A training system based on AI applications and chatbots: Impact on developing ethical awareness among postgraduate students

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ABSTRACT

This study examined the effect of artificial intelligence (AI) applications on developing chatbot production skills and awareness of AI ethics among female postgraduate students. Using a quasi-experimental design, the research employed a cognitive test to measure AI knowledge, an observation checklist to assess chatbot production using Botmake.io, and an AI ethics questionnaire covering integrity and fairness, privacy and security, humanity, social and environmental benefits, reliability and safety, transparency and explainability, and accountability and responsibility. The sample included 38 randomly selected female postgraduate students from the Department of Educational Technology at Taibah University during the first semester of 2025. The results showed significant improvement in chatbot production performance and AI-related knowledge after the intervention. Moreover, students demonstrated a very high level of ethical awareness in all principles except accountability and responsibility, which were rated at a high level.

1. Introduction

The education sector in the Kingdom of Saudi Arabia is witnessing significant advancements in the field of technology. These advancements have, in turn, contributed to the development of the educational process, enabling the acquisition of learning outcomes across various courses and curricula, and fostering outstanding performance in community building and advancement. Notably, artificial intelligence (AI) is one of the modern scientific fields that primarily relies on computers and their associated software. Specifically, AI focuses on creating knowledge after its acquisition, including storage, processing, preservation, and utilization to address complex problems. This leads to more efficient opportunities and the ability to achieve competitive advantages in diverse fields (Alshahrani and Mostafa, 2025; Alotaibi and Alshehri, 2023).

Moreover, AI offers technological capabilities that promote the invention of improved educational and training practices, facilitating lifelong learning. This trend suggests that AI's future will significantly alter the educational landscape due to its rapid advancements and extensive applications (Khan et al., 2025; Palenski et al., 2024).

Among the key applications of AI are chatbots, designed to understand human language and interact with users naturally. These applications aim to mimic human-like interactions, enabling individuals to engage effortlessly with digital systems. Such chatbots can be effectively employed to support the educational process, enhancing accessibility and engagement (Davar et al., 2025; Labadze et al., 2023).

In fact, chatbots are among the most critical modern technologies in education, playing a vital role in enhancing the learning experience. They contribute to delivering personalized content tailored to individual students' learning styles and abilities, thereby boosting their motivation to complete their education. Teachers can also use chatbots to perform various tasks, such as sending assignments to students. These assignments are integrated into digital content and presented in a specific format, with questions attached to each file, which students respond to directly within the chatbot.

Several studies, including those by Davar et al. (2025) and Labadze et al. (2023), have highlighted educational applications of chatbots. They serve as tools to create engaging and engaging educational content for students, provide essential support around the clock without fatigue or delay, oversee

administrative tasks, and reduce the workload of the teacher. Moreover, chatbots help keep learners updated with the latest information and notifications through automated messages. In addition, AI-powered chatbots can conduct assessments and provide instant feedback on student performance.

To fully leverage the potential of chatbots on a broader scale, it is imperative to design them responsibly. This requires adherence to ethical principles and policies to protect the data of all users involved in the educational process.

Recent developments in artificial intelligence (AI) have redefined educational landscapes worldwide, particularly through personalized and adaptive learning environments. Chatbots, a key subset of AI, offer scalable and interactive learning tools, particularly for enhancing ethical competencies in learners (Labadze et al., 2023). In line with Saudi Vision 2030, educational institutions are increasingly deploying AI to elevate learning outcomes, necessitating research into the pedagogical and ethical implications of such technologies (Aldosari, 2020; Khan et al., 2025).

Based on this context, the present study seeks to explore the impact of a training system based on AI applications and chatbots on the development of ethical awareness skills among graduate students.

Aligned with Vision 2030, the Ministry of Education in Saudi Arabia is prioritizing the integration of AI and digital tools across educational institutions to modernize the learning experience. While significant advancements have been made, studies indicate a need for targeted training for educators in developing educational chatbots (Al-Amri and Al-Abdullatif, 2024). Recent recommendations from key conferences, such as the Fourth International Conference on the Future of Digital Education in the Arab World in 2023, underscore the importance of ethical AI practices and data protection in digital learning environments. This aligns with UNESCO's focus on ethical AI use to foster collaboration among stakeholders (UNESCO, 2021).

Fairness and impartiality are key principles of artificial intelligence ethics. They require developers to reduce potential biases in AI systems by considering human values and promoting human well-being. The principle of privacy and security stresses the protection of personal data, compliance with regulations, and the application of cybersecurity measures to prevent unauthorized access that may harm individuals' reputation, mental health, or financial and professional status. The principle of humanity highlights the importance of designing AI within an ethical framework that respects human rights, cultural values, and fundamental principles. The principle of social and environmental benefits emphasizes creating positive outcomes for individuals and society. Reliability and safety require that AI systems meet established standards and function as intended. Transparency and interpretability are also essential for building trust, which calls for AI systems to be designed with clarity and openness. Finally, accountability and responsibility hold system designers and developers morally responsible for the consequences of AI use, especially when harm or risk to individuals and society may occur (SDAIA, 2023).

Hamayel (2023) noted some unethical practices associated with AI, including its ability to generate fake and unreal data, including the ability to overlay audio onto video, and convert it to a voice that sounds like real audio. AI systems can also provide users with fake and anonymous references.

From the above, we conclude that the use of AI systems and chatbots in education requires designers to use them responsibly, in a manner that complies with AI ethics, protects human rights, and reduces risk, thus avoiding potential negative impacts for all participants in the educational process.

Studies within broader literature have addressed AI's role in higher education (Bond et al., 2024), including chatbots in teaching cognitive and behavioral skills (Davar et al., 2025). However, the ethical aspects of AI use, particularly ethical awareness, are still not well studied. Previous research shows that ethical training is important for reducing the misuse of AI and for encouraging responsible digital behavior (Hamayel, 2023; Kamali et al., 2024). Additionally, recent articles (Al-Amri and Al-Abdullatif, 2024) highlight the value of micro-training environments for fostering ethical reasoning.

However, a critical gap remains in creating training environments that adapt to graduate students' varied learning styles and personal approaches. Recognizing these needs, this study explores the potential of an AI-based training system with chatbots to enhance ethical awareness among graduate students, addressing both the customization and ethical concerns identified in previous research.

This study comes in response to digital transformations, as artificial intelligence is a technology that plays a significant role in the education sector. It provides numerous tools that help support the educational process, while also promoting AI ethics principles during the production of chatbots. This aims to prepare a knowledgeable generation capable of handling and applying AI tools ethically.

1.1. Research questions

- First question: What ethical awareness skills should postgraduate students possess from the perspective of experts and specialists?
- Second question: What is the effect of an AI-based training system on developing the cognitive achievement of the chatbot associated with ethical awareness skills among postgraduate students?
- Third question: What is the impact of an AI-based training system on improving the chatbot's practical performance for ethical awareness skills among graduate students?

2. Methodology

The study employed an experimental approach using a quasi-experimental, single-group design to examine the effect of selected artificial intelligence applications on postgraduate students' cognitive achievement and practical performance in chatbot development. The experimental treatment design is presented in Table 1. The population included all 47 female postgraduate students in the Department of Educational Technology, College of Education, Taibah University, during the 2025 academic year. From this group, a sample of 38 students was randomly selected in the first semester of 2025.

- Instruments: Ethical awareness scale (7 principles), a 20-item cognitive achievement test, and a 25-skill performance checklist.
- Platform: Chatbots were developed using Botmake.io.
- Procedure: Students designed and interacted with AI-based chatbots while applying ethical design principles.

2.1. Ethical awareness skills required for postgraduate students

The questionnaire was developed to measure the level of ethical awareness expected of postgraduate students. To construct it, the researcher reviewed relevant literature on ethical awareness skills and consulted faculty members in educational technology at Taibah University. Based on their input, the questionnaire was designed to evaluate expert views on the ethical awareness skills that postgraduate students should possess. It covered seven main principles: integrity and fairness, privacy and security, humanity, social and environmental benefits, reliability and safety, transparency and interpretability, and accountability and responsibility.

2.2. Cognitive achievement test

- Test objective: The purpose of the test was to measure the effect of a training system based on AI applications on improving postgraduate students' cognitive achievement in chatbot development related to ethical awareness skills at Taibah University in Al-Madinah al-Monawara. It also aimed to assess how well the trainees achieved the goals of the training program.
- Preliminary test preparation: The test items were designed to cover all cognitive aspects of chatbot production skills linked to ethical awareness. An initial draft of twenty multiple-choice questions was prepared to address all the intended objectives.
- Test instructions: Clear instructions were provided, including an introduction to the test, the number of questions, and the method of answering.

- Validation: Content validity was established by using a specification table that aligned the educational content with the test objectives. The test was also reviewed by a panel of experts to confirm its clarity, appropriateness, and relevance. Necessary modifications were made based on their feedback.

2.3. Observation checklist for practical performance

- Purpose: The checklist was designed to assess the performance of postgraduate students at Taibah University in Al-Madinah al-Monawara in producing chatbots related to ethical awareness skills, both before and after the training program.
- Skills covered: The checklist was developed from the final list of chatbot production skills related to ethical awareness. It included 20 main skills and 5 sub-skills, making a total of 25. Each skill was operationally defined, simple, clearly described, free from negation, and logically ordered.
- Measurement: Skills were evaluated on a binary scale (performed / not performed). One point was awarded for each skill performed, and zero if not performed. The total score was 60 points.
- Instructions: Clear instructions were provided, outlining the checklist's purpose and the scoring method for each skill based on the two performance levels.
- Validation: The checklist was reviewed by a panel of educational technology experts to confirm the clarity, consistency, and observability of its items. Their agreement established the validity of the checklist.
- Final version: After confirming its validity and reliability, the checklist was finalized for use in evaluating postgraduate students' chatbot production skills linked to ethical awareness. These included identifying the chatbot interface, understanding user–chatbot interactions, integrating messages and responses, managing chatbot databases, and configuring, previewing, and deploying chatbots using Botmake.io.

3. Results

To address the first question, the researcher applied a questionnaire based on seven principles: integrity and fairness, privacy and security, humanity, social and environmental benefits, reliability and safety, transparency and interpretability, and accountability and responsibility. These principles were used to evaluate participants' attitudes toward the use of AI applications in promoting ethical awareness. The responses were examined using descriptive analysis, including arithmetic means, standard deviations, and frequencies, as shown in Table 2. According to Table 2, the overall ethical awareness of AI was rated very high, with a mean score of 95%. The principles of integrity, privacy, humanity, and inclusive growth

received the highest approval, showing their importance to respondents.

In contrast, accountability and responsibility were rated only as high, suggesting that further awareness and training may be necessary in this area. The low standard deviation reflects a strong level of agreement among respondents. These findings can be used to strengthen the positive applications of AI in education, while addressing weaknesses, especially in accountability and responsibility. This improvement is partly due to workshops organized by educational institutions, which have helped postgraduate students develop ethical behavior and reduce the negative impacts of AI applications. The results also support Hamayel's (2023) study, which identified ethical concerns,

technical risks, and regulatory challenges as key barriers to AI adoption. Similarly, they align with Flores-Viva and García-Peñalvo's (2023) findings, which stressed the importance of developers considering ethical principles in AI design to ensure regulations are applied without undermining human values.

To address the second research question, a paired-sample t-test was conducted to compare the mean scores of the pre-test and post-test. This analysis measured the effect of an AI-based training system on improving the cognitive achievement of a chatbot linked to ethical awareness skills among postgraduate students. Table 3 presents the descriptive statistics, t-test results, statistical significance, and effect size.

Table 1: Experimental methodology with quasi-experimental design for the study

Group	Pre-measurement	Experimental treatment	Dimensional measurement
Experimental	Achievement test, observation card	The impact of using some artificial intelligence applications to design a chatbot	Achievement test, observation card, AI ethics principles questionnaire

Table 2: Descriptive statistics for sample responses on the ethical awareness skills for AI use

Statement	Agree (n, %)	Disagree (n, %)	Mean	Standard deviation	Rating
1. Integrity and fairness	36 (94.7%)	2 (5.3%)	0.94	0.22	Very high
2. Privacy and security	38 (100%)	0 (0%)	1.00	0.00	Very high
3. Humanity	38 (100%)	0 (0%)	1.00	0.00	Very high
4. Transparency and explainability	34 (89.5%)	4 (10.5%)	0.89	0.31	Very high
5. Accountability and responsibility	32 (84.2%)	6 (15.8%)	0.84	0.36	High
6. Reliability and safety	37 (97.4%)	1 (2.6%)	0.97	0.16	Very high
7. Social and environmental benefits	38 (100%)	0 (0%)	1.00	0.00	Very high
Overall	-	-	0.95	0.06	Very high

Table 3: Paired-sample t-test results for differences in cognitive achievement scores

Group	Sample size	Mean	Standard deviation	Degrees of freedom	T-value	Effect size (η^2)
Pre-test	38	36.06	1.84	35.1	8.28	0.66
Post-test	38	38.88	1.38	-	-	-

Table 3 shows statistically significant differences between the pre-test and post-test in favor of the post-test, with a t-value of 8.28, degrees of freedom (35.1), and a significance level of $\alpha \leq 0.05$. This indicates that the independent variable had a strong effect on improving the cognitive achievement of the chatbot among graduate students. The effect size was also calculated, and Table 3 reports $\eta^2 = 0.66$, suggesting a substantial impact of the independent variable. These results indicate that the AI-based training system made a meaningful contribution to enhancing the chatbot's cognitive achievement. The positive effect can be attributed to the careful design of the training system, which presented the theoretical framework clearly across topics such as historical development, concepts and definitions,

benefits and challenges, and theoretical foundations. This clarity positively influenced the cognitive achievement of female graduate students.

The findings are consistent with those of Kamali et al. (2024), but differ from Deveci Topal et al. (2021), who reported no significant differences between the experimental and control groups in terms of achievement.

To address the third research question, a paired-sample t-test was conducted to compare the means before and after the intervention. This test measured the effect of the AI-based training system on improving the chatbot's practical performance for graduate students.

Table 4 presents the descriptive statistics, t-test results, and effect size.

Table 4: T-test results for differences between pre- and post-application means for chatbot production skills

Group	Sample size	Mean	Standard deviation	Degrees of freedom	T-value	Effect size (η^2)
Pre-test	38	0.00	0.00	35.1	14.06	0.85
Post-test	38	74.94	3.22	-	-	-

Table 4 shows statistically significant differences between the pre- and post-application, favoring the post-application, with a T-value of 14.06, degrees of freedom (35.1), and $\alpha \leq 0.05$, indicating statistical significance. This shows the significant impact of the

independent variable on enhancing the chatbot's practical performance among graduate students. To determine the effect size, the researcher calculated the effect size coefficient, showing $\eta^2 = 0.85$, which indicates a large effect. This suggests that the AI-

based training system used in the study significantly improved the chatbot production skills of the sample. This can be explained by the fact that the AI-based training system designed for the graduate students was user-friendly and required no coding knowledge, which contributed to enhancing the chatbot's practical performance.

This result can be explained by the fact that the learning environment available in the application is characterized by a flexible and easy-to-use interface, and it does not require complex coding instructions, which contributed to a significant improvement in the practical performance of producing a chatbot for each student. In addition, the user interface facilitates interaction with the chatbot, and it can be added to many WhatsApp sites. This is what was produced by graduate students. The chatbots were shared on the WhatsApp group for the study sample, allowing students to view, critique, and modify each other's chatbots in an atmosphere of enthusiasm and competition among them.

The current study's results align with those of Kamali et al. (2024). However, they differ from the findings of Deveci Topal et al. (2021), which showed no statistically significant differences between the experimental and control groups in achievement, though students found the chatbot to be enjoyable and useful and expressed a desire to use it in other courses.

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Moreover, the findings revealed that ethical awareness was very high, with an average agreement of 95% (SD = 0.06). The highest scores were related to "social and environmental benefits," "privacy," and "humanity," while "accountability" showed a slight decrease. In terms of cognitive achievement, there was a significant improvement post-intervention (M = 38.88 vs. 36.06; $p < 0.05$; η^2 = 0.66), indicating a large effect. Practical performance also improved markedly, with chatbot production scores showing strong gains post-training (η^2 = 0.85), which confirms a very high level of practical acquisition of ethical skills.

4. Conclusion

The findings confirm the effectiveness of chatbot-based training in developing both ethical sensitivity and technical competence. This supports earlier studies highlighting the pedagogical value of interactive AI tools (Deveci Topal et al., 2021). However, the lower ratings for accountability point to the need for specific instructional modules focused on AI responsibility frameworks (UNESCO, 2021; SDAIA, 2023).

AI-based chatbot systems can play a key role in strengthening ethical awareness among postgraduate students, particularly when embedded in structured educational programs. We recommend targeted training initiatives and the adoption of national AI ethics curricula to reinforce principles of accountability, privacy, and generalizability in AI design and application.

To achieve this, educators should be equipped to use chatbots effectively in teaching, while stakeholders must also be actively involved in raising ethical awareness. Teacher workshops should emphasize the use of chatbots to support skill development, such as creating AI-driven presentations. Moreover, ethical awareness can be promoted through social media platforms and open learning environments. Finally, there is a need to establish a unified global framework for assessing the ethical implications of AI in education.

Acknowledgment

Compliance with ethical standards

Ethical considerations

The study was conducted in accordance with institutional ethical guidelines and the Declaration of Helsinki. All participants were informed about the objectives and procedures of the study and provided informed consent prior to participation. Participation was voluntary, and data were kept confidential and used only for research purposes.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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