

## THE EXTENT OF KNOWLEDGE AMONG FACULTY MEMBERS AT JORDANIAN UNIVERSITIES REGARDING PRINCIPLES OF AI ETHICS IN SCIENTIFIC RESEARCH AND ITS GUIDELINES

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### ABSTRACT

**Objectives:** Objectives: This study aims to explore the extent of knowledge among faculty members at Jordanian universities regarding the principles of AI ethics in scientific research and its regulatory guidelines, in alignment with SDG 4: Quality Education to promote inclusive and equitable education and lifelong learning opportunities.

**Theoretical Framework:** The study is based on the ethical principles of artificial intelligence, emphasizing key dimensions such as data reliability and integrity, privacy and security, human and socio-cultural benefits, and the ethics of integrity, fairness, justice, responsibility, and transparency. These dimensions were used as the basis for designing the study instrument.

**Method:** A descriptive survey methodology was employed. The researchers developed a questionnaire consisting of 40 items, distributed across four domains: (1) data reliability and integrity, (2) privacy, security, and protection, (3) human and socio-cultural benefits, and (4) ethics of integrity, fairness, justice, responsibility, and transparency. The instrument was administered to a randomly selected sample of 245 faculty members across various Jordanian universities.

**Results and Discussion:** The results revealed a high level of knowledge among faculty members regarding the principles and guidelines of AI ethics in scientific research. Moreover, no statistically significant differences were found in participants' responses based on variables such as college affiliation, teaching experience, academic rank, or source of academic degree. The discussion elaborates on these findings, emphasizing their significance in enhancing ethical research practices involving AI.

**Research Implications:** The study highlights the importance of incorporating AI ethics education into faculty development programs and strengthening institutional guidelines to uphold ethical standards in scientific research.

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**Originality/Value:** This research fills a gap in understanding the level of AI ethics knowledge among faculty members at Jordanian universities, providing actionable insights to advance ethical AI use in academic research.

**Keywords:** AI ethics, faculty members, jordanian universities, scientific research, guidelines, quality education (SDG 4), sustainable development goals (SDGs).

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## 1 INTRODUCTION

Given the rapid growth in practices and technologies related to artificial intelligence (AI) and the diverse range of its applications due to significant technological advancements and the proliferation of online platforms, alongside the emergence of robots and intelligent machines, AI presents both opportunities and challenges across various aspects of human life. However, while its applications bring numerous benefits, there is also a rising "AI-phobia" concerning the potential impact on human ethics, particularly regarding scientific research ethics.

Utilizing AI to support scientific research within higher education institutions can be achieved through various tools, such as automated text translation across different languages and translating articles and texts. By employing machine learning, which recognizes original language texts, suitable linguistic structures can be selected to ensure reader comprehension, thus saving researchers time and effort in translating numerous academic works (Al-Dahshan, 2020).

In this context, universities have sought to develop their AI capabilities to keep pace with modernization, incorporating various forms of advanced technology. This includes the use of mobile devices to enhance data accuracy, leveraging advanced big data analytics to identify critical statistical patterns, and utilizing AI applications to gather, organize, and discover knowledge (Xing & Marwala, 2017).

Numerous calls have emerged for the establishment of core ethical guidelines and maintaining open communication with stakeholders, including AI developers and decision-makers within universities. There is a pressing need for ethical guidelines for AI systems that align with societal values. Safeguards have been implemented to oversee the design, function, and evolution of AI systems, with an emphasis on embedding self-aware behavioral sciences to inspire AI developers toward creating more trustworthy and responsible AI (Sullivan, 2019).

In this regard, UNESCO's recommendation on AI ethics emphasizes the identification of shared values and principles necessary to ensure sound AI development, advocating for the legislative measures needed to enforce these principles according to each country's constitutional and administrative frameworks. In alignment with global trends and best practices in this domain, and to enhance the nation's competitive standing in AI readiness and maturity assessments, these guidelines aim to bolster international competitiveness (National AI Ethics Charter, 2023).

## 1.1 PROBLEM STATEMENT AND RESEARCH QUESTIONS

Artificial intelligence (AI) is increasingly pervasive in learning and education systems, placing a significant responsibility on faculty members to contribute to the advancement of the educational process by staying abreast of the latest technological developments in educational and pedagogical fields. It is essential to emphasize the ethical and responsible use of AI, ensuring adherence to AI ethics, particularly within scientific research, to manage its risks and uphold ethical principles and values. This study aims to address the following questions:

- **First Question:** What is the extent of knowledge among faculty members at Jordanian universities regarding the principles of AI ethics in scientific research and its regulations?
- **Second Question:** Are there statistically significant differences at the level of  $\alpha = 0.05$  in the mean responses of faculty members at Jordanian universities concerning their knowledge of AI ethics principles in

scientific research and its regulations, attributed to variables such as faculty, experience, academic rank, and source of academic certification?

## 1.2 OBJECTIVES OF THE STUDY

The current research seeks to:

1. Identify the level of cognitive awareness of the application of AI ethics in educational research among faculty members.
2. Examine the presence of statistically significant differences at the level of ( $\alpha= 0.05$ ) among the mean scores of faculty members' knowledge levels on AI ethics principles in scientific research, considering variables (faculty, experience, academic rank, and source of academic certification).

## 1.2 SIGNIFICANCE OF THE STUDY

The significance of this study lies in its contemporary relevance and the scarcity of studies that specifically address this aspect. The study is anticipated to offer results and recommendations that support faculty members at Jordanian universities in adhering to ethical principles when utilizing AI. Additionally, it will develop a tool related to AI ethics in scientific research, providing a basis for ongoing research in the field of AI ethics.

## 1.3 STUDY TERMINOLOGY

- **AI Ethics:** The ethical considerations guiding the development, dissemination, and responsible use of AI systems in ways that protect human rights, uphold values, minimize harm, maximize benefits, reduce bias, enhance fairness and transparency, and safeguard data privacy for all stakeholders involved in educational and scientific research processes (Hamayel, 2023);



- **Scientific Research in AI Applications:** Examining structural design variables of e-learning environments and their relation to AI components, to identify suitable designs that meet learner characteristics and needs, efficiently achieving educational objectives (Abu Khatwa, 2022).

#### 1.4 STUDY BOUNDARIES

- **Human Boundaries:** This study is limited to faculty members at Jordanian universities;
- **Spatial Boundaries:** The study includes three selected public and private Jordanian universities;
- **Temporal Boundaries:** The research is conducted during the second semester of the 2023/2024 academic year;
- **Subject Boundaries:** The study focuses on faculty members' knowledge at Jordanian universities regarding the principles of AI ethics in scientific research and its regulations.

## 2 METHODOLOGY

The study adopts a descriptive survey method, which is suitable for the study's objectives.

#### 2.1 PREVIOUS STUDIES

Through a review of the literature, researchers have identified several relevant studies, organized from the most recent to the oldest, as follows:

- Al-Shamrani (2024) conducted a study aimed at understanding and analyzing international students' perspectives on AI ethics in education, using the ChatGPT application as a model. The study was implemented with a diverse sample of 45 international students using a survey methodology. Data was collected through a questionnaire, and the results revealed that international students exhibit a clear awareness of the importance of AI ethics and believe in the necessity of developing

ethical standards for the responsible use of these technologies according to appropriate criteria;

- Hamayel (2023) focused on outlining global standards for AI ethics in education, as proposed by international associations and bodies concerned with AI ethics. Conducted in Palestine, this study used a descriptive approach, analyzing research, books, journals, and online resources to explore ethical considerations surrounding AI in higher education from a global perspective and investigate the ethical challenges of integrating AI in university education. The study aimed to identify opportunities provided by AI to enhance the responsible use of AI technologies in education;
- Ghanayem (2023) aimed to understand the reasons behind fear of AI and its connection to research ethics, identifying the ethical considerations in research necessary to avoid "AI-phobia." A qualitative approach was used, highlighting fears linked to scientific research across various fields of knowledge, as well as concerns regarding the rapid advancements of AI;
- Al-Makkawi (2023) sought to establish an ethical framework for the use of AI in educational research, employing a descriptive-analytical method. The study concluded that the core elements of an ethical charter should include respecting researchers' and participants' privacy, ensuring reliability and integrity in using AI tools within educational research;
- Mukhtar (2022) highlighted challenges in AI applications within the educational system, noting issues like weak educational policies, reliance on traditional in-person education, and the lack of readiness for remote learning in many countries, compounded by the absence of digitized curricula. Using a descriptive-analytical method, the study connected AI with education, revealing various challenges, such as achieving balance between "AI for education" and "education for AI," along with ensuring equitable access to AI Technologies;
- Wang (2021) conducted a study exploring the role of AI in educational leadership. Using a descriptive methodology that involved reviewing literature on AI, decision-making, and educational leadership, the results indicated that AI could improve analytical efficiency, assisting

educational leaders in data-driven, evidence-based decision-making. It showed that ethical, value-based human judgment can address shortcomings in AI-supported decisions;

- Al-Qahtani and Al-Dail (2020) aimed to assess the cognitive awareness and attitudes of Princess Noura University students regarding AI concepts and applications in education. The study sample comprised 333 students and employed a descriptive-analytical approach, using a 26-item questionnaire. The results indicated a high level of awareness and positive attitudes toward AI concepts across different faculties;
- Darar (2019) examined AI ethics, ethical issues associated with AI, and concerns about AI's potential self-awareness. Using a descriptive-analytical approach, the study concluded that the Arab world lacks comprehensive AI and robotics ethical policies. The study also noted that Germany's Ministry of Transport's policies met the highest ethical standards at 48.7%, indicating the need for significant improvements in AI and robotics ethical policies;
- Fox (2019) explored AI ethics in higher education through an analytical approach, discussing both challenges and opportunities of AI integration in higher education with a focus on its ethical implications. The study emphasized the need for ethical and responsible AI use, stressing transparency and explainability in AI systems, and proposed that institutions take steps to educate students and faculty on ethical AI practices;
- Sullivan (2019) aimed to examine the ethical considerations involved in AI integration within higher education. Adopting an inductive approach, the study underscored the importance of ethical AI usage, highlighting transparency and the need for comprehensible AI systems to ensure that both students and teachers fully understand AI decision-making processes.

The above-reviewed studies reveal some methodological similarities, particularly in adopting a descriptive approach, as seen in Al-Shamrani (2024) and Hamayel (2023), though differing from Fox's (2019) study, which utilized a qualitative approach. The current study has benefited from previous research

by establishing a robust theoretical and scientific framework and by refining the study tool. Additionally, this study uniquely provides results and recommendations that will be valuable to researchers in the field of education.

**Study Population and Sample:** The study population comprised faculty members from three Jordanian universities—Amman Arab University, Yarmouk University, and Jerash University—with a total of 750 faculty members. A random sampling technique was employed, resulting in a sample of 254 faculty members who responded to the questionnaire.

**Study Instrument:** To address the research questions, the researchers developed a questionnaire consisting of 40 items in its final form, drawing from theoretical literature and prior studies, such as Wang (2021) and Mukhtar (2022).

**Content Validity:** To ensure the content validity of the questionnaire, an initial draft containing 43 items was presented to a panel of 10 expert reviewers from Jordanian universities. Based on their feedback, 3 items were removed, resulting in a final version of 40 items. To evaluate responses from the study sample, the researchers adopted a scale outlined in Table (1).

**Table 1**

*Rating Criteria for Individual Questionnaire Items*

Value Range	1 - 2.33	2.34 - 3.67	3.68 - 5
Rating Level	Low	Medium	High

**Construct Validity:** To verify the construct validity of the questionnaire, Pearson correlation coefficients were calculated between each item and its respective domain, as well as between each item and the overall questionnaire score. Table (2) shows the correlation coefficients for questionnaire items with their respective domains and with the overall questionnaire.



**Table 2**

*Correlation Coefficients for Questionnaire Items with Domain and Total Score*

Item Number	Correlation with Domain	Correlation with Total Score	Item Number	Correlation with Domain	Correlation with Total Score
1	**0.77	**0.74	21	**0.82	**0.75
2	**0.85	**0.77	22	**0.57	**0.52
3	**0.82	**0.66	23	**0.87	**0.79
4	**0.80	**0.72	24	**0.79	**0.71
5	**0.86	**0.80	25	**0.92	**0.79
6	**0.85	**0.72	26	**0.92	**0.80
7	**0.90	**0.82	27	**0.83	**0.78
8	**0.82	**0.68	28	**0.90	**0.86
9	**0.93	**0.83	29	**0.84	**0.73
10	**0.86	**0.85	30	**0.77	**0.76
11	**0.86	**0.89	31	**0.85	**0.84
12	**0.85	**0.84	32	**0.91	**0.85
13	**0.85	**0.81	33	**0.82	**0.81
14	**0.89	**0.84	34	**0.85	**0.79
15	**0.86	**0.80	35	**0.84	**0.80
16	**0.88	**0.82	36	**0.83	**0.78
17	**0.91	**0.85	37	**0.90	**0.84
18	**0.85	**0.77	38	**0.82	**0.88
19	**0.87	**0.80	39	**0.93	**0.86
20	**0.80	**0.73	40	**0.82	**0.76

Statistically significant at  $p < 0.01$

Table (2) shows that the correlation coefficients with the domain ranged from 0.57 to 0.93, and the correlations with the total score ranged from 0.52 to 0.89. These values are statistically significant and considered acceptable for conducting this study.

**Instrument Reliability:** To verify the reliability of the questionnaire, it was administered to a sample of 30 faculty members outside the main study sample, and Cronbach's alpha coefficient was calculated for internal consistency. Table (3) presents these results.

**Table 3**

*Reliability Coefficients for the Questionnaire*

	Instrument Domain	N	Cronbach's Alpha
Questionnaire	Data Reliability and Integrity	10	0.95
	Privacy, Security, and Protection	10	0.96
	Human and Social-Cultural Benefits	10	0.94
	Ethical Values: Integrity, Fairness, Justice, Responsibility, Transparency	10	0.96
	Overall	40	0.98

Table (3) shows that the reliability coefficients for the domains ranged from 0.94 to 0.96, with an overall reliability coefficient of 0.98, which is acceptable for the purposes of the current study.

**Statistical Analysis:** To address the first research question, means and standard deviations were calculated. For the second question, multivariate analysis of variance (MANOVA) was used.

**Question 1: What is the level of awareness among faculty members at Jordanian universities regarding the principles and regulations of AI ethics in scientific research?** To address this question, mean scores, standard deviations, and rankings were calculated for the questionnaire domains, and Table (4) presents these results.

**Table 4**

*Means, standard deviations, and rankings of the level of awareness among Jordanian university faculty members of AI ethics principles and regulations in scientific research, arranged in descending order.*

Item Sequence	Rank	Domain	M	SD	Awareness Level
1	1	Data Reliability and Integrity	3.77	0.94	High
3	2	Human and Social-Cultural Benefits	3.70	1.01	High
4	3	Diverse Ethics: Integrity, Fairness, Justice, Responsibility, and Transparency	3.68	1.05	High
2	4	Privacy, Security, and Protection	3.64	1.10	Moderate
Overall		Questionnaire Overall	3.70	0.95	High

Table (4) demonstrates that the level of awareness among faculty members at Jordanian universities regarding AI ethics principles and regulations

in scientific research is high, with a mean score of 3.70 and a standard deviation of 0.95. Specifically, awareness was ranked across the subdomains as follows: Data Reliability and Integrity ranked first with a mean of 3.77 and a standard deviation of 0.94, rated high; Human and Social-Cultural Benefits ranked second with a mean of 3.70 and a standard deviation of 1.01, rated high; Diverse Ethics: Integrity, Fairness, Justice, Responsibility, and Transparency ranked third with a mean of 3.68 and a standard deviation of 1.05, rated high; and Privacy, Security, and Protection ranked fourth with a mean of 3.64 and a standard deviation of 1.10, rated moderate.

Means and standard deviations were calculated for each item in the questionnaire and each domain, and Tables (5, 6, 7, 8) detail these findings.

**Table 5**

*Means and standard deviations of the awareness level of Jordanian university faculty members on AI ethics principles and regulations in scientific research for items within the domain of Data Reliability and Integrity, arranged in descending order.*

Item Number	Rank	Item	M	S D	Practice Level
1	1	Identifying potential benefits of using AI applications essential in scientific research	4.13	0.88	High
2	2	Selecting high-quality AI tools to find appropriate and accurate references for research	3.89	1.01	High
8	3	Continuous evaluation of AI applications to avoid risks in their employment	3.86	1.06	High
3	4	Assessing research information obtained through intelligent tools for reliability and quality	3.80	0.94	High
6	5	Choosing storage and preservation tools for data that facilitate research use	3.79	1.11	High
4	6	Proper use of audio or visual recordings to obtain required information	3.70	1.15	High
10	7	Ensuring accurate data acquisition, classification, processing, and availability	3.67	1.23	High
7	8	Precision in transferring information and using it in research to prevent plagiarism	3.64	1.16	Moderate
5	9	Verifying information obtained from intelligent chat tools related to research	3.63	1.26	Moderate
9	10	Using appropriate AI methods to analyze research data according to methodology	3.62	1.29	Moderate
		Overall	3.77	0.94	High

Table (5) reveals that the knowledge level of faculty members at Jordanian universities regarding the principles of AI ethics in scientific research, specifically within the domain of "Data Reliability and Integrity," is high, with a mean score of 3.77 and a standard deviation of 0.94. The mean scores for the individual items ranged from 3.62 to 4.13, with item (1) ranking first with a high mean of 4.13 and a standard deviation of 0.88, while item (9) ranked last, achieving a mean score of 3.62 with a standard deviation of 1.29, indicating a moderate level.

**Table 6**

*Means and standard deviations for the level of knowledge among faculty members at Jordanian universities regarding the principles and standards of AI ethics in scientific research within the "Privacy, Security, and Protection" domain, listed in descending order.*

Item Number	Description	Rank	M	SD	Level
20	Identifying potential harms during research processes and intervening to prevent them	1	3.81	1.15	High
15	Avoiding the use of individuals in research in ways that may harm or exploit them	2	3.77	1.31	High
11	Managing research and controlling its results to ensure adherence to privacy and security standards	3	3.72	1.04	High
19	Ensuring information security throughout all intelligent application procedures in scientific research	4	3.68	1.37	High
12	Protecting the personal data privacy of research participants	5	3.64	1.35	Moderate
14	Adhering to regulations and legislation that safeguard individual freedom when using AI	6	3.58	1.24	Moderate
17	Determining necessary levels of protection and mechanisms for data use and disclosure	7	3.57	1.41	Moderate
16	Obtaining prior consent from participants for research procedures	8	3.54	1.35	Moderate
13	Complying with cybersecurity standards to protect research data and prevent unauthorized access	9	3.53	1.22	Moderate
18	Restricting access to information to authorized individuals and establishing controls for this access	10	3.50	1.35	Moderate

Privacy, Security, and Protection (Overall): Mean = 3.64, Standard Deviation = 1.10, Level = Moderate



Table (6) indicates that the knowledge level of faculty members at Jordanian universities concerning the principles and standards of AI ethics in scientific research, specifically in the "Privacy, Security, and Protection" domain, is moderate, with an overall mean score of 3.64 and a standard deviation of 1.10. The mean scores for individual items in this domain ranged from 3.50 to 3.81, with item (20) ranking highest with a mean of 3.81 and a standard deviation of 1.15, reflecting a high level, while item (18) ranked lowest with a mean of 3.50 and a standard deviation of 1.35, indicating a moderate level.

**Table 7**

*Means and Standard Deviations of Faculty Members' Knowledge Levels in Jordanian Universities on AI Ethics Principles and Regulations in Scientific Research for the Domain (Humanity and Social and Cultural Benefits), Ranked in Descending Order*

Item	Rank	Item	M	SD	Degree of Practice
21	1	Setting limits on AI usage in alignment with human needs.	3.88	1.16	High
24	2	Allowing human intervention when AI use is unsuitable.	3.82	1.12	High
28	3	Ensuring research benefits society and advances humanity.	3.80	1.33	High
29	4	Conducting research that considers social and environmental priorities and challenges.	3.72	1.23	High
30	5	Utilizing AI solutions to achieve sustainable development goals in society.	3.71	1.23	High
26	6	Upholding ethics that prevent AI misuse when it compromises humanity.	3.68	1.26	High
25	7	Emphasizing humanity as an effective ethical standard in AI research use.	3.67	1.20	Moderate
23	8	Ensuring AI systems do not fully replace human responsibility and accountability.	3.57	1.29	Moderate
22	9	Avoiding conflicts between AI applications in research and fundamental human rights.	3.56	1.14	Moderate
27	10	Conducting periodic assessments of AI applications' impact on humanity and societal values.	3.55	1.28	Moderate
		Overall	3.70	1.10	High

Observation from Table (7): The knowledge level of faculty members in Jordanian universities regarding AI ethics principles and regulations in scientific research, specifically in the domain of "Humanity and Social and Cultural Benefits," was found to be high, with an overall mean of 3.70 and a standard deviation of 1.10. The means of individual items ranged from 3.55 to 3.88, with item number 21 ranked first (mean = 3.88, SD = 1.16, high level) and item number 27 ranked last (mean = 3.55, SD = 1.28, moderate level).

**Table 8**

*Means and Standard Deviations of Faculty Members' Knowledge Levels in Jordanian Universities on AI Ethics Principles and Regulations in Scientific Research for the Domain (Diverse Ethics: Integrity, Fairness, Justice, Responsibility, and Transparency), Ranked in Descending Order*

Item	Rank	Item	M	SD	Degree of Practice
32	1	Establishing fair and objective standards to select research populations, samples, and variables.	3.81	1.21	High
31	2	Defining responsibilities and obligations in research with clear accountability mechanisms.	3.77	1.15	High
34	3	Following ethical practices for data collection, handling, and management to ensure result accuracy.	3.76	1.21	High
37	4	Promoting transparency in AI use to clarify its operations and understand its technologies.	3.72	1.20	High
40	5	Disclosing AI tools and technologies used in research to prevent risks of plagiarism or imitation.	3.70	1.27	High
33	6	Choosing suitable AI metrics to ensure	3.65	1.06	Moderate

		ethical results in research.			
36	7	Achieving transparency to foster trust in ethical AI usage in research.	3.63	1.25	Moderate
38	8	Addressing challenges related to AI transparency and interpretability.	3.62	1.24	Moderate
39	9	Involving stakeholders in decision-making and systematically addressing emerging issues.	3.59	1.17	Moderate
35	10	Selecting specialized algorithms for analyzing and interpreting results, incorporating human oversight.	3.57	1.35	Moderate
		Overall	3.68	1.05	High

Observation from Table (8): Faculty members' knowledge in the domain of "Diverse Ethics" was rated as high, with an overall mean of 3.68 and a standard deviation of 1.05. The means of individual items ranged from 3.57 to 3.81, with item number 32 ranked highest (mean = 3.81, SD = 1.21, high level) and item number 35 ranked lowest (mean = 3.57, SD = 1.35, moderate level).

**Question Two: Are there statistically significant differences at the level of  $\alpha = 0.05$  in the mean responses of faculty members at Jordanian universities concerning their level of knowledge of the principles and ethical regulations of artificial intelligence in scientific research, attributable to the study's variables?** To answer this question, the means and standard deviations of responses were calculated across various variables: faculty, years of experience, academic rank, and source of academic qualification. Table 9 presents these results.

**Table 9**

*Means and Standard Deviations of Faculty Members' Responses on the Degree of Application of AI in Education and Scientific Research, Categorized by Variables such as Gender, Type of University, Faculty, and Program Level*

Variables	Levels	Fields	Data Reliability	Privacy and Security	Humanity and Benefits	Diverse Ethics	Overall Score
Faculty	Humanities	M	3.8	3.68	3.80	3.75	3.76
		SD	0.89	1.09	1.03	1.09	0.97
	Sciences	M	3.73	3.56	3.54	3.57	3.60
		SD	1.03	1.13	0.96	0.99	0.93
Experience	Less than 5 years	M	3.72	3.61	3.72	3.64	3.67
		SD	0.95	0.91	0.96	1.14	0.90
	5-10 years	M	3.66	3.31	3.23	3.38	3.39
		SD	1.13	1.22	0.94	1.10	1.05
	10+ years	M	3.82	3.71	3.79	3.76	3.77
		SD	0.90	1.13	1.02	1.01	0.95
Academic Rank	Assistant Professor	M	3.65	3.46	3.57	3.55	3.56
		SD	0.84	0.95	0.98	0.99	0.85
	Associate Professor	M	3.59	3.50	3.75	3.52	3.59
		SD	1.28	1.29	1.24	1.35	1.27
	Professor	M	4.11	4.04	3.87	4.03	4.01
		SD	0.75	1.13	0.85	0.83	0.82
Qualification Source	Local	M	3.88	3.78	3.81	3.84	3.83
		SD	0.90	1.14	1.04	1.10	0.98
	Arab	M	3.83	3.63	3.69	3.71	3.71
		SD	0.86	1.14	1.00	1.00	0.96
	International	M	3.62	3.47	3.58	3.48	3.54
		SD	1.04	1.03	0.98	1.01	0.93

As shown in Table 9, apparent differences exist in the mean responses of faculty members based on the variables of faculty, years of experience, academic rank, and source of academic qualification. To determine if these differences are statistically significant, results from the multivariate analysis of variance (MANOVA) were generated, as shown in Table 10.



**Table 10**

*Multivariate Analysis of Variance (MANOVA) Results for Significance of Differences Between the Means of Study Sample Responses Based on Variables of Faculty, Experience, Academic Rank, and Certificate Source*

Source of Variance	Fields	SS	df	M S	F	Sig
Hotelling (0.011) F value (0.62) Significance Level (0.648)	Data Reliability and Integrity	0.645	1	0.645	1.873	0.172
	Privacy, Security, and Protection	0.947	1	0.947	1.445	0.231
	Human, Social, and Cultural Benefits	0.316	1	0.316	0.560	0.455
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	0.318	1	0.318	0.505	0.478
	Overall Score	0.527	1	0.527	1.169	0.281
Experience Wilks' Lambda (0.602) F value (1.583) Significance Level (0.745)	Data Reliability and Integrity	21.173	2	10.586	30.734	0.351
	Privacy, Security, and Protection	31.031	2	15.515	23.659	0.275
	Human, Social, and Cultural Benefits	33.515	2	16.758	29.667	0.721
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	26.087	2	13.043	20.729	0.102
	Overall Score	27.344	2	13.672	30.343	0.397
Rank Wilks' Lambda (0.847) F value (4.796) Significance Level (0.710)	Data Reliability and Integrity	7.652	2	3.826	11.107	0.715
	Privacy, Security, and Protection	14.639	2	7.320	11.162	0.328
	Human, Social, and Cultural Benefits	8.629	2	4.314	7.638	0.987
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	11.380	2	5.690	9.043	0.703
	Overall Score	10.256	2	5.128	11.380	0.789
Certificate Source Wilks' Lambda (0.911) F value (2.635) Significance Level (0.120)	Data Reliability and Integrity	2.735	2	1.368	3.970	0.420
	Privacy, Security, and Protection	3.673	2	1.836	2.800	0.063
	Human, Social, and Cultural Benefits	3.297	2	1.649	2.919	0.076
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	7.433	2	3.717	5.907	0.703
	Overall Score	4.017	2	2.009	4.458	0.113
Error	Data Reliability and Integrity	77.158	224	0.344		
	Privacy, Security, and Protection	146.897	224	0.656		
	Human, Social, and Cultural Benefits	126.526	224	0.565		
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	140.946	224	0.629		
	Overall Score	100.931	224	0.451		

Total	Data Reliability and Integrity	226.239	253			
	Privacy, Security, and Protection	309.781	253			
	Human, Social, and Cultural Benefits	258.407	253			
	Ethics: Integrity, Fairness, Justice, Responsibility, Transparency	280.363	253			
	Overall Score	232.623	253			

Table (10) demonstrates no statistically significant differences in the mean scores of participants' responses concerning their knowledge of AI ethics principles in scientific research and related regulations across the variables of faculty, experience, academic rank, and source of academic certification.

### 3 DISCUSSION OF RESULTS

**Question 1:** What is the level of knowledge among faculty members at Jordanian universities regarding the principles and regulations of AI ethics in scientific research? This question revealed that the faculty members at Jordanian universities exhibit a high level of awareness of the principles and regulations surrounding AI ethics in scientific research. This finding aligns with the study by Al-Shamrani (2024), which demonstrated a clear awareness of the importance of AI ethics. Faculty members expressed that ethical standards should be developed to ensure the responsible use of these technologies in accordance with appropriate guidelines, thereby enhancing educational quality and improving the learning process. Specifically, the level of knowledge among faculty members regarding the principles of AI ethics in scientific research is distributed across subfields as follows:

- 1. Data Reliability and Integrity:** This subfield ranked highest with a high degree of awareness. This can be attributed to universities' efforts to advance and improve machine learning and AI technologies in scientific research and to ensure their responsible use according to ethical standards. Data collected and stored in machine learning databases serves as a resource for knowledge sharing and management and as a reference for making any intelligent decisions by AI systems. This result is consistent with Wang's (2021) study, which highlighted AI's potential for analytical efficiency, assisting in

data-driven and evidence-based decision-making through a blend of evidence-supported, data-based decision-making and value-based ethical decision-making. It also aligns with AI's role as a human-like agent in making data-driven, evidence-supported decisions. Similarly, it agrees with Al-Makawi's (2023) study, which emphasized considerations of privacy for researchers and participants, reliability and honesty in the use of AI tools in educational research, and institutional integrity in AI usage.

2. **Humanity and Socio-Cultural Benefits:** This subfield ranked second with a high degree of awareness, likely due to the universal accessibility of this technology and its potential to provide socio-cultural benefits. This finding aligns with the studies by Ghanayem (2023) and Mukhtar (2022), which emphasize similar benefits. Sullivan (2019) further supports this by recommending that educational institutions educate students and faculty on the ethical implications of AI and how it can be used responsibly.
3. **Diverse Ethical Principles:** This subfield, which includes principles such as integrity, fairness, justice, responsibility, and transparency, ranked third with a high degree of awareness. This finding is consistent with the study by Darar (2019), which concluded that ethical policies regarding AI and robotics are largely absent in the Arab world, especially in higher education. Additionally, it agrees with the studies by Fox (2019) and Sullivan (2019), both of which highlight the importance of transparency and the ability to explain AI systems to ensure that students and faculty fully understand how AI-driven decisions are made.
4. **Privacy, Security, and Protection:** This subfield ranked fourth with a moderate level of awareness. This outcome can be attributed to the emphasis on critical ethical dimensions such as respecting the privacy of researchers and participants, ensuring reliability and honesty in the use of AI tools in educational research, institutional adherence to ethical AI usage, and the use of AI applications to support communication between research institutions and the wider community.

**Question Two:** Are there statistically significant differences at the level of  $\alpha=0.05$  in the mean responses of faculty members at Jordanian universities regarding their knowledge of the principles and regulatory standards of AI ethics

in scientific research, attributable to the study variables? This question demonstrated no statistically significant differences between the mean responses of the study sample members regarding their level of knowledge, attributable to variables such as faculty, experience, academic rank, and the source of their academic degrees. This result may be attributed to the similar conditions of faculty members across universities, whether among male and female members, across faculties, or programs, with regard to employing AI applications in their work and understanding research ethics related to AI. This similarity is possibly due to the novelty of these applications and tools.

**Study Recommendations:** Based on the study results, the researchers recommend the following:

1. Selecting specialized algorithms for analyzing and interpreting results while involving human reasoning in the process;
2. Engaging relevant university stakeholders in decision-making and systematically and transparently addressing arising issues;
3. Implementing privacy, security, and protection systems pertinent to research ethics;
4. Utilizing appropriate AI applications to analyze scientific research data in accordance with its methodology;
5. Encouraging faculty members to participate in community discussions on AI ethics in higher education through the organization of workshops and interactive seminars.

## 4 CONCLUSION

The study concludes by analyzing the extent of faculty members' knowledge at Jordanian universities concerning AI ethics principles and regulatory standards in scientific research, presenting key findings intended to guide researchers. It provides discussions on prominent results relevant to the study's domains, which include data reliability and integrity, the domain of human and social-cultural benefits, and ethical principles like integrity, fairness, justice, responsibility, transparency, as well as privacy, security, and protection—all rated as high priorities. Regardless of these significant findings,



the study offers several recommendations, suggesting further research on each dimension independently. It is hoped that this study will modestly contribute to this field by elucidating the theoretical framework of AI ethics in scientific research, defining related terms and concepts, and reviewing previous intellectual contributions to the topic.

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