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International Journal for Educational Integrity (2025) 21:16
https://doi.org/10.1007/s40979-025-00189-4

International Journal for Educational Integrity

RESEARCH Open Access

AI in education: enhancing learning potential and addressing ethical considerations among academic staff—a cross-sectional study at the University of Jordan

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Abstract

Aim: To investigate the ethical implications of AI-driven natural language generation systems (NLG), such as ChatGPT, in university education at the University of Jordan from the perspective of academic staff. Specific objectives include assessing awareness levels, identifying ethical concerns, and exploring institutional support and training needs.

Methods: A cross-sectional survey of 274 academic staff members (111 females and 163 males) from diverse disciplines was conducted. Participants provided demographic data and responded to questions on knowledge, awareness, ethical concerns, and institutional support related to AI in education. Statistical analyses included descriptive statistics, Chi-square tests, Mann–Whitney U tests, and regression analyses.

Results: Varied awareness and usage of AI-driven NLG among academic staff were found, with 46.7% using AI for university tasks, primarily in research (46.4%) and teaching (33.9%). While 62% demonstrated moderate to high knowledge of AI in academia, which varied by academic discipline ($p < .001$, Table 3). Fewer than one-third were familiar with current ethical guidelines for AI in education (Table 2). Ethical concerns about AI use by students were prevalent (70% of academic staff), especially regarding plagiarism and exam cheating (Table 2). Editing and language corrections (70.8%) were deemed ethically acceptable uses of AI for students (Table 2), with ethical concerns over effortless assignments, sole reliance on AI for research, and exam cheating. Regression analyses revealed that factors such as gender, age, academic rank, teaching experience, and discipline influenced attitudes and knowledge of AI ($p < .05$, Tables 5 and 6).

Conclusion: This study reveals that a significant proportion of academic staff at the University of Jordan use AI and have moderate to high knowledge of it. Although there are gaps in their understanding of AI ethics, they expect students to maintain high ethical standards. This underscores the need for comprehensive ethical guidelines, strong institutional support, and initiatives such as training programs and workshops on ethical AI use to support their role in guiding students in Jordanian academia.

Keywords: Artificial intelligence (AI), Natural language generation (NLG), Education, Ethics, Academic staff, Higher education

Introduction

In recent years, Artificial Intelligence (AI) has profoundly reshaped education, offering students and academic staff powerful tools, such as AI-driven natural language generation (NLG) systems like ChatGPT and GEMINI. These systems excel in understanding and generating human language, enabling diverse applications in education (Ouyang & Jiao 2021; Brown et al. 2020).

AI-driven NLG systems have the potential to transform education by providing personalized tutoring tailored to individual student needs and diverse learning styles. Platforms like Khan Academy exemplify this with adaptive learning experiences that adjust to students'learning rates and comprehension levels (Khan Academy 2023), thereby enhancing engagement and knowledge retention (Muñoz et al. 2023; Zengin 2017). Additionally, AI-driven NLG analytics, like Brightspace and Edmodo, can give educators insights into student performance, allowing them to customize teaching strategies and intervene effectively (Siemens & Long 2011).

In addition, the automation of routine tasks, such as grading and feedback, significantly saves time for both educators and students, allowing them to focus on more interactive and intellectually stimulating aspects of education (Huang et al. 2021). In addition to these benefits, the integration of AI into the academic environment transforms research. AI contributes to data analysis and pattern recognition, accelerating the research process and potentially facilitating innovative discoveries and advancements in academic scholarship (Van Dis et al. 2023; Xames & Shefa 2023).

However, the widespread use of AI in education poses challenges. One major concern is algorithmic bias, where AI systems may perpetuate existing biases, as seen with AI grading systems at Stanford University that exhibited bias against certain groups due to the used training data (Liang et al. 2023). Also, privacy issues arise with AI systems designed to monitor student behavior, potentially compromising privacy and autonomy, as observed in New York school districts. This raises ethical dilemmas regarding surveillance and data security (New York Post 2024).

Furthermore, AI-driven systems can enable academic dishonesty and plagiarism by generating or granting access to unoriginal content, challenging academic integrity (Halaweh 2023). There is also concern that integrating AI might limit student creativity by favoring established patterns, discouraging innovative problem-solving and restricting critical thinking development (Halaweh 2023; Mhlanga 2023). Additionally, AI systems designed for educational purposes may lead to over-reliance on automated decision-making processes, reducing human oversight and accountability. This could result in decisions that lack transparency and misalignment with educational values (Floridi & Cowls 2019; Schiff 2022). Moreover, AI-driven tutoring and personalized learning systems may reduce the variety of learning approaches, limiting students'exposure to alternative perspectives and methods. Additionally, they could replace or reduce the need for certain staff positions, raising concerns about job security for educators and other staff (Halaweh 2023; Schiff 2022).

As the influence of AI in education continues to grow, addressing these risks becomes imperative to ensure a fair, equitable, and ethically sound learning environment. Efforts to establish ethical guidelines for AI in education are diverse and evolving globally. UNESCO promotes rights-based approaches, emphasizing fairness, transparency, and accountability in AI use (UNESCO 2021). Similarly, the European Commission has developed AI guidelines with specific recommendations for educational settings to uphold fundamental rights and ethical standards (European Commission 2019). However, universal guidelines face challenges due to diverse educational backgrounds and cultural contexts worldwide. What may work effectively in one country may not necessarily be suitable in another due to variations in educational policies, technological infrastructure, and social values. Additionally, implementations remain voluntary and vary by country, which raises concerns about consistency and potential gaps in maintaining ethical standards in education globally (Pedro et al. 2019).

In Jordan, efforts to develop AI guidelines are underway, with a focus primarily on general applications. However, these efforts may not adequately address the specific ethical challenges posed by AI in education. Existing frameworks often lack specificity for educational contexts, leaving educators and institutions without clear guidance on these unique ethical challenges. The Jordan Ministry of Digital Economy and Entrepreneurship plays an active role in shaping these initiatives, notably through Jordan's Artificial Intelligence Strategy and Implementation Plan for 2023–2027, underscoring the nation's commitment to advancing AI technologies. However, resources tailored specifically for the ethical integration of AI language models in education are still in development (Jordan Ministry of Digital Economy and Entrepreneurship 2022).

Other Arab countries, such as the United Arab Emirates (UAE) with its AI Strategy 2031 and Saudi Arabia under its Vision 2030 initiative, have also made significant progress in adopting AI across various sectors, including education. However, like Jordan, their focus is primarily on broader applications of AI rather than on developing specific ethical guidelines for educational settings (United Arab Emirates Government 2017; Vision 2030 Saudi Arabia 2016).

Although substantial research has explored AI's potential in education, there is a notable lack of empirical studies from regions such as Western Asia, where the ethical implications of AI remain underexplored (Monasterio Astobiza et al. 2022). A recent scoping review of 118 peer-reviewed studies further highlights the importance of addressing ethical considerations in the integration of AI in education. This review identified several practical and ethical challenges, including low technological readiness, lack of transparency, and insufficient privacy safeguards. These findings emphasize the need for a human-centered approach and improved reporting standards to address these challenges effectively (Yan et al. 2024). Our study aims to address this gap by examining the perspectives of academic staff in Jordan, a country in the early stages of AI integration in education. While many countries globally continue to grapple with AI ethics challenges, Jordan's educational landscape, sociopolitical context, and technological infrastructure present both opportunities and challenges in adopting AI responsibly. By focusing on Jordan, this study provides new insights into how countries in Western Asia navigate AI ethics, contributing to regional and global discussions on the responsible use of AI in academia.

Methods

Participants and sample size calculation

The participants in this study were academic staff members from a variety of disciplines at the University of Jordan. Specifically,"academic staff"refers to professors, associate professors, assistant professors, and lecturers who were currently employed, actively engaged in teaching, and not on leave or retired. An a priori power analysis determined the minimal sample size to be 204, based on F tests for multiple linear regression with an effect size of 0.1, study power (1 – β) of 0.95, and an α probability error of 0.05. A computer program was utilized for this purpose (G*Power, version 3.1.9.7; Heinrich-Heine University). To meet the minimum calculated sample size and achieve a representative overview of academic staff perspectives, 300 individuals were invited to participate in this study, and 275 agreed to participate and returned the survey (response rate 91.7%). One participant was excluded from the study due to returning an incomplete survey. Ultimately, 274 participants were included, and their data analyzed.

Survey instrument and validation

The survey, developed following a literature review on ethical considerations and knowledge of AI in academia, was structured using a combination of closed-ended and open-ended questions, all analyzed quantitatively. The closed-ended questions addressed demographic information, awareness of AI language models, attitudes towards their integration in teaching, and ethical considerations, while the open-ended questions focused on institutional support and future training needs. The survey included seven parts aimed at assessing participants'demographic information, general awareness and knowledge of AI in education, ethical considerations of AI use by students and academic staff, challenges and concerns regarding ethical AI use, institutional support and regulation, and future training and development.

Four authors collaboratively structured the survey questions with predetermined aims for each section. After drafting, the survey was reviewed by a panel of three academic professionals who provided feedback to refine clarity, add relevant questions, and avoid redundancy. The finalized survey underwent a pilot test with 40 academic staff members, validating its clarity, relevance, and reliability. Cronbach's Alpha scores of 0.705 for aim-based total scores, 0.842 for individual items, and 0.743 for combined scores indicated adequate reliability.

Apart from the demographic section (Sect. 1), responses were recorded as yes/no or on a Likert scale from 1 to 5. Total scores for each section were calculated for statistical analysis: Sect. 2 (2–21), Sect. 3 (1–30), Sect. 4 (1–24), Sect. 5 (1–10), Sect. 6 (1–19), and Sect. 7 (0–1). The overall awareness and knowledge score for participants ranged from 6 to 105, used solely for statistical purposes without normative reference or cut points.

Ethical approval and consent

The study has obtained ethical approval from the University of Jordan Institutional Review Board (IRB) (Approval Number: 143/2023), ensuring compliance with ethical

standards. Participants were provided with a clear and concise informed consent form at the beginning of the survey, emphasizing their voluntary participation, confidentiality, and the purpose of the research.

Data collection

The survey was electronically distributed to the identified sample of academic staff members. Participants were invited via email, emphasizing the voluntary nature of their participation. The data collection period was set for 4 months (13 Jan- 13 May) to allow participants sufficient time to respond. Two reminder emails were sent to encourage participation.

Data analysis

Demographic information and survey responses were analyzed using descriptive and inferential statistics. Categorical variables like age, gender, and academic rank were summarized with percentages and frequencies, while ordinal and non-normally distributed scores used medians and ranges. The normally distributed total knowledge and awareness score were presented with mean and standard deviation. Chi-square tests, t-tests, ANOVA, and regression analyses identified patterns and correlations, applying a 95% confidence interval and a significance level of 0.05. Analyses were performed using SPSS software. Open-ended survey responses underwent thematic analysis, with identified themes quantified to enhance the understanding of participants'ethical perspectives.

Statistical analysis

Descriptive statistics for the categorical variables (age, gender, academic rank, teaching experience, major school, and answers for the items regarding the knowledge and awareness of AI) were presented as percentages and frequencies. Also, median, interquartile range and range were utilized to portray the ordinal categorical variables as well as the non-normally distributed individual section scores. However, the total knowledge and awareness score was normally distributed (Shapiro–Wilk test statistic $=0.990$, $p=0.508$), and was presented as mean, standard deviation, standard error, and 95% confidence intervals.

The relationships between the demographic variables (age, gender, academic rank, teaching experience, and major school) and the answers for the items regarding the knowledge and awareness of AI were identified using the Chi-square test. The effect size for significant associations was determined using Phi, Cramer's V, and Eta values where applicable. The independent t-test was utilized to identify gender differences regarding the total score for participants' total awareness and knowledge regarding the use of AI within academic settings. The ANOVA test was utilized to identify differences in the total score for participants' total awareness and knowledge regarding the use of AI within academic settings based on different age categories, academic ranks, teaching experience, and major school. The ANOVA and independent t-test were used for testing the variations in participants' total awareness and knowledge regarding the use of AI within academic settings based on the variables mentioned above because the dependent variable was normally distributed (Shapiro–Wilk test statistic $=0.990$, $p=0.508$) and the homogeneity of variance assumption was assured utilizing the Levene's test (all

p values of Levene's test were > 0.05: equaled to 0.384 for age, 0.352 for gender, 0.161 for academic rank, 0.212 for years of experience, and 0.772 for school category). The Mann–Whitney U test was utilized to identify gender differences regarding total scores of each section. Meanwhile, the Kruskal–Wallis test was utilized to identify differences in total scores of each section based on different age categories, academic ranks, teaching experience, and major school.

Multiple linear regression analyses were conducted and utilized the demographic variables to predict the total score for participants' total awareness and knowledge regarding the use of AI within academic settings, the section scores, as well as the individual items with scale responses. Also, multiple logistic regression analyses were conducted and utilized the demographic variables to predict the responses to items with yes or no answers. Moderation analyses were conducted to identify moderation effects of gender and/or school on the relationships between different items and scores regarding the knowledge and awareness of AI use. Also, moderation analyses were conducted to identify moderation effects of gender and/or school on the relationships of age with different scores and items regarding the knowledge and awareness of AI use. The Sobel test was used to verify the significance of any moderation effects.

A 95% confidence interval and a two-tailed α of 0.05 were used to identify significant statistical outcomes during this study. The Cronbach's Alpha was used to assess the reliability of the survey in the pilot as well as the main study. The SPSS computer program (IBM SPSS Statistics v20.0; IBM Corp., USA) was used to perform the statistical analysis for the collected data during this research.

Results

Data from 274 (111 females and 163 males) were collected and analyzed. Table 1 demonstrates the distribution of participants' demographic variables including gender, age, academic rank, teaching experience, and major school. Table 2 presents the descriptive statistics for knowledge, awareness, ethical concerns, challenges, and recommendations regarding the use of AI by students and academic staff within the academic field. Table 2 also presents the significant differences between the frequencies of different responses to each item utilizing the Chi-Square test. Table 3 demonstrates the associations between responses to each survey item and demographic variables including gender, age, academic rank, teaching experience, and major school.

General awareness and usage of AI language models

About 46.7% (n = 128) of the participants had used AI during university experience (Table 2), and the mean duration of using AI in academic activities was 12.3 months (SD = 20.46, SE = 1.81, median = 10.00, interquartile range = 8.00, range = 0–204, 95% CI = 8.71–15.87). Participants from health science schools were the least to use AI ($X^2(2) = 7.387$, $p = 0.025$, Cramer's V = 0.164, Table 3).

Most participants (n = 170) were very (15.3%) or moderately (46.7%) knowledgeable of AI usage in the academic field (Table 2). Also, participants from health sciences schools were the least knowledgeable, while participants from science and engineering were the most knowledgeable in this regard ($X^2(8) = 29.287$, $p < 0.001$, Cramer's V = 0.231,

Table 3). About 54% of the participants never or rarely used AI in academic activities, while others used it weekly (20.1%) or daily (7.7%) (Table 2).

Ethical use of AI language models by students (Academic staff point of view)

The participants indicated that the main purposes for using AI in the academic field were research (46.4%) and teaching (33.9%) (Table 2). More than 70% of the participants were concerned regarding the ethical use of AI in the academic field by students (Table 2). Besides, females were more ethically concerned than males regarding the use of AI by students in the academic field ($X^2(4) = 12.459$, $p = 0.014$, Eta $= 0.231$).

Editing and language corrections (70.8%) were the most academic activities that were considered ethically acceptable for students to use AI models (Table 2). Meanwhile, accomplishing assignments and projects without effort (19%), completely relying on AI for research (8.8%), and exam cheating (4%) raised ethical concerns and were ethically unacceptable. Approximately 39.4% of the participants observed instances where students' use of AI raised ethical concerns (Table 2). Participants from health science schools were the least to observe such instances ($X^2(2) = 11.229$, $p = 0.004$, Cramer's $V = 0.202$, Table 3).

More than 80% of the participants agreed that students should receive guidance on the ethical use of AI in their academic work (Table 2). Furthermore, conducting workshops and training sessions on ethical AI usage (69.7%) was the most suggested measure to ensure the ethical use of AI language models in education and to prevent its misuse by students (Table 2). More than 80% of the participants indicated that AI–based plagiarism detection mechanisms should be used to detect the percentage of AI-generated text in academic reports. Also, 92% ($n = 251$) of the participants suggested that AI plagiarism should not exceed 25% (mean $\pm$ SD $= 11.8 \pm 14.4$, SE $= 0.87$, median $= 10$, interquartile range $= 20$, range $= 0–100$, 95% CI $= 10.07–13.49$).

Ethical considerations for the use of AI language models by academic staff

Fewer than one-third of the participants were familiar with the current ethical guidelines or policies regarding the use of AI in educational institutions (Table 2). Females, participants with teaching experience of more than 10 years, and participants from health sciences schools were less familiar with the current ethical guidelines or policies ($p < 0.05$, Table 3).

Furthermore, nearly half of the participants (48.9%) were not aware of any ethical principles related to the use of AI in education. Females and participants from health sciences schools were the least aware of any ethical principles related to the use of AI in education ($p < 0.05$, Table 3). Only 7.7% of the participants have observed instances where their colleagues' use of AI raised ethical concerns. These instances were mainly related to using AI in research (4%, Table 2).

Participants with higher levels of knowledge regarding AI use in academia were more familiar with the current ethical guidelines and policies for AI use in academia (Spearman correlation test: Spearman Rho correlation coefficient $= 0.442$, $p < 0.001$),

Table 1 Distribution of demographic variables among the study population ($n = 274$)

Variables		n (Total $n = 274$)	%
Gender	Female	111	40.5
	Male	163	59.5
Age (in years)	Under 30	6	2.2
	31–35	23	8.4
	36–40	66	24.1
	41–45	51	18.6
	46–50	32	11.7
	51–55	37	13.5
	56–60	19	6.9
	61–65	21	7.7
	Above 65	19	6.9
Academic Rank	Lecturer	54	19.7
	Assistant Professor	59	21.5
	Associate Professor	73	26.6
	Professor	88	32.1
Teaching experience (in years)	0–5	54	19.7
	6–10	54	19.7
	11–15	60	21.9
	16–20	33	12.0
	21–25	27	9.9
	above 25	46	16.8
Major school category	Humanities	99	36.1
	Health	82	29.9
	Science	93	33.9

and had higher awareness and knowledge of the ethical use of AI by students (Spearman correlation test: Spearman Rho correlation coefficient $= 0.171$, $p = 0.005$).

Institutional support and awareness

About 40% of the participants felt that they were not adequately supported by their institution in understanding and implementing ethical principles related to AI in education. Also, most participants (85.8%) did not believe that their institution was actively promoting awareness of ethical considerations in the use of AI in education among academic staff (Table 2).

Challenges and concerns

The main challenges in applying ethical principles when using AI in education were identified as the undetectability of AI use in tasks (5.5%), uncertainty regarding the accuracy of information obtained through AI tools (3.6%), and the lack of guidelines to use AI in this regard (3.6%) (Table 2). Also, the main concerns regarding the ethical implications of AI in education were dependence on AI to perform tasks (18.6%) and using AI for cheating (5.5%) (Table 2). Females expressed more concerns regarding dependence on AI to perform tasks ($X^2(1) = 4.018$, $p = 0.045$, Phi $= 0.121$).

Participants who had used AI in university before expressed more concerns about the ethical use of AI in academia by students (X^2 $(4) = 10.206$, $p = 0.037$, Effect size

Table 2 Descriptive statistics for and differences in responses to categorical individual items related to knowledge, awareness, ethical concerns, challenges, and recommendations regarding the use of AI in academic field among the study participants ($n = 274$)

Sections with relative items	Response	N	%	[b]X^2	P
General awareness and usage of AI language models					
2.1. Level of Knowledge of AI use in academic work	Not knowledgeable at all	18	6.6	131.876	<.001
	Not very Knowledgeable	49	17.9		
	Neutral	37	13.5		
	Moderately knowledgeable	128	46.7		
	Very knowledgeable	42	15.3		
2.2. Used AI in university before	No	146	53.3	1.182	.277
	Yes	128	46.7		
2.4. Frequency of using AI in academic work	Never	69	25.2	35.635	<.001
	Rarely	79	28.8		
	Monthly	50	18.2		
	Weekly	55	20.1		
	Daily	21	7.7		
2.5. Purposes of using AI in academic field[a]	Research	127	46.4	1.460	.227
	Teaching	93	33.9	28.263	<.001
	Administrative tasks	54	19.7	100.569	<.001
	Assignment & Exam preparations	38	13.9	143.080	<.001
	Lecture preparation	51	18.6	107.971	<.001
	Curriculum development	38	13.9	143.080	<.001
	Grading & Evaluation	9	3.3	239.182	<.001
	Workshop & Training material development	28	10.2	173.445	<.001
	Academic writing	59	21.5	88.818	<.001
	Source of general information	9	3.3	239.182	<.001
2.7. The used AI language[a]	ChatGPT	173	63.1	18.920	<.001
	GPT2	9	3.3	239.182	<.001
	GPT3	28	10.2	173.445	<.001
	BERT	13	4.7	224.467	<.001
	RoBERTa	3	1.1	262.131	<.001
	GPT4	5	1.8	254.365	<.001
	Gemini/BARD	8	2.9	242.934	<.001
	ERNIE, Poe, Claude, copilot	5	1.8	254.365	<.001
	LlaMa	2	0.7	266.058	<.001
	Never used any language	7	2.6	246.715	<.001
Ethical use of AI language models by students					
3.1. Have ethical concerns regarding students use of AI in academia	Not concerned at all	7	2.6	132.168	<.001
	Not concerned	35	12.8		
	Neutral	38	13.9		
	Concerned	116	42.3		
	Very concerned	78	28.5		

Table 2 (continued)

Sections with relative items	Response	N	%	[b]X^2	P
3.2. Ethically acceptable academic activities for students to use AI[a]	Writing process of essays, reports, etc	43	15.7	128.993	<.001
	Language related tasks like translation and proofreading	194	70.8	47.431	<.001
	Data analysis	88	32.1	35.051	<.001
	Programming	86	31.4	37.971	<.001
	Reviewing and summarizing literatures and resources	117	42.7	5.839	.016
	Exam preparation	97	35.4	23.358	<.001
	Presentations	80	29.2	47.431	<.001
	Source of general information	3	1.1	262.131	<.001
3.4. Ethically unacceptable activities for students to use AI[a]	Cheating in exams	14	5.1	220.861	<.001
	Complete reliance on AI for assignments	14	5.1	220.861	<.001
	Complete reliance on AI for thesis writing	14	5.1	220.861	<.001
	Using AI to produce fraudulent research	14	5.1	220.861	<.001
3.5. Observed AI use that caused ethical concerns	No	166	60.6	12.277	<.001
	Yes	108	39.4		
3.6. Cases caused ethical concern due to AI use[a]	Exam cheating	11	4.0	231.766	<.001
	Assignments and project without efforts	52	19.0	105.474	<.001
	Rely on AI for research	24	8.8	186.409	<.001
	High plagiarism	24	8.8	186.409	<.001
3.7. Students should have guidance on ethical AI use	Strongly disagree	1	.4	341.219	<.001
	Disagree	9	3.3		
	Neutral	28	10.2		
	Agree	68	24.8		
	Strongly agree	168	61.3		
3.8. Measures to ensure proper ethical AI use in education[a]	Ban AI use in education	22	8.0	193.066	<.001
	Restrict AI use based on needs	80	29.2	47.431	<.001
	Conduct training sessions & workshops on ethical use of AI	191	69.7	42.569	<.001
	Provide clear guidelines for acceptable AI use	160	58.4	7.723	.005
	Integrate ethics to curriculum	128	46.7	1.182	.277
	Share & promote ethical AI use examples	139	50.7	.058	.809
	Define policies to use AI in education	109	39.8	11.445	.001
	Monitor and review compliance with AI use policies	109	39.8	11.445	.001
	Have alternative resources as AI is only supplement	93	33.9	28.263	<.001
	Have confidential reporting system of misuse	79	28.8	49.109	<.001
3.10. Should AI based plagiarism detection mechanism be used	No	53	19.3	103.007	<.001
	Yes	221	80.7		
Ethical considerations for the use of AI language models by academic staff					
4.1. Familiarity with current ethical guidelines/policies for AI use in academia	Not familiar at all	36	13.1	50.343	<.001
	Not very familiar	86	31.4		
	Neutral	60	21.9		
	Somewhat familiar	71	25.9		
	Very familiar	21	7.7		

Table 2 (continued)

Sections with relative items	Response	N	%	[b]X^2	P
4.2. Awareness of ethical principles for using AI in education[a]	Not aware of	134	48.9	0.131	.717
	Fairness and inclusivity	43	15.7	128.993	<.001
	Equitable access and avoid discrimination	59	21.5	88.818	<.001
	Beneficence	58	21.2	91.109	<.001
	Non-maleficence	69	25.2	67.504	<.001
	Transparency	63	23.0	79.942	<.001
	Privacy and informed consent	60	21.9	86.555	<.001
	Data security and integrity	75	27.4	56.117	<.001
	Freedom and autonomy	36	13.1	148.920	<.001
	Accountability and responsibility	57	20.8	93.431	<.001
	Promoting accuracy	55	20.1	98.161	<.001
	Not a substitute for human teacher/interaction	59	21.5	88.818	<.001
4.4. References for ethical guidelines and principles[a]	None	108	39.4	12.277	<.001
	Internet browsing	9	3.3	239.182	<.001
	Articles and journals	18	6.6	206.730	<.001
	Courses	15	5.5	217.285	<.001
	Social media	15	5.5	217.285	<.001
	official guidelines and policies	10	3.6	235.460	<.001
4.5. Encountered colleagues' use of AI that raised ethical concerns	No	253	92.3	196.438	<.001
	Yes	21	7.7		
4.6. Encountered colleagues' use of AI in research that raised ethical concerns	No	263	96.0	231.766	<.001
	Yes	11	4.0		
4.7. What to do to ensure ethical AI use in academia by themselves[a]	Training course	56	20.4	275.920	<.001
	Review ethical guidelines	32	11.7	160.949	<.001
Institutional support and awareness					
5.1. Support by institution for ethical AI use in academic field	Strongly disagree	28	10.2	146.949	<.001
	Disagree	83	30.3		
	Neutral	117	42.7		
	Agree	41	15.0		
	Strongly agree	5	1.8		
5.2. Institution promotes awareness of ethical AI use	No	235	85.8	140.204	<.001
	Yes	39	14.2		
5.3. Means institution used to promote ethical AI use[a]	Conducting lectures and workshops about AI for academic staff	27	9.9	176.642	<.001
	In the process of setting-up regulations for AI use	4	1.5	258.234	
Challenges and concerns					
6.1. Challenges for applying ethical principles for AI use in academia[a]	AI information accuracy is not guaranteed (unreliable information)	10	3.6	235.460	<.001
	Use of AI is not detectable in tasks (lack of transparency) making it difficult to assess its influence and impact	15	5.5	217.285	<.001
	Lack of clear guidelines for the ethical use of AI in educational settings complicates implementation	10	3.6	235.460	<.001

Table 2 (continued)

Sections with relative items	Response	N	%	[b]X^2	P
6.2. Concerns regarding ethical implications for AI use[a]	Dependence for tasks (over-reliance)	51	18.6	107.971	<.001
	Cheating	15	5.5	217.285	<.001
	Might affect academic integrity	15	5.5	217.285	<.001
Future training and development					
7.1. Interested in training for ethical use of AI in academia	No	59	21.5	88.818	<.001
	Yes	215	78.5		
7.2. Topics to cover about AI ethics and AI use in future training[a]	Use of AI in teaching	19	6.9	203.270	<.001
	Use of AI in research	32	11.7	160.949	<.001
	Principles of ethical and unethical use of AI in academia	28	10.2	173.445	<.001
	How to use it as clinical tool in medical filed	9	3.3	239.182	<.001

AI Artificial intelligence language models, X^2 Chi square statistic for, *P* Probability value and significance of the difference between responses to the item

[a] Frequencies of "Yes" responses are presented

[b] Degree of freedom equals 4 for items 2.1, 2.4, 3.1, 3.7, 4.1, and 5.1; equals 2 for item 4.7; and equals 1 for the rest of the items

$= 0.070$), were more familiar with the current ethical guidelines and policies for AI use in academia (X^2 (4) $= 19.817$, $p = 0.001$, Effect size $= 0.256$), and had higher awareness and knowledge of the ethical use of AI by students (X^2 (20) $= 32.603$, $p = 0.037$, Effect size $= 0.269$).

Participants with higher total awareness of AI use in academia expressed more concerns regarding ethical use of AI in academia (Spearman correlation test: Spearman Rho correlation coefficient $= 0.131$, $p = 0.031$), had higher awareness and knowledge of the ethical use of AI by students (Spearman correlation test: Spearman Rho correlation coefficient $= 0.289$, $p < 0.001$), and had higher awareness and knowledge of the ethical use of AI by academic staff (Spearman correlation test: Spearman Rho correlation coefficient $= 0.466$, $p < 0.001$).

Future training and development

The majority of participants (78.5%) were interested in additional training or professional development related to the ethical use of AI in education. Females, participants under 45 years old, participants with lower academic rank (lecturers and assistant professors), participants with lower teaching experience, and participants from health sciences schools were more interested in having training ($p < 0.05$, Table 3).

The total score of participants' awareness and knowledge of AI use in the academic field ranged between 20 and 73 (mean $\pm$ SD $= 39.81 \pm 10.47$, SE of mean $= 0.632$, 95% CI $= 38.57$–41.05). Table 4 shows the descriptive statistics and demographic-based differences for the total and section scores among the study population. No significant differences were found in total AI awareness and knowledge scores as well as each section scores based on demographic variables; except that males had better knowledge of challenges facing application of ethical AI use in academic field in comparison to females (MWU $= 7710.5$, z $= -2.098$, $p = 0.036$, Table 4).

Table 3 Associations between items regarding knowledge and awareness of AI use in academic field and demographic factors among the study population ($n = 274$)

Item	Gender		Age		Academic Rank		Teaching experience		Major school category	
	X^2(df)	P	X^2(df)	P	X^2(df)	P	X^2(df)	P	X^2(df)	P
2.1. Level of Knowledge of AI use in academic work	3.282 (4)	.512	26.893 (32)	.723	10.926 (12)	.535	16.726 (20)	.671	29.287 (8) **C =.231**	<.001
2.2. Used AI in university before	0.001 (1)	.971	10.643 (8)	.223	0.894 (3)	.827	1.511 (5)	.912	7.387 (2) **C =.164**	.025
2.3. Months of using AI before	28.436 (25)	.288	222.421 (200)	.132	64.172 (75)	.809	115.732 (125)	.712	59.528 (50)	.168
2.4. Frequency of using AI in academic work	3.489 (4)	.480	37.839 (32)	.220	13.573 (12)	.329	21.541 (20)	.366	12.162 (8)	.144
2.5. Total score of purposes to use AI	8.010 (9)	.533	71.317 (72)	.501	35.896 (27)	.118	40.884 (45)	.647	24.005 (18)	.155
3.1. Concerned ethically about students use of AI in academic field	12.459 (4) **E =.213**	.014	39.407 (32)	.172	11.197 (12)	.512	23.802 (20)	.251	8.679 (8)	.370
3.5. Observed AI use by students that caused ethical concerns	1.432 (1)	.231	5.558 (8)	.697	3.359 (3)	.339	4.619 (5)	.464	11.229 (2) **C =.202**	.004
3.7. Students should have guidance on ethical AI use	5.934 (4)	.204	25.353 (32)	.791	12.634 (12)	.396	18.623 (20)	.546	4.780 (8)	.781
3.8. Total score of measures to ensure proper ethical AI use	15.995 (9)	.067	57.368 (72)	.896	21.177 (27)	.778	45.532 (45)	.450	9.490 (18)	.947
3.10.AI–based plagiarism detection mechanisms should be used	0.621 (1)	.431	10.064 (8)	.261	5.453 (3)	.141	5.888 (5)	.317	3.915 (2)	.141
3.11. Acceptable percentage of AI plagiarism	17.774 (17)	.403	125.738 (136)	.725	49.162 (51)	.547	71.967 (85)	.842	30.610 (34)	.635
4.1.Familiarity with current ethical guidelines/policies for AI use in academia	14.632 (4) **C =.231**	.006	35.212 (32)	.319	7.458 (12)	.826	32.824 (20) **C =.173**	.035	17.014 (8) **C =.176**	.030
4.2. Not aware of ethical principles for using AI in education	0.447 (1)	.504	13.836 (8)	.086	0.264 (3)	.967	3.085 (5)	.687	9.178 (2) **C =.183**	.010
4.2. Total score for ethical principles for using AI in education	23.603 (11) **E =.293**	.015	106.729 (88)	.085	27.090 (33)	.756	44.554 (55)	.842	14.168 (22)	.895
4.4. No references for AI ethical principles	1.144 (1)	.285	9.219 (8)	.324	6.257 (3)	.100	6.588 (5)	.253	8.653 (2) **C =.178**	.013
5.1. Support by institution for ethical AI use	3.399 (4)	.493	40.084 (32)	.154	16.231 (12)	.181	24.556 (20)	.219	9.639 (8)	.291
5.2. Institution promote awareness of Ethical AI use	2.189 (1)	.139	12.885 (8)	.116	1.254 (3)	.740	5.542 (5)	.353	4.421 (2)	.110
7.1. Interested in training for ethical use of AI	12.696 (1) **Phi =.215**	<.001	22.257 (8) **C =.285**	.004	16.259 (3) **C =.244**	.001	19.647 (5) **C =.268**	.001	19.231 (2) **C =.265**	<.001

AI Artificial intelligence language models, X^2 Chi square statistic, *df* Degree of freedom, *P* Probability value of the association between responses to the items and the demographic variable. *C* Cramer's V statistic, *E* Eta statistic, *Phi* Phi statistic

Multiple linear regression analyses demonstrated that being female ($p = 0.045$) and having a higher academic rank ($p = 0.022$) were associated with less knowledge regarding the ethical use of AI by academics (Table 5). Males had scores 1.18 times higher for knowledge regarding the ethical use of AI by academics compared to females ($p = 0.045$). Also, for each increase in academic rank, the section score for the knowledge regarding ethical use of AI by academics would decrease by 0.683 units ($p = 0.022$). In addition, females had 0.649 times more knowledge regarding the challenges for using AI in academic teaching than males ($p = 0.035$, Table 5). Furthermore, for each increase in the age category, the level of knowledge of AI use in academic field would decrease by 0.185 units ($p = 0.005$, Table 5). Besides, being from health sciences school was associated with 0.520 unit decrease in the level of knowledge of AI use in academic field (item 2.1) in comparison to being from humanities school ($p = 0.003$, Table 5, Fig. 1).

Moreover, for each category increase in the age category, the frequency of using AI in academic field (item 2.4) would decrease by 0.187 units ($p = 0.012$, Table 5, Fig. 1). In addition, being a female was associated with 0.230 times more believe that students should have guidance on ethical AI use in academic filed (item 3.7) than males ($p = 0.047$, Table 5, Fig. 2). Furthermore, being a female was associated with 0.341 times less familiarity with current ethical guidelines for AI use in academia (item 4.1) in comparison to males ($p = 0.040$, Table 5, Fig. 2). Also, being from health sciences school ($p = 0.002$) or science and engineering school ($p = 0.020$) was associated with 0.561 and 0.399 times less familiarity with current ethical guidelines for AI use (item 4.1) than being from humanities school respectively (Table 5, Fig. 2). Moreover, being a female was associated with 1.239 times less knowledge regarding the ethical principles for AI use in education (item 4.2) than males ($p = 0.006$, Table 5, Fig. 2). Also, for each increase in the academic rank, the knowledge regarding the ethical principles for AI use in education (item 4.2) would decrease by 0.485 units ($p = 0.032$, Table 5, Fig. 2).

Logistic regression analyses demonstrated that higher age categories were associated with 0.709 less odds of having used AI in university before ($p = 0.006$, Table 6). Also, being from health sciences school was associated with 0.362 less odds of having used AI in university before (item 2.2) in comparison to being from science and engineering school ($p = 0.003$, Table 6). In addition, higher age categories were associated with 0.821 less odds of having observed AI use that caused ethical concerns (item 3.5, $p = 0.019$, Table 5). Also, being from a health sciences school was associated with 0.322 less odds of having used AI in university before (item 3.5, $p = 0.003$, Table 6).

Moderation analyses (Supplementary Table 1) for moderating effects of school and/or gender on the relationship between age and each of having used AI before (item 2.2), knowledge level of AI in academic field (item 2.1), and having observed AI use by students that caused ethical concerns were conducted. Also, moderating effects of school and/or gender on the relationship between knowledge level of AI in academic field (item 2.1) and each of familiarity with the current ethical guidelines for AI use in academia and the section scores of the knowledge of ethical use of AI by students were studied. In addition, the moderating effects of school and/or gender on the relationship between having used AI before (item 2.2) and each of familiarity with the current ethical guidelines for AI use in academia, the section scores of the knowledge of ethical use of AI by

Table 4 The descriptive statistics and demographic-based differences for total awareness and knowledge scores as well as each section scores among the study population ($n = 274$)

Variable	Descriptive statistics		Gender	Age	Academic rank	Teaching Experience	School Category
Total AI knowledge score	Mean ± SD	39.81 ± 10.47	t = 1.022, *P* = .308	[a]F(8) = 0.321, *P* = .958	F(3) = 0.125, *P* = .945	F(5) = 1.342, *P* = .247	F(2) = 0.788, *P* = .456
	Median	39.00					
	IQR	15					
	Range	20–73					
Section score for general awareness of AI use	Mean ± SD	8.34 ± 3.97	MWU = 8378.0, *P* = .298	[a]X^2(8) = 5.790, *P* = .671	X^2(3) = 2.751, *P* = .432	X^2(5) = 4.801, *P* = .441	X^2(2) = .504, *P* = .777
	Median	8.00					
	IQR	6					
	Range	2–20					
Section score for ethical considerations for AI use by students	Mean ± SD	16.06 ± 4.30	MWU = 8359.5, *P* = .285	X^2(8) = 5.877, *P* = .661	X^2(3) = 0.411, *P* = .938	X^2(5) = 10.653, *P* = .059	X^2(2) = 4.538, *P* = .103
	Median	16.00					
	IQR	6					
	Range	7–27					
Section score for ethical considerations for AI use by academic staff	Mean ± SD	5.78 ± 4.10	MWU = 8404.0, *P* = .315	X^2(8) = 9.039, *P* = .339	X^2(3) = 1.366, *P* = .713	X^2(5) = 6.035, *P* = .303	X^2(2) = .645, *P* = .724
	Median	4.00					
	IQR	6					
	Range	1–18					
Section score for institutional support and awareness regarding AI use	Mean ± SD	2.98 ± 1.34	MWU = 9044.0, *P* = .997	X^2(8) = 7.673, *P* = .466	X^2(3) = 4.944, *P* = .176	X^2(5) = 3.674, *P* = .597	X^2(2) = .676, *P* = .713
	Median	3.00					
	IQR	1					
	Range	1–7					
Section score for challenges and concerns regarding ethical AI use	Mean ± SD	5.87 ± 2.12	MWU = 7710.5, *P* = .036	X^2(8) = 11.713, *P* = .164	X^2(3) = 3.220, *P* = .359	X^2(5) = 2.687, *P* = .748	X^2(2) = .600, *P* = .741
	Median	6.00					
	IQR	2					
	Range	1–12					
Section score for future training and development regarding ethical AI use	Mean ± SD	0.78 ± 0.41	MWU = 8896.0, *P* = .743	X^2(8) = 11.324, *P* = .184	X^2(3) = 0.464, *P* = .927	X^2(5) = 5.030, *P* = .412	X^2(2) = .059, *P* = .971
	Median	1					
	IQR	0					
	Range	0–1					

AI Artificial intelligence language models, *SD* Standard deviation, *IQR* Interquartile range, *t* t-statistic using independent samples t-test, *F* F-statistic using ANOVA test, *MWU* Mann Whitney U test statistic, X^2 Chi square statistic using Kruskal Wallis test, *P* Probability value

[a] Degree of freedom is presented between parenthesis next to the F and X^2 statistic

students and concerned about ethical AI use by students (item 3.1) were evaluated (Supplementary Table 1). Furthermore, the moderation effects of school and/or gender on the relationship between total scores of knowledge and awareness of AI use in academia and each of the section scores of the knowledge of ethical use of AI by students, the

Table 5 Linear regression analyses predict knowledge and awareness of AI ethical use in academic field utilizing the demographic variables among the study sample ($n = 274$)

Dependent variable	Predictors[b]	UnS Co		S Co	t	P	95% CI for B		Correlations				Collinearity statistics	
		B	SE	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Part[2]	Tol	VIF
Academic ethical AI use section score $R^2 = .036$ DW = 1.819	Constant	7.972	1.335	–	5.970	<.001	5.343	10.601	–	–	–	–	–	–
	Age	-.050	.240	-.026	-.207	.836	-.523	.423	.061	-.013	-.012	.014	.237	4.226
	Gender	− 1.180	.586	-.142	− 2.012	.045	− 2.334	-.025	-.102	-.122	-.121	1.46	.729	1.373
	Academic rank	-.683	.297	-.186	− 2.300	.022	− 1.267	-.098	-.041	-.139	-.138	1.90	.551	1.813
	Teaching exp	.407	.279	.171	1.460	.145	-.142	.956	.083	.089	.088	.774	.262	3.814
	[a]HS School	.512	.630	.057	.813	.417	-.728	1.752	-.007	.050	.049	.240	.726	1.378
	[a]SE School	.245	.603	.028	.406	.685	-.942	1.432	.041	.025	.024	.058	.740	1.351
Challenges section score $R^2 = .020$ DW = 1.981	Constant	4.851	.697	–	6.961	<.001	3.479	6.223	–	–	–	–	–	–
	Age	.091	.125	.090	.723	.470	-.156	.338	-.016	.044	.044	.194	.237	4.226
	Gender	.649	.306	.151	2.121	.035	.047	1.251	.125	.129	.128	1.64	.729	1.373
	Academic rank	-.074	.155	-.039	-.475	.635	-.379	.231	-.055	-.029	-.029	.084	.551	1.813
	Teaching exp	-.038	.146	-.030	-.258	.797	-.324	.249	-.016	-.016	-.016	.026	.262	3.814
	[a]HS School	-.127	.329	-.028	-.387	.699	-.774	.520	-.005	-.024	-.023	.053	.726	1.378
	[a]SE School	.094	.315	.021	.298	.766	-.526	.713	.012	.018	.018	.032	.740	1.351
Item 2.1. Knowledge level of AI use in academic field $R^2 = .098$ DW = 1.965	Constant	3.944	.361	–	10.917	<.001	3.233	4.655	–	–	–	–	–	–
	Age	-.185	.065	-.341	− 2.850	.005	-.313	-.057	-.107	-.172	-.166	2.76	.237	4.226
	Gender	-.012	.159	-.005	-.079	.937	-.325	.300	-.009	-.005	-.005	.003	.729	1.373
	Academic rank	.024	.080	.023	.294	.769	-.135	.182	-.058	.018	.017	.029	.551	1.813
	Teaching exp	.131	.075	.198	1.741	.083	-.017	.280	-.032	.106	.101	1.02	.262	3.814
	[a]HS School	-.520	.170	-.208	− 3.052	.003	-.855	-.184	-.237	-.184	-.177	3.13	.726	1.378
	[a]SE School	.262	.163	.108	1.605	.110	-.059	.583	.181	.098	.093	.865	.740	1.351

Table 5 (continued)

Dependent variable	Predictors[b]	UnS Co		S Co	t	P	95% CI for B		Correlations				Collinearity statistics	
		B	SE	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Part[2]	Tol	VIF
Item 2.4 Frequency of using AI in academic field R^2 = .059 DW = 1.926	Constant	2.989	.410	–	7.299	<.001	2.183	3.796	–	–	–	–	–	–
	Age	-.187	.074	-.309	− 2.531	.012	-.332	-.041	-.159	-.153	-.150	2.25	.237	4.226
	Gender	.018	.180	.007	.098	.922	-.336	.372	.027	.006	.006	.004	.729	1.373
	Academic rank	.130	.091	.114	1.431	.154	-.049	.310	-.040	.087	.085	.723	.551	1.813
	Teaching exp	.045	.086	.061	.528	.598	-.123	.214	-.109	.032	.031	.096	.262	3.814
	[a]HS School	-.372	.193	-.134	− 1.923	.055	-.752	.009	-.126	-.117	-.114	1.30	.726	1.378
	[a]SE School	.149	.185	.055	.803	.422	-.216	.513	.077	.049	.048	.230	.740	1.351
Item 3.7 Students should have guidance on ethical AI use R^2 = .026 DW = 2.134	Constant	4.106	.273	–	15.045	<.001	3.569	4.644	–	–	–	–	–	–
	Age	-.037	.049	-.095	-.762	.447	-.134	.059	-.065	-.047	-.046	.213	.237	4.226
	Gender	.230	.115	.136	1.995	.047	.003	.457	.141	.121	.120	1.44	.786	1.272
	Academic rank	.009	.061	.012	.143	.886	-.111	.128	-.038	.009	.009	.008	.551	1.813
	Teaching exp	.041	.057	.085	.724	.470	-.071	.154	-.021	.044	.044	.194	.262	3.814
	[a]HS School	.112	.129	.062	.868	.386	-.142	.365	.080	.053	.052	.270	.726	1.378
	[a]SE School	.069	.123	.040	.564	.573	-.173	.312	-.013	.034	.034	.116	.740	1.351
Item 4.1 Familiarity with current ethical guidelines for AI use in academia R^2 = .069 DW = 1.918	Constant	3.589	.377	–	9.524	<.001	2.847	4.331	–	–	–	–	–	–
	Age	-.049	.068	-.087	-.719	.473	-.182	.085	.054	-.044	-.042	.176	.237	4.226
	Gender	-.341	.165	-.143	− 2.062	.040	-.667	-.015	-.170	-.125	-.122	1.49	.729	1.373
	Academic rank	.021	.084	.020	.252	.801	-.144	.186	.053	.015	.015	.023	.551	1.813
	Teaching exp	.063	.079	.093	.806	.421	-.092	.218	.055	.049	.048	.230	.262	3.814
	[a]HS School	-.561	.178	-.219	− 3.159	.002	-.911	-.212	-.180	-.190	-.187	3.50	.726	1.378
	[a]SE School	-.399	.170	-.161	− 2.343	.020	-.734	-.064	-.024	-.142	-.138	1.90	.740	1.351

Table 5 (continued)

Dependent variable	Predictors[b]	UnS Co		S Co	t	P	95% CI for B		Correlations				Collinearity statistics	
		B	SE	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Part[2]	Tol	VIF
Item 4.2 Ethical Principles for AI use in education total score R^2 = .042 DW = 1.853	Constant	4.793	1.014	–	4.729	<.001	2.798	6.789	–	–	–	–	–	–
	Age	-.129	.182	-.087	-.708	.479	-.488	.230	.026	-.043	-.042	.176	.237	4.226
	Gender	− 1.239	.445	-.195	− 2.784	.006	− 2.115	-.363	-.133	-.168	-.167	2.79	.729	1.373
	Academic rank	-.485	.225	-.174	− 2.153	.032	-.929	-.042	-.050	-.131	-.129	1.66	.551	1.813
	Teaching exp	.297	.212	.164	1.404	.161	-.120	.714	.050	.086	.084	.706	.262	3.814
	[a]HS School	.452	.478	.066	.945	.346	-.490	1.393	-.012	.058	.057	.325	.726	1.378
	[a]SE School	.289	.458	.044	.631	.528	-.612	1.190	.049	.039	.038	.144	.740	1.351

R^2 Coefficient of determination, *DW* Durbin-Watson statistic, *UnS Co* Unstandardized coefficient, *S Co* Standardized coefficient, *B* Beta statistics, *SE* Standard error, *t* t statistic, *P* Two tailed probability value, *CI* Confidence intervals, *Part* Semi-partial correlations, *Part*^{2} Squared semi-partial correlations multiplied by 100 to show the real variation explained by the sole effect of the relevant variable, *Tol* Tolerance, *VIF* Vertical inflation factor, *Teaching exp* Teaching experience, *HS School* Health Sciences School, *SE School* Science and Engineering School

[a] Reference category is Humanity School

[b] Gender, age, academic ranks, teaching experience, and major school categories were entered in the regression model utilizing Enter method

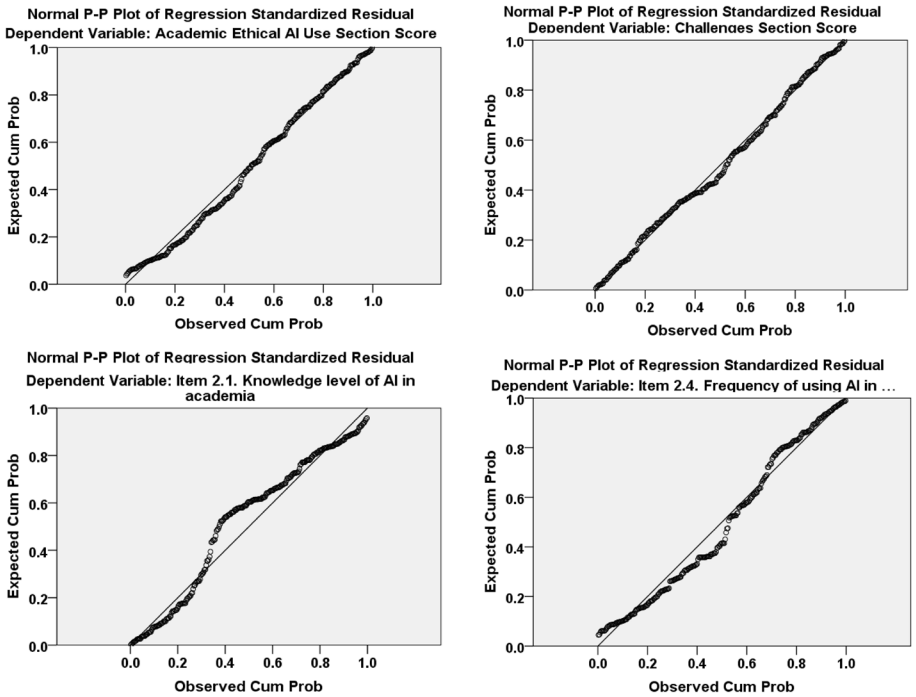

Fig. 1 Normal P-P plots for regression standardized residuals for dependent variables including academic ethical use section score, challenges section score, item 2.1, and item 2.4

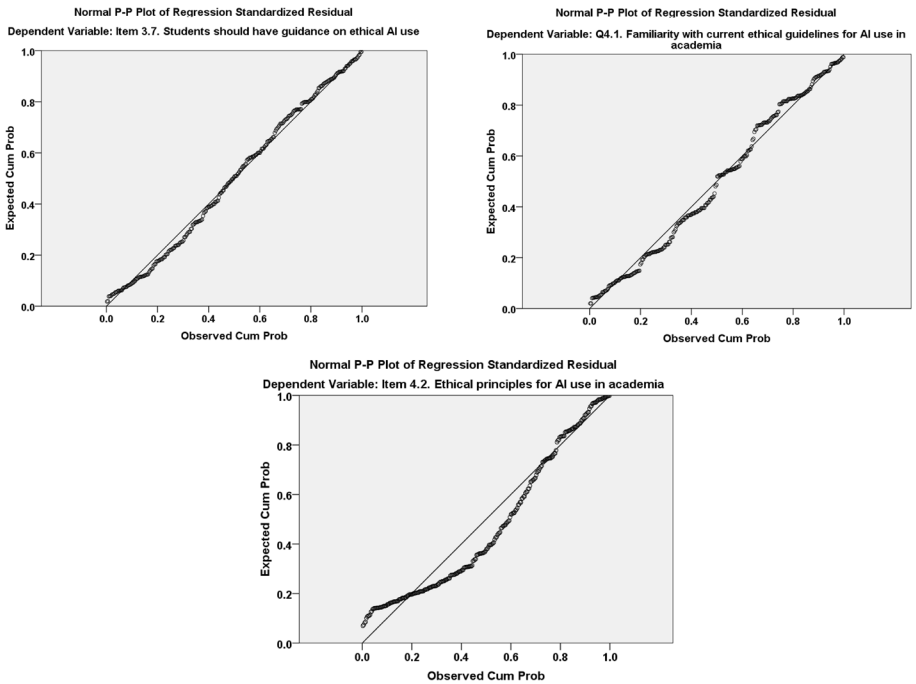

Fig. 2 Normal P-P plots for regression standardized residuals for dependent variables including items 3.7, 4.1, and 4.2

Table 6 Logistic regression analyses predict knowledge and awareness of AI ethical use in academic field utilizing the demographic variables among the study sample ($n = 274$)

Dependent variable	Predictors[b]	B	SE	df	P	Odds ratio	95% CI of odds ratio	
							Lower	Upper
Item 2.2. Used AI in university before POP = 62.8% NR^2 = .083 HL = .514	Age	-.344	.125	1	.006	.709	.554	.906
	Gender	-.068	.298	1	.820	.934	.521	1.676
	Academic Rank	.126	.153	1	.411	1.134	.840	1.531
	Teaching Experience	.192	.143	1	.179	1.212	.916	1.604
	Humanity School[a]	-.578	.306	1	.059	.561	.308	1.022
	Health Science School[a]	− 1.016	.337	1	.003	.362	.187	.701
	Constant	1.149	.709	1	.105	3.154	––	––
Item 3.5. Observed AI use that caused ethical concern POP = 60.2% NR^2 = .083 HL = .103	Age	-.197	.084	1	.019	.821	.696	.969
	Gender	-.213	.302	1	.481	.809	.447	1.461
	Academic Rank	.215	.154	1	.163	1.240	.917	1.677
	Humanity School[a]	-.202	.300	1	.501	.817	.454	1.472
	Health Science School[a]	− 1.133	.352	1	.001	.322	.162	.642
	Constant	.602	.713	1	.398	1.825	––	––

POP Predicted overall percentage in the final block, NR^2 Nagelkerke coefficient of determination for the final block, *HL* Hosmer and Lemeshow test probability value for the final block, *B* the B coefficient of the model, *SE* Standard error of B coefficient, *df* Degree of freedom, *P* Two-tailed probability value, *95%CI* 95% Confidence intervals

[a] Reference category is Schools of science and engineering

[b] Gender, age categories, academic ranks, teaching experience, and major school categories were entered in the regression model utilizing Enter method

section scores of the knowledge of ethical use of AI by academic staff, and the section scores of concerns regarding AI use in academia were tested. The moderation analyses revealed no significant moderating effects for gender or school on any of the relationships mentioned above ($p > 0.05$, Supplementary Table 1).

Finally, the Cronbach's Alpha test was used to assess the reliability of the survey in the main study. Considering the total score of questions for each targeted aim (section) in the main study, the Cronbach's Alpha score was 0.714; indicating adequate reliability of the survey aim (section) scores. Also, considering the questions of the survey regardless the aims, the Cronbach's Alpha was 0.828; indicating adequate reliability of the survey items. In addition, considering both the individual items and the aim (section) total scores together, the Cronbach's Alpha was 0.702; indicating adequate reliability of the survey.

Discussion

46.7% of participants in our study used generative AI during their university experience, with an average duration of 12.3 months. This moderate engagement with AI technologies among academic staff at the University of Jordan aligns with general trends, in which institutional AI adoption is reported, but individual faculty use remains limited (Shaw C et al., 2023; EDUCAUSE, 2024; Syed et al. 2024; Harris 2024). This moderate rate of AI engagement highlights the emerging but cautious integration of AI in academic settings. Notably, 54% of participants rarely or never used AI in their academic activities, highlighting a significant opportunity for increased integration and training.

This moderate rate of AI integration underscores the impact of resource and infrastructure limitations, as noted by the OECD AI Policy Observatory (2021). Regions with robust technological infrastructures and substantial AI research investments achieve advanced integration, while others, like Jordan encounter adoption challenges (OECD AI Policy Observatory 2021). Furthermore, Jordan faces unique challenges due to limited AI-focused research funding and slower digital transformation in higher education (Al Najdawi et al. 2024; Hamad M et al. 2024). These factors likely contribute to the cautious adoption of AI in academic settings.

The study also examined differences in AI usage across various academic domains. Our study found that faculty members from health science schools were less likely to use AI and had less knowledge about it compared to their counterparts in science and engineering fields. This aligns with general trends showing that STEM (Science, Technology, Engineering, and Mathematics) fields adopt new technologies more readily than health sciences, and humanities (Hajkowicz et al. 2023; Stöhr et al. 2024).

Academic staff in our study identified research (46.4%) and teaching (33.9%) as the primary purposes for utilizing AI in academia, highlighting its dual role in enhancing these practices. This aligns with broader trends where AI is increasingly integrated into curriculum development and academic research (Padovano & Cardamone 2024; Pusporini & Nurdiyanto 2024; Butson & Spronken-Smith 2024). For example, many researchers in the MENA region are familiar with AI tools like ChatGPT, with most planning to continue using them to enhance research productivity. Similarly, nearly half of the surveyed urologists worldwide have already incorporated ChatGPT into their research workflows (Sana'a, A. J. et al. 2025).

Despite the benefits, the use of AI by students remains a critical concern, with over 70% of academic staff in our study expressing concerns about its ethical implications. Editing and language corrections (70.8%) were widely considered acceptable, while using AI to complete assignments, relying solely on AI for research, and engaging in exam cheating raised significant concerns. These findings suggest that ethical concerns are particularly heightened in tasks where AI might directly impact academic assessment and research integrity. Similar concerns have been reported in countries such as Austria, the United States, Egypt, and Portugal (Abdelhafiz et al. 2024; Cabellos et al. 2024; Sana'a et al. 2025), where educators highlighted risks associated with generative AI tools, including scientific inaccuracies, biases, and intellectual property violations. These concerns contribute to broader discussions on responsible AI use, emphasizing the need for transparency, accountability, and ethical safeguards.

Interestingly, participants noted domain-specific differences in observed ethical concerns, with health sciences schools less likely to report instances of ethical problems related to AI use by students. This variation may be attributed to differences in assessment types, such as practical versus theoretical assessments, and the nature of assignments that require more qualitative analysis rather than technical solutions. Future research should explore the relationship between assessment methods and the prevalence of AI-related ethical concerns across disciplines.

As a measure for ethical applications, around 8% of participants suggested banning AI altogether, reflecting concerns about its unpredictable impacts (Winner 1978). Approximately 29.2% recommend restricting AI use based on specific needs, aligning with the

principle of contextual integrity, which advocates for technology use tailored to specific contexts (Nissenbaum 2009). Over 80% of participants support AI-based plagiarism detection mechanisms, indicating a growing reliance on technological solutions to maintain academic integrity. The suggested threshold of AI-generated text in academic reports, not exceeding 25%, reflects a pragmatic approach to integrating AI tools while maintaining traditional academic standards (Steponenaite & Barakat 2023; Razack et al. 2021). Additionally, over 70% support implementing workshops and training sessions to guide students on the ethical use of AI, highlighting the gap between expectations for ethical conduct and current student awareness.

While there was high awareness among participants that adherence to ethical principles is paramount, significant gaps in awareness of ethical guidelines among academic staff were revealed. Less than one-third reported familiarity with current ethical guidelines governing AI use in educational institutions. This finding aligns with broader concerns in the literature regarding the insufficient integration of ethical frameworks in AI deployment across sectors (Daly et al. 2019; Slimi & Carballido 2023).

Participants from health sciences schools showed lower awareness of ethical principles related to AI in education. This finding is consistent with research highlighting concerns about data privacy, patient consent, and algorithmic bias in healthcare AI adoption (Haltaufderheide & Ranisch 2024; Al-Ani et al. 2024). Interventions to enhance ethical awareness, such as integrating AI ethics training into health sciences curricula and developing case studies illustrating healthcare-specific ethical dilemmas, should be implemented. These measures can better prepare future healthcare professionals to deal with AI-related ethical challenges.

Despite gaps in their understanding of AI ethics, academic staff hold high expectations for students to maintain ethical standards. This expectation likely stems from institutional norms that prioritize integrity and responsibility in academic settings. Therefore, comprehensive ethical education strategies must be integrated into academic curricula. Approximately 78.5% of academics expressed interest in additional training or professional development in this regard, indicating promising prospects for further development.

Participants with higher AI knowledge were more familiar with ethical guidelines and policies. Those with experience using AI in university settings exhibited more concern about its ethical use by students, suggesting that practical engagement with AI improves awareness of ethical issues (Munoko et al. 2020).

Overall, these findings highlight the complex relationship between knowledge, experience, and ethical concerns related to AI in academia. Targeted interventions, such as training and professional development, are essential to improve ethical awareness among academic staff and create a more ethically informed academic environment, enhancing the responsible use of AI in education.

Moving forward, participants highlighted significant challenges in the ethical deployment of AI language models in education. Concerns included the invisibility of AI in tasks, uncertainties regarding information accuracy, and the absence of clear guidelines. Additionally, the potential misuse of AI for activities like cheating was a major concern, further complicating efforts to maintain academic integrity (Nguyen & Goto 2024;

Abd-Elaal et al. 2019). Many participants also felt their institutions provided inadequate support in understanding and implementing AI-related ethical principles, with around 40% expressing this view. This highlights the urgent need for institutions to enhance their support mechanisms. Global literature underscores the importance of institutional policies and clear guidelines in mitigating ethical risks associated with AI deployment (Floridi & Cowls 2019; European Commission 2019). Educational institutions must prioritize the development of robust policies, guidelines, and tailored training programs to ensure transparent and accountable AI use.

In conclusion, this study highlights significant gaps in ethical awareness and knowledge of AI use among academic staff at the University of Jordan, especially in health sciences. The findings underscore the importance of adopting context-specific strategies that address unique ethical challenges posed by AI in academia. Specialized workshops should equip academic staff with the skills to navigate AI's ethical complexities, focusing on critical areas such as academic integrity, algorithmic bias, and real-world case studies. Additionally, the development of clear, actionable guidelines is crucial for ensuring responsible AI integration in teaching and research. Creating an ethically informed academic environment requires institutional commitment, faculty engagement, and accessible resources to empower academic staff to responsibly integrate AI into education while safeguarding ethical standards.

Limitations and Future research

The findings of this study are specific to the University of Jordan and may not be fully generalizable to other academic institutions due to unique cultural norms and institutional practices that could influence participant responses and study outcomes. Additionally, the data were collected through subjective questionnaires, relying on the honesty and integrity of participants, which could affect the accuracy of the results. Although the questionnaire was tested for clarity through a pilot study, the inherent limitations of self-reported data must be considered when interpreting the results. Moreover, multiple comparisons may increase the risk of false positives; therefore, results near the significance threshold should be interpreted cautiously due to potential randomness. Furthermore, the relatively low R^2 values observed in our models, while typical in social sciences due to the complexity of interacting factors, highlight a limitation in the explanatory power of the findings. However, these low R^2 values do not diminish the practical significance of the relationships identified, which contribute meaningful insights into the studied factors.

Future research should focus on identifying specific barriers to AI adoption in less engaged fields like health sciences and exploring practical solutions and interventions. Longitudinal studies tracking the impact of interventions in AI education and awareness will provide valuable insights into the effectiveness of these strategies over time. By addressing these issues and promoting comprehensive AI integration strategies, academic institutions can improve the quality of education and research across various fields while maintaining academic integrity. This will help create an academic environment that is both technologically skilled and ethically aware.

Abbreviations

AI	Artificial Intelligence
NLG	Natural language generation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UAE	United Arab Emirates
IRB	Institutional Review Board
OECD	Organization for Economic Co-operation and Development
STEM	(Science, Technology, Engineering, and Mathematics)
MENA	Middle East and North Africa

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s40979-025-00189-4.

Supplementary Material 1. Supplementary Table 1. Bivariate and multiple regression analysis to identify various moderation effects between moderators (gender and school), dependent variables, and independent variables (predictors) among the study sample (*n*=274).

Clinical trial number
Not applicable.

Authors' contributions
Marwa M. AInsour conceptualization; Marwa M. AInsour; methodology; Mahmoud K. AL-Omiri, formal analysis, Marwa M. AInsour, Latifa Qouzah, Sanaa Jammani, Rasha A. Alamoush; data curation, Marwa M. AInsour writing—original draft preparation, all authors have read and agreed to the published version of the manuscript.

Funding
No funding was received for this study.

Data availability
To help preserve the anonymity of academic staff the survey responses are not included in an open-access repository. The data may be provided upon request to the authors and approval of the university research ethics board.

Declarations

Ethics approval and consent to participate
This study was approved by the Institutional Review Board (IRB) at the University of Jordan (Approval Number: 143/2023). Informed consent was obtained online, and participation in the survey was voluntary. Consent was implied through participants'completion of the survey, as approved by the IRB.

Consent for publication
Participants consented to the publication of anonymized data and findings derived from the study.

Competing interests
The authors declare no competing interests.

Received: 11 September 2024 Accepted: 10 April 2025
Published: 27 May 2025

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