personalized learning pathways for students.	4.28	0.89
6. AI has the potential to enhance the assessment and evaluation processes in higher education.	4.27	0.90
7. AI can help predict and address students' individual learning needs.	4.27	0.91
8. AI can support the development of lifelong learning skills in students.	4.24	0.95
Total	4.30	0.73

Table 9 MANOVA Tests.						
Effect		Value	F	Hypothesis df	Error df	Sig.
Uses	Wilks' Lambda	0.492	2.845	80.000	1154.325	0.000
Purposes		0.547	2.272	84.000	1155.822	0.000
Difficulties		0.614	1.898	80.000	1154.325	0.000

ranged from 4.47 to 4.24, indicating a high level of agreement. Overall, participants recognized the importance of considering ethical and social aspects when integrating AI in higher education.

The future role of AI in higher education (RQ4). Table 8 indicates participants' positive expectations regarding the future role of AI in higher education. They recognized AI's potential to contribute to the development of intelligent tutoring systems, prioritize ethical considerations and human values, transform teaching and learning, foster collaboration and interdisciplinary research, develop personalized learning pathways, enhance assessment processes, address individual learning needs, and support the development of lifelong learning skills. The mean scores ranged from 4.36 to 4.24, indicating a high level of agreement. Overall, participants expressed optimism about the future integration of AI in higher education.

The Impact of Demographic Characteristics on the Participants' Perspectives (RQ5). Multivariate Analysis of Variance tests (MANOVA) were conducted on various factors indicate their significant effects on the variables under consideration. Table 9 provides information on the effect, F-value, Wilks' Lambda, significance level (p-value), and partial eta squared (η^2).

The Multivariate test yielded significant results for the variables total uses, total purposes, and total difficulties. For total uses, the test showed a significant effect (Wilks' Lambda = 0.492, $F = 2.845$, $p < 0.001$, $\eta^2 = 0.163$), indicating that the independent variable(s) have a statistically significant impact on the uses of AI. Similarly, for total purposes, the test revealed a significant effect (Wilks' Lambda = 0.547, $F = 2.272$, $p < 0.001$, $\eta^2 = 0.140$), suggesting that the independent variable(s) significantly influence the purposes of AI. In the case of total difficulties, the test demonstrated a significant effect (Wilks' Lambda = 0.614, $F = 1.898$, $p < 0.001$, $\eta^2 = 0.115$), indicating that the independent variable(s) have a statistically significant impact on the difficulties associated with AI. These findings highlight the importance of the independent variable(s) in shaping attitudes, goals, and challenges related to AI use.

Table 10 presents the results of the tests of between-subjects effects for the variables total uses, total purposes, and total difficulties.

These tests examine the significance of the independent variables on the dependent variables as follows:

1. **For uses:**
 - 11. Uses have a significant impact ($F = 4.570$, $p = 0.000$, $\eta^2 = 0.237$) on attitudes and perceptions.
 - 12. Uses have a significant impact ($F = 4.803$, $p = 0.000$, $\eta^2 = 0.246$) on role of AI in teaching and learning.
 - 13. Uses show a significant impact ($F = 2.035$, $p = 0.006$, $\eta^2 = 0.121$) on ethical and social implications.
 - 14. Uses have a significant impact ($F = 3.713$, $p = 0.000$, $\eta^2 = 0.201$) on future role of AI.
2. **For purposes:**
 - 21. Purposes have a significant impact ($F = 4.870$, $p = 0.000$, $\eta^2 = 0.257$) on attitudes and perceptions.
 - 22. Purposes have a significant impact ($F = 5.177$, $p = 0.000$, $\eta^2 = 0.269$) on role of AI in teaching and learning.
 - 23. Purposes show a significant impact ($F = 2.331$, $p = 0.001$, $\eta^2 = 0.142$) on ethical and social implications.
 - 24. Purposes have a significant impact ($F = 4.086$, $p = 0.000$, $\eta^2 = 0.225$) on future role of AI.
3. **For difficulties:**
 - 31. Difficulties have a significant impact ($F = 2.298$, $p = 0.002$, $\eta^2 = 0.135$) on attitudes and perceptions.
 - 32. Difficulties have a significant impact ($F = 1.980$, $p = 0.008$, $\eta^2 = 0.118$) on role of AI in teaching and learning.
 - 33. Difficulties have a significant impact ($F = 1.676$, $p = 0.036$, $\eta^2 = 0.102$) on future role of AI.

Figure 8 provides a visual representation of these relationships, illustrating how the uses, purposes, and difficulties associated with AI correlate with attitudes, perceptions, and views on the role and future of AI in higher education.

Discussion

This study delves into the repercussions of AI on higher education, scrutinizing its ethical, social, and educational ramifications. It investigates the viewpoints and attitudes of students, faculty, and administrators towards the implementation of AI,

Table 10 Tests of Between-Subjects Effects.							
Source	Total	Type III Sum of Squares	df	Mean Square	F	Sig.	η^2
Uses	Attitudes and perceptions	20.000	20	1.000	4.570	0.000	0.237
	Role of AI in Teaching and Learning	25.766	20	1.288	4.803	0.000	0.246
	Ethical and social implications	10.382	20	0.519	2.035	0.006	0.121
	Future role of AI	19.691	20	0.985	3.713	0.000	0.201
Purposes	Attitudes and perceptions	22.380	21	1.066	4.870	0.000	0.257
	Role of AI in Teaching and Learning	29.161	21	1.389	5.177	0.000	0.269
	Ethical and social implications	12.490	21	0.595	2.331	0.001	0.142
	future role of AI	22.755	21	1.084	4.086	0.000	0.225
Difficulties	Attitudes and perceptions	10.057	20	0.503	2.298	0.002	0.135
	Role of AI in Teaching and Learning	10.622	20	0.531	1.980	0.008	0.118
	future role of AI	8.888	20	0.444	1.676	0.036	0.102

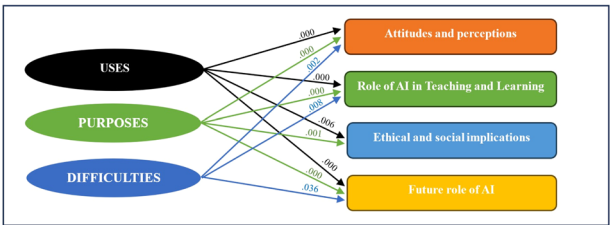


Fig. 8 Summary of Relationships and *p* values.

concentrating on AI’s role in teaching and learning, ethical concerns, and stakeholders’ expectations for its future integration in higher education. The findings contribute valuable insights for stakeholders in higher education, fostering a deeper comprehension of the impact of AI and emphasizing the ethical and educational dimensions of its application.

While a significant portion of participants reported low subjective expertise in AI, a noteworthy percentage indicated daily engagement with AI technologies. This suggests that despite perceiving limited expertise, individuals actively involve themselves with AI in their daily lives (Doncieux et al. 2022; Hassan et al. 2022; Jiang and Pang, 2023; Kuo et al. 2021; Vendraminelli et al. 2022). The increasing popularity of AI technologies among higher education stakeholders is a promising trend.

Results further unveiled positive evaluations of AI tools and services by participants. Face recognition services received the highest rating, followed by speech recognition services and AI-chatting tools like chatbots. This indicates a readiness within higher education to embrace these technologies, building on successful prior research findings, particularly regarding chatbot implementation (Crown et al. 2011; Dai and Ke, 2022; Essel et al. 2022; Kumar, 2021). Conversely, AI-powered design and creativity tools, along with Google AI services, received slightly lower ratings, likely due to the specialized knowledge and expertise required for operation. Participants acknowledge the value of AI for tasks like facial recognition, speech processing, and chatbots, yet there appears to be room for improvement in training and support for advanced AI-powered technologies.

Moreover, participants highly prioritize and value AI for general, educational, research, and entertainment purposes. However, there is slightly lower enthusiasm for AI in e-Government and commercial applications. This might stem from concerns about the perceived lack of impact, or ethical implications and potential risks associated with AI in these contexts, as established in prior research (Al-Zahrani, 2023; Al-Zahrani, 2024a; Farisco et al. 2020; Kerr et al. 2020; Owe and Baum, 2021; Resseguier and Rodrigues, 2020; Ryan and Stahl, 2020; Stahl et al. 2021).

The study also delves into negative experiences associated with AI usage, revealing participants’ moderate concerns about privacy

and security issues. This indicates an awareness of potential risks and implications, especially related to data privacy and security breaches. Robust privacy measures in AI applications are emphasized, aligning with previous research findings (André Renz, 2021; Crawford et al. 2023; Doncieux et al. 2022; Dignum, 2017; Seo et al. 2021; Zhang and Aslan, 2021). Additionally, challenges such as technical issues during usage, installation difficulties, usage problems, and financial costs were moderately reported. These results underscore the need for active administration, improved user interfaces, cost reduction, comprehensive training, and support to enhance the overall user experience of AI technologies.

Participants in the study exhibit positive attitudes and perceptions towards the use of AI in higher education. They recognize AI’s potential to enhance the learning experience, personalize instruction, improve student outcomes, and optimize administrative processes. Improved access to educational resources is also identified as a benefit of AI, enabling students to utilize digital libraries, online databases, and academic materials. This aligns with the broader discourse on technology’s transformative impact in education (Al-Zahrani, 2023; Al-Zahrani, 2024a; Chu et al. 2022; Dai and Ke, 2022; El-Ansari, 2021; Kuleto et al. 2021; Kochmar et al. 2022; Huang, 2018; Seo et al. 2021; Z. Liu et al. 2023).

Furthermore, participants express positive perceptions regarding the role of AI in teaching and learning in higher education. They recognize its potential to improve accessibility, personalize learning experiences, automate administrative tasks, create adaptive learning environments, provide real-time insights into student performance, enhance engagement and participation, influence teaching methods, and support the development of critical thinking and problem-solving skills. These findings highlight the benefits and opportunities that AI brings to the educational process, including equal access to education, tailored instruction, efficient administrative operations, dynamic learning environments, data-driven decision-making, increased student engagement, and the cultivation of higher-order cognitive abilities.

Moreover, participants emphasize the importance of ethical and social implications of AI in higher education, underscoring the need for ethical guidelines to govern AI implementation. This includes respect for student autonomy, avoidance of societal inequalities, preservation of human interaction, addressing biases in AI systems, data ethics, transparency, accountability, and addressing privacy and security concerns. These results align with previous research (Al-Zahrani, 2024b; André Renz, 2021; Crawford et al. 2023; Doncieux et al. 2022; Dignum, 2017; Seo et al. 2021; Zhang and Aslan, 2021).

Participants’ optimism regarding the future role of AI in higher education underscores its significant impact on various aspects of

teaching, learning, and educational processes. This includes the development of intelligent tutoring systems for personalized and adaptive learning experiences, prioritizing ethical considerations and human values, transforming teaching and learning processes, fostering collaboration and interdisciplinary research, developing personalized learning pathways, enhancing assessment processes, addressing specific learning needs, and supporting the development of lifelong learning skills. These findings affirm the positive perceptions, attitudes, and the required ethical considerations identified in the current study, indicating the readiness of higher education to adopt recent advancements in AI technologies and their implications for educational contexts.

MANOVA tests emphasize the significance of total AI uses and total purposes in understanding attitudes, perceptions, and future implications of AI integration in teaching and learning. The results indicate that the extent and purposes of AI usage have notable impacts on various aspects of AI integration, influencing attitudes, perceptions, and perceived future implications. These findings underscore the importance of practical AI implementation in educational settings and its potential to shape individuals' perceptions of AI's role.

Furthermore, the significant effects of total purposes highlight the critical role of intentionality in AI implementation. The purposes for which AI is used in teaching and learning substantially impact attitudes, perceptions, and future implications. This underscores the need for clear goals and careful consideration of the ethical and social implications associated with AI integration.

Lastly, it is noteworthy that total difficulties had a significant influence on attitudes, perceptions, and the future role of AI, although to a lesser extent compared to total uses and total purposes. The difficulties encountered in AI usage are associated with individuals' attitudes and perceptions towards AI, as well as their perspectives on its future role. These findings imply that addressing challenges and providing adequate support in AI implementation can contribute to more positive attitudes and perceptions, leading to effective integration of AI in higher education.

To sum up, these results illuminate the intricate interplay between AI usage, purposes, difficulties, and their impact on attitudes, perceptions, and future implications. They underscore the necessity for a comprehensive understanding of AI integration, considering not only its technical aspects but also the ethical, social, and educational dimensions. By acknowledging the role of AI uses, AI usage purposes, and addressing associated difficulties, educational stakeholders can work towards harnessing the benefits of AI while ensuring responsible and effective implementation in teaching and learning contexts.

Conclusions and implications

This study sheds light on the favorable attitudes and perceptions of stakeholders in higher education towards the adoption of AI. Participants not only acknowledged the value of AI in enriching teaching and learning experiences but also in improving resource accessibility, streamlining administrative processes, and fostering innovation within higher education institutions. Their enthusiasm extended particularly to AI tools and services, such as facial recognition, speech processing, and chatbots. However, they also recognized the imperative for advancements in more sophisticated AI technologies.

Ethical considerations took precedence among participants, underscoring the need for guidelines governing AI implementation. Privacy, security, and bias were identified as critical issues requiring attention. Despite these concerns, there was a prevailing optimism regarding AI's future role in higher education, with participants envisioning personalized learning experiences, ethical AI integration, collaborative endeavors, and ongoing support for lifelong learning.

The study underscores how the utilization, purposes, and challenges of AI influence attitudes, perceptions, and future implications. Exposure and experience with AI emerged as key determinants shaping individuals' perspectives. Aligning AI goals with educational objectives and effectively addressing associated challenges were identified as crucial factors in fostering positive attitudes and perceptions. These findings underscore the necessity for comprehensive implementation strategies, encompassing technical, ethical, social, and educational considerations.

In summary, this research offers insights for stakeholders in higher education, aiding their decision-making processes concerning the ethical and educational ramifications of AI. The study's findings yield several implications for policy and practice in higher education:

1. Develop and implement ethical guidelines for AI integration.
2. Invest in professional development and training programs for faculty, administrators, and students.
3. Provide resources and infrastructure to support AI implementation.
4. Encourage collaboration and interdisciplinary research on AI in education.
5. Address data ethics and privacy concerns in AI implementation.
6. Establish evaluation frameworks to measure the impact of AI.
7. Foster collaborations with industry partners for AI development.
8. Continuously monitor and adapt AI implementations in response to challenges.

Limitations and future research

While this study offers valuable insights into AI's impact on higher education, it is crucial to acknowledge its limitations. First, the study depends on participants' self-reported data, which can be biased and prone to inaccuracies. Their responses may not always align with their actual behaviors or attitudes towards AI. Second, the study may not fully incorporate contextual factors that could influence participants' attitudes and perceptions regarding AI in higher education. Factors like cultural, institutional, or regional differences could impact the findings. Finally, the study concentrates solely on AI's impact on higher education and may not encompass the broader societal implications or perspectives from other sectors.

Future research can address the study's limitations by conducting cross-cultural and comparative studies, conducting interdisciplinary research on AI in education, and performing comparative analysis with other educational contexts. This will enhance understanding of the influence of contextual factors, uncover broader societal implications, and identify unique considerations specific to higher education.

Data availability

Available as supplementary material.

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Author contributions

Abdulrahman M. Al-Zahrani and Talal M. Al-Asmari contributed equally to this work.

Competing interests

The authors declare no competing interests.

Ethical approval

The questionnaire and methodology for this study was approved by the Learning Design and Technology Department at University of Jeddah (#23-241 on Feb. 07, 2023).

Informed consent

Prior to data collection, informed consent was obtained from all participants. Each individual was provided with information regarding the purpose of the study, their rights as participants (including the right to withdraw at any point), and the measures taken to protect their personal data. Participants gave their consent to participate voluntarily.

Additional information

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