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Battle of AI chatbots: Graduate students' perceptions of ChatGPT versus Gemini for learning purposes in Egyptian higher education

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Abstract

The rapid developments of AI chatbots since the inauguration of ChatGPT in November 2022 have had significant impacts on higher education. The war between various AI chatbots is growing with many consequences on students' learning journey. This study delves into this battle of AI chatbots in higher education and examines graduate students' perceptions of ChatGPT versus Gemini, the most commonly used AI chatbots, for learning purposes. The research undertook a sequential mixed method approach with two stages of study. The first stage adopted a pretested survey using the UTAUT framework to explore graduate students' perceptions of ChatGPT versus Gemini for learning purposes in a sample of Egyptian higher education institutions. The results informed the second stage of a qualitative study, which included in-depth interviews with a sample of graduate students who completed the survey to probe their answers and delve into the differences between these AI chatbots. Statistical SEM results using AMOS software (version 25) showed positive perceptions among graduate students' of ChatGPT and Gemini, which significantly affected their behavioral intention and actual usage of both AI chatbots for learning purposes. However, the results of Gemini's structural model showed more acceptance; hence, higher intention and usage than those of ChatGPT. The results of interviews showed more acceptance of Gemini over ChatGPT among graduate students with some reasons specific to the Egyptian context. Students confirmed a lack of institutional support to integrate AI for learning reasons and confirmed that their use of AI chatbots is their own choice and responsibility with informal support from their tutors. The findings of this study suggested some implications for academics and policymakers in the higher education context in order to best use these AI tools in education.

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Introduction

The technological innovations associated with digital revolutions have led to notable changes in many aspects of life. Education is one of the most important aspects of life and has been influenced by this evolution (Ifelebuegu, 2024). In this regard, multiple studies (e.g. Kasneci et al., 2023; Hasanein & Sobaih, 2023; Calonge et al., 2023; Sobaih et al., 2024; Hasanien et al., 2024) confirmed that the rapid incorporation of artificial intelligence (AI) into education has significantly affected higher education institutions. These studies focused on drivers of AI use in education and the consequences of its use for educational purposes either positively or negatively. In this vein, Imran and Almusharraf (2024) indicated that AI chatbots supported both students and faculty members in achieving their educational goals. The integration of AI chatbots in education is moving forward rapidly, with major players led by ChatGPT, Gemini, and Copilot. AI chatbots, whether Gemini or ChatGPT, are powered by natural language processing (NLP) to generate immediate responses. Since the launch of AI chatbots, they have gained great attention and interest from scholars, educators, and policymakers in the education system in many countries worldwide (Kouam & Muchowe 2024; Lo, 2023). Earlier studies (e.g., Rudolph et al., 2023; Hasanien & Sobaih, 2023; Xames & Shefa, 2023; Ifelebuegu et al., 2023) have indicated that the incorporation of AI chatbots into the education environment will lead to massive changes in higher education. These chatbots can be used in higher education for multiple purposes, such as manuscript preparation, literature review, academic writing, language translation, language editing, and statistical and data analysis (Hasanien & Sobaih, 2023; Joseph et al., 2024; Van Dis et al., 2023).

In 2018, OpenAI in San Francisco developed the Generative Pre-trained Transformer (GPT) model, which later led to the creation of chatbots like ChatGPT, a type of Large Language Model (LLM) designed to imitate human language processing abilities (OpenAI, 2022). According to Sullivan et al. (2023), ChatGPT uses sophisticated algorithms and advanced AI technology to perform various language tasks, such as answering questions, generating texts, and translating content. Notably, in 2018, OpenAI in San Francisco developed the Generative Pre-trained Transformer (GPT) model, which later led to the creation of chatbots like ChatGPT which can grasp the context of a situation to respond like humans. In November 2022, OpenAI developed the language model family ChatGPT-3.5, and in March 2023, ChatGPT-4 was released. End users can use the conversational beta version of ChatGPT-3.5 free of charge or with \$20 monthly for ChatGPT-4 (OpenAI, 2023) or the most recent version of ChatGPT-4o (Pang et al., 2024). Remarkably, ChatGPT has a million users in the first five days of its launch and, over 100 million users in a few months. Sobaih et al. (2024) indicated that ChatGPT has become the fastest technology emerging in history.

In December 2023, Google launched Gemini, an extended module for its old version of Bard, as a cutting-edge AI model to compete with ChatGPT. Gemini was developed in three versions: Nano, Pro, and Ultra. This multimodal tool, powered by DeepMind's Visual Language Model

(VLM) technology, goes beyond text, incorporating visual understanding for a more comprehensive approach (Coles, 2023; Perera & Lankathilaka, 2023). In this regard, Portakal (2023) and Koubaa et al. (2023) stated that Gemini, in opposition to ChatGPT, has multi-modal capabilities. Gemini can deal with all kinds of colloquial input data like audio and video data. Additionally, multiple studies (such as Imran & Almusharraf, 2024; Nyaaba, 2023; Saeidnia, 2023; Perera & Lankathilaka, 2023; Knight, 2023) reported that Gemini encompasses multiple features such as better understanding across modalities and versatility in communication with advanced performance. Hence, Nyaaba, (2023) indicated that Gemini, a versatile AI tool, could function as a valuable resource in the education field by utilizing its advanced GenAI features. Gemini can assist in generating educational content, organizing study materials, developing lesson plans, incorporating visual elements, and producing a wide range of teaching resources, e.g., puzzles, worksheets, and creative concepts (Nyaaba, 2023). Rudolph et al. (2023) predicted a "war of the chatbots" in the upcoming years and anticipated to have a noteworthy impact on higher education.

The incorporation of AI chatbots in higher education is growing rapidly. Therefore, there is a growing body of studies investigating the perceptions of faculty members and students concerning the incorporation of chatbots for academic purposes in higher education (Van Wyk, 2024; Alafnan et al., 2023; Rahman & Watanobe, 2023; Hasanein et al., 2024). Other studies (e.g., Hasanien & Sobaih, 2023; Ifelebuegu et al., 2023; Nyaaba, 2023; Sobaih, 2024; van Dis et al., 2023) have discussed the key benefits, opportunities, challenges, and ethical considerations of using AI chatbots in higher education. Strzelecki (2023) identified a research gap concerning students' acceptance and use of chatbots in educational settings. In this regard, some studies were recently undertaken to bridge this gap in knowledge regarding students' perceptions of ChatGPT usage in education (e.g. Sobaih et al., 2024; Elshaer et al., 2024) or students' perceptions of Gemini usage in education (e.g. Hasanein et al., 2024).

ChatGPT and Gemini are the most popular chatbots that have been incorporated deeply into education settings and are widely used by higher education students for academic purposes (Hasanein et al., 2024; Rudolph et al., 2023; Sobaih et al., 2024; Strzelecki, 2023). There is a growing body of studies (e.g., Rudolph et al., 2023; Waisberg et al., 2023; Ram & Verma, 2023; Cheong et al., 2023; Aiumtrakul et al., 2023; Sobaih et al., 2024; Hasanein et al., 2024) addressing the use of different AI chatbots, i.e. ChatGPT, Gemini, Copilot, Claude, Quillbot and Baidu's Ernie, in education. However, none of these studies undertook a comparison between these AI tools based on students' learning experiences. As such, this paper represents one of the first efforts to compare ChatGPT with Gemini, two of the most powerful and widely used chatbots among higher education students. This study specifically focuses on students' perceptions, including their acceptance and use of AI chatbots, particularly ChatGPT versus Gemini in the context of Egyptian higher education. Moreover, the current study investigates the factors that influence graduate students' usage of these chatbots (Gemini versus ChatGPT). The guiding research questions for this research were as follows:

1. To what extent do graduate students in Egyptian higher education rely on Gemini ver-sus ChatGPT for learning purposes, especially for teaching and learning reasons?
2. Are there any differences in graduate students' experiences in relation to using ChatGPT versus Gemini for learning purposes?
3. What were the implications for academics, decision-makers, and university teachers regarding using ChatGPT and Gemini for learning purposes?

Literature review

The use of ChatGPT and Gemini in higher education

Kasneci et al. (2023) described ChatGPT as an innovative, transformative, and flexible source of AI educational tools for faculty members and students alike in a dynamic learning environment. Kouam and Muchowe (2024) indicated that students gain multiple benefits from ChatGPT's abilities by offering immediate clarification on unclear concepts, learning support, and access to abundant information and enriching educational journeys. Likewise, Rasul et al. (2023) demonstrated that ChatGPT is recognized as a valuable educational resource that can enhance the education journey, improve efficiency, and prepare students to meet the needs of a knowledge-driven educational environment. A study conducted by Hasanein and Sobaih (2023) indicated positive sequences of incorporating ChatGPT into the education setting for students, such as saving time, offering immediate responses for complex concepts, anxiety reduction, improving language skills, boosting self-confidence, and improving time management skills.

Regarding faculty, ChatGPT enhances the education environment by automating administrative tasks, providing personalized feedback, and analyzing data to understand student needs. Consequently, this gives faculty members more space and time to focus on other aspects such as teaching approaches and fostering creativity in curriculum design (Lim et al., 2023). Furthermore, Dwivedi et al. (2023) argued that educators could employ ChatGPT to generate syllabus content for particular modules, design education material and activities (e.g. promoting self-learning), conduct evaluations and assessments, and facilitate the writing of the research process. Nevertheless, there are worries and concerns about incorporating ChatGPT into education in terms of developing critical skills and academic integrity. Therefore, educational institutions should guide proper use while highlighting the significance of critical thinking (Rasul et al., 2023). Furthermore, Alafnan et al. (2023) argued that incorporating ChatGPT into higher education could decrease the need for a faculty environment, thus decreasing human interaction and personal connections. As a result, higher education institutions should seek the proper methods to incorporate AI into their education system, recognizing its potential to transform traditional teaching methods, enhance student interaction, and establish a new learning environment (Tlili et al., 2023).

Gemini uses an optimized variant of Language Models for Dialogue Applications (LaMDA), pre-trained on a broad spectrum of publicly available resources. Gemini provides training data that encompasses archives of multiple resources, supporting more than 40 languages, and allowing it to understand and process web searches with ease (Imran & Almusharraf, 2024). GenAI's most innovative creation, Gemini, breaks new ground in the AI landscape with its extensive feature set (Imran & Almusharraf, 2024). These features for Gemini versions include multimodal capabilities, versatility in communication, and advanced performance (Imran & Almusharraf, 2024; Nyaaba, 2023). In terms of multimodal capabilities and versatility in communication, Lee et al. (2023) indicated that one of Gemini's most powerful features is its ability to work with different kinds of data, such as text, pictures, sounds, PDFs, and videos. In this vein, Portakal (2023) argued that through a powerful mix of audio, video, image, and text, Gemini fosters immersive learning environments.

Standing out in the competitive landscape of AI education, ChatGPT and Gemini have the ability to comprehend and process diverse data formats. This unique strength for Gemini represents a powerful contender in delivering personalized, accessible, and dynamic learning experiences (Perera & Lankathilaka, 2023). Regarding the third feature, "advanced performance", Nyaaba (2023) demonstrated that Gemini excels in a wide range of tasks, like text analysis, programming, logical reasoning, reading comprehension, and solving math problems. Furthermore, Gemini is specifically trained to minimize the generation of harmful responses (Imran & Almusharraf, 2024).

A key advantage of Gemini over other AI models is its ability to stay up-to-date. Unlike prior models that rely on static datasets, Gemini can access and process real-world information through Google Search (Portakal, 2023). This allows it to provide more relevant and current responses to end-user queries. Since the launching time, one of the significant differences between ChatGPT and Gemini was that ChatGPT's responses were not up-to-date and limited to information available up to 2021, while Gemini utilized recent information (Rane et al., 2024). In terms of feedback assessment, a study conducted by Saeidnia (2023) suggested that Gemini works as a bridge between various learning communities, fostering knowledge exchange and communication. This, in turn, promotes a collaborative learning environment. Gemini 1.5 Pro is developed to tackle problem-solving, particularly challenges within massive blocks of code. Google Team (Team et al., 2023) reported that it could analyze 100,000 lines of code, offering reasonable solutions, modifications, and sufficient explanations. Furthermore, Aydin and Karaarslan (2023) indicated that Gemini could be used in scientific research, particularly in generating a literature review with better paraphrasing and a low similarity index score in terms of plagiarism.

Challenges of incorporating AI chatbots in higher education Hasanein and Sobaih (2023) identified six challenges for incorporating ChatGPT into education. These challenges are overreliance on AI, academic integrity, lack of accuracy and quality, concerns with learning outcomes, potential bias, and students' social skills. Earlier studies (Rasul et al., 2023;

Hasanein & Sobaih, 2023) emphasized that depending heavily on chatbots for academic purposes negatively influences students' ability to engage in critical thinking and problem-solving. Concerning academic integrity, chatbots can be improperly used by learners for unethical purposes, such as cheating or plagiarism (Sullivan et al., 2023). Regarding plagiarism, Chaka (2023) indicated that the content generated by chatbots might probably bypass identification by traditional plagiarism detection systems.

Regarding accuracy and quality, Lo et al. (2023) and Limna et al. (2023) stated that accuracy and reliability are the main challenges when incorporating AI-generated content in education-al settings. Challenges related to reliability include relying on biased information and lack of up-to-date information (Sullivan et al., 2023; Rasul et al., 2023; Calonge et al., 2023). AI chatbots could provide fake/inaccurate information (Tlili et al., 2023). By the same train of thought, Sullivan et al. (2023) and Yu (2023) indicated that the improper use of information introduced by AI-generated content might lead to copyright violations.

Hasanein and Sobaih (2023) argued that when students rely on chatbots as a primary source of assistance and teaching, social interaction and communication skills could be decreased. According to earlier studies (Imran & Almusharraf, 2024; Rasul et al., 2023), continuous reli-ance on chatbots for academic purposes negatively affects students' skill sets because it might hinder the development of the required skills. In terms of potential bias, Hasanein and Sobaih (2023) indicated that chatbot feedback is introduced based on certain data used during the development of chatbots. They can be unintentionally perpetuated in chatbot interactions with users. Bias can be evident in different forms, such as racial, cultural, and gender bias. It can generate improper or discriminatory feedback, reinforcing prejudices or stereotypes.

To conclude, utilizing chatbots in educational settings raises many ethical concerns (Van Wyk, 2024). Hence, some higher education institutions have implemented full or partial limitations to the utilization of AI chatbots for learning (Alafnan et al., 2023; Rahman & Watanobe, 2023), while other institutions permitted the usage of AI tools and support the incorporation by creating use guidelines properly and ethically (Neumann et al., 2023).

Students' acceptance of ChatGPT/Gemini, and behavioral intentions

The UTAUT was employed as the theoretical framework as it offers an in-depth context for understanding the use of technology and AI in various contexts, particularly in education (Venkatesh et al., 2003; Venkatesh, 2022). According to Shahsavar and Choudhury (2023) employing the UTAUT framework to incorporate AI chatbots, like Gemini and ChatGPT into educational settings offers a well-structured approach to understanding students' behavioral intentions (BIs) related to the advanced language model. In that sense, Venkatesh et al. (2003) identified four key factors that influence user intention and usage behavior namely, performance expectancy (PE), social influence (SI),

effort expectancy (EE), and facilitating conditions (FCs). Concerning PE, it was employed to assess students' beliefs about how using AI platforms, such as ChatGPT and Gemini, could enhance their academic achievements (Brachten et al., 2021). In terms of SI, earlier studies (Venkatesh et al., 2003; García-Peñalvo, 2024), indicated that students' perceptions of AI platforms are shaped by their teachers' and peers' attitudes and behaviors. This influence is evident in how students adopt the attitudes and behaviors of others regarding the use of Gemini/ChatGPT in the education setting (Venkatesh, 2022). Several studies (e.g., Menon & Shilpa, 2023) have reported that when peers use Gemini for learning, it has the ability to affect other students' BI performance. In this regard, research findings of Menon and Shilpa (2023) indicated that when peers utilize ChatGPT/ Gemini for educational purposes, it could enhance the BI of other students. EE reflects students' perceptions of the ease or difficulty of using the technology. Students find AI platforms such as ChatGPT/ Gemini to be user-friendly, intuitive, and easy to integrate into routine activities, which in turn boosts their BI (Menon & Shilpa, 2023). Given that utilizing AI platforms like ChatGPT/Gemini requires little effort, it increases the chances that students will integrate it into their regular learning practices (Hasanein & Sobaih, 2023; Wang & Zhao, 2023; Tian et al., 2024). FC considers the accessibility of resources required for the effective use of AI in education (Venkatesh et al., 2003). This component includes aspects such as technical accessibility, availability of suitable guidance and tools, and extensive incentive programs for integration (Strzelecki, 2023; Menon & Shilpa, 2023). A study conducted by Strzelecki (2023) indicated that FC displayed no significant impact on BI in the use of ChatGPT in education. Similarly, the study findings of Hasanein et al. (2024) showed that FC failed to positively affect BI. While the study results of Sobaih et al. (2024) confirmed that FC has a negative significant impact on BI to use ChatGPT in education, particularly among Saudi Arabia students. BI reflects students' intention to use AI learning platforms like Gemini or ChatGPT. BI is significantly influenced by students' perceptions that the learning environment provides the necessary resources and support for effective implementation (Ha-sanein & Sobaih, 2023; Sevnarayan & Potter, 2024). Based on this discussion, we are formulating the following hypotheses.

- H1: PE positively impacts BI to use both ChatGPT and Gemini.
- H2: EE positively impacts BI for both ChatGPT and Gemini.
- H3: SI positively impacts BI for both ChatGPT and Gemini.
- H4: FC positively impacts BI for both ChatGPT and Gemini.

Students' acceptance to use ChatGPT/Gemini and actual usage

Several studies (e.g., Cheong et al., 2023; Asrif & Fatmi, 2024; Ashrafimoghari et al., 2024; Sobaih et al., 2024; García-Peñalvo, 2024; Hasanein et al., 2024), have explored how PE, including factors like accessibility for educational chatbots,

and EE, such as clarity and compatibility with students' needs, predict students use of chatbots in education, including ChatGPT and Gemini. In this regard, ample studies (e.g., Hasanein et al., 2024; Venkatesh, 2022; Terblanche & Kidd, 2022) confirmed the importance of BI when adopting new technology. Chang and Park's study (2024) indicated that the adoption of AI chatbots like ChatGPT/Gemini can be heavily impacted by positive social signals from peers within a user's social network who are actively using or promoting the technology. Additionally, a study conducted by Tian et al. (2024) indicated that students' choices to incorporate technology into their everyday educational activities, like using ChatGPT/Gemini for their learning tasks, can be significantly impacted by the encouragement, recommendations, or/and positive experiences shared by others. Furthermore, earlier studies (e.g., Menon & Shilpa, 2023; Chan & Zhou, 2023; Duong et al., 2023) emphasized the significant impact of FC on both the adoption and actual usage of AI chatbots in educational settings. Regarding FC, it encompasses all necessary infrastructure and support for the effective use of AI platforms within an educational context (Menon & Shilpa, 2023). As a result, we could suggest the following hypothesize:

- H5: PE positively influences the usage of ChatGPT and Gemini.
- H6: EE positively influences the usage of ChatGPT and Gemini.
- H7: SI positively influences the usage of ChatGPT and Gemini.
- H8: FC positively influences the usage of ChatGPT and Gemini.

BI and use of ChatGPT/Gemini

The relationship between students' BI to use ChatGPT/ Gemini and its actual use is a key factor in adoption and implementation of the technology (Hasanein et al., 2024). Users' BI indicates their willingness to accept and adopt innovative technologies, such as AI platforms (Venkatesh et al., 2003). By the same train of thought, several studies (e.g., Menon & Shilpa, 2023; Duong et al., 2023; Chaka, 2023) demonstrated that the positive BI towards students' usage of AI applications for educational purposes is considered a crucial motive for their actual usage in their daily educational tasks. According to Chan and Zhou (2023), there is a strong positive relationship between students' BI and the actual use of AI in an educational context due to the critical help needed to complete their educational activities. Likewise, Sobaih et al. (2024) confirmed that there is a positive relationship between student BI and the use of ChatGPT in the education setting of Saudi Arabia. Additionally, the recent study conducted by Hasanein et al. (2024) confirmed that there is a positive correlation between student BI and the use of Google Gemini in the education setting of Saudi Arabia. Therefore, based on these insights, we are formulating this hypothesis.

- H9: Students' BI positively influences the use of ChatGPT/Gemini.

The role of BI in the link between students' acceptance and usage of ChatGPT/Gemini

Many studies (e.g., Yeadon & Hardy, 2024; García-Peñalvo, 2024; Sobaih et al., 2024; Tian et al., 2024) have examined the relationship between students' acceptance, BI, and use of ChatGPT/Gemini for educational purposes. However, there is a lack of research focusing on the mediating role of BI between acceptance and use of Gemini versus ChatGPT. This study addresses this gap by employing the UTAUT model and proposes the following hypotheses:

- H10: BIs mediate the relationship between PE and the Use of ChatGPT/Gemini.
- H11: BIs mediate the link between EE and the Use of ChatGPT/Gemini.
- H12: BIs mediate the link between SI and the Use of ChatGPT/Gemini.
- H13: BIs mediate the link between FC and Use of ChatGPT/Gemini.

Method

Research design

This research undertook a sequential mixed methods study (Creswell, 2021). This research approach has two stages. The first stage is a quantitative study using a self-administered survey given to graduate students in public Egyptian institutions. The survey form included three parts. The first introduces the study and explains its purposes. The second part of the survey asked participants to fill in their profile, e.g. age, gender, appliance used to connect, frequency of using AI chatbots for learning purposes, and their experience with AI chatbots. The third and fourth parts investigate students' perceptions of Gemini and ChatGPT for learning purposes. Parts Three and Four included 22 pre-tested items assessed with a five-point Likert scale ranging from strongly agree "5" to strongly disagree "1". These items come under six main variables namely: performance expectancy (four items), effort expectancy (five items), social influence (three items), facilitating condition (four items), behavioral intention (three items), and actual usage (three items). The scales were adapted from earlier studies by Strzelecki (2023) and Strzelecki and ElArabawy (2024) and originally from the UTAUT framework by Venkatesh et al. (2003). The scale of behavioral intention variables was adapted from Ajzen and Fishbein (1972) and the use Gemini/ChatGPT variable developed by Venkatesh et al. (2003). The second stage of this research adopted a qualitative study using in-depth semi-structured interviews with a sample of graduate students who filled out the survey to probe their answers and follow up on the survey results.

Population, sampling, and procedures

This study is concerned with graduate students, mainly those studying master's degree, in public institutions in Egypt who utilized these AI chatbots, i.e. Gemini and ChatGPT,

for learning purposes. These institutions offer tourism and hospitality majors. Graduate students from six institutions, universities, and locations were contacted to participate in the study voluntarily. These six institutions were a part of Alexandria University (North), Helwan University (Capital), South Valley University (South), Sadat University (Urban), Minia University (South), and Suez Canal University (Canal). The sample employed in this study is a convenience sampling method. Approximately 90 graduate students from each university were invited to participate. Among 550 questionnaires distributed, 450 were returned, while 410 were completed and valid for analysis with a good response rate of 74.5%. This sample size was considered sufficient for data analysis. It showed a favorable comparison with earlier samples from related studies (Hasanien et al., 2024; Elshaer et al., 2024). Gathering of data collection took 40 days, which was ongoing from the beginning of April 2024. The data collected showed that male students' participation (54%) was slightly higher than females' (46%). The majority of participants were in the age group of 20-30 (47%), followed by students in the age group between 30 and 40 years old (45%), and the rest (8%) were above 40 years old. The vast majority of students confirmed that they are using AI chatbots for academic purposes on a daily basis (62%) or at least on a weekly basis (32%), whereas a very slight proportion (7%) used them every month. The surveyed students used different devices to utilize AI chatbots - 53% of students preferred to use their smartphones, whereas 31% used their laptops, and the rest of the students used their desktops or iPads/tablets (8%).

Following the data collected from the survey, a sample of graduate students was interviewed to follow up on the survey results and gain more insights from graduate students. The number of interviewees, a total of 42, was derived after data saturation was achieved. The interviews were conducted one-on-one with graduate students who participated voluntarily after obtaining their consent. Interviews were conducted at a convenient place at each university with assistance from colleagues working at these institutions. Interviews were recorded and transcribed for data analysis after gaining consent from interviewees.

Data analysis

This study employed two software applications, the Statistical Package for Social Science (SPSS) and Analysis of Moment Structures (AMOS), version 25. Participant profiles were analyzed using frequency distributions and percentages. Descriptive statistics, including mean and standard deviation, were employed to summarize the data. To ensure the reliability of the measurement scales, we calculated Cronbach's Alpha, finding values above 0.7 for all variables, which aligns with the proposition of Peterson (1994). The research team also assessed both convergent and discriminant validity to confirm the robustness of our constructs. AMOS was employed to develop structural models for ChatGPT and Gemini, allowing for a comparative analysis of the two AI chatbots. Additionally, qualitative data collected from interviews were analyzed using qualitative content analysis to provide deeper insights into participants' perceptions.

Results of the study

Convergent and discriminant validity

We checked for convergent validity to determine whether all the variables in our two models (ChatGPT vs Gemini) convey the phenomenon in question. To do this, the CR "composite reliability" has to be higher than 0.7 and the AVE "Average Variance Extracted" should be higher than 0.5. As Tables 1 and 2 show, our results indicate that all the variables have convergent validity (Hair et al., 2014). In addition, we tested their discriminant validity to ensure that all the variables in the two models were truly distinct. To do this, we checked the square root of the AVE, which has to be higher than the association it shares with other factors. The results in Tables 1 and 2 for both models (ChatGPT vs Gemini) indicate that all the variables demonstrated discriminant validity as suggested by Hair et al. (2014).

Table 1. ChatGPT's convergent and discriminant validity.

Variables	F.L.	CR	AVE	MSV	1	2	3	4	5	6
Performance expectancy		0.808	0.585	0.656	0.764					
PE1CGPT	0.70									
PE2CGPT	0.78									
PE3CGPT	0.81									
Effort expectancy		0.893	0.677	0.722		0.822				
EE1CGPT	0.79									
EE2CGPT	0.85									
EE3CGPT	0.85									
EE5CGPT	0.80									
Social influence		0.835	0.629	0.792			0.793			
SI1CGPT	0.73									
SI2CGPT	0.89									
SI3CGPT	0.75									
Facilitating condition		0.897	0.686	0.765				0.828		
FC1CGPT	0.79									
FC2CGPT	0.83									
FC3CGPT	0.87									
FC4CGPT	0.82									
Behavioral intention		0.798	0.569	0.624					0.754	
BI1CGPT	0.71									
BI2CGPT	0.76									
BI3CGPT	0.79									
Actual use		0.817	0.598	0.640						0.773
AU1CGPT	0.75									
AU2CGPT	0.77									
AU3CGPT	0.80									

Note: "F.L. = Factor loading; CR = Composite reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Value; Bold Items are square roots of AVE". Items (PE4CGPT and EE4CGPT) were eliminated because their factor contributions were less than 0.4.

Table 2. Gemini's convergent and discriminant validity.

Variables	F.L.	CR	AVE	MSV	1	2	3	4	5	6
Performance expectancy		.918	.736	0.828	0.857					
PE1GIM	0.83									
PE2GIM	0.86									
PE3GIM	0.91									
PE4GIM	0.83									
Effort expectancy		.877	0.587	0.624		0.766				
EE1GIM	0.75									
EE2GIM	0.77									
EE3GIM	0.78									
EE4GIM	0.79									
EE5GIM	0.74									
Social influence		0.760	0.514	0.562			0.716			
SI1GIM	0.75									
SI2GIM	0.70									
SI3GIM	0.70									
Facilitating condition		0.897	0.686	0.739				0.828		
FC1GIM	0.85									
FC2GIM	0.81									
FC3GIM	0.79									
FC4GIM	0.86									
Behavioral intention		0.822	0.608	0.756					0.779	
BI1GIM	0.70									
BI2GIM	0.76									
BI3GIM	0.87									
Actual use		0.869	0.689	0.722						0.830
AU1GIM	0.81									
AU2GIM	0.85									
AU3GIM	0.83									

Note: "F.L. = Factor loading; CR = Composite reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Value; Bold Items are Square roots of AVE".

Structural equation modeling results

We used structural equation modeling (SEM) to test the influence of performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating condition (FC) on whether to apply ChatGPT or Gemini for learning purposes (USE) through student behavioral intention (BI). The results showed a Chi-square related to its degree of freedom (2.604) for ChatGPT and (2.006) for Gemini. The results were acceptable as the values were less than 3. In addition, the RMSEA indices had the following values respectively (0.067) and (0.022); hence, close to zero, indicating a satisfactory outcome. Respectively, the NFI = (0.982, 0.988), TLI = (0.987, 0.988), and CFI = (0.986, 0.989) values were also acceptable offering a fitness of the model. The standardized RMRs, SRMR= (0.0547, 0.0328) were excellent, being very close to zero. All the hypotheses for the first ChatGPT model were examined confirming significant relationships ranging from $p < 0.001$ to $p < 0.05$ (Table 3, Figure 1). More specifically, PE and EE and SI and FC have significantly and positively influence BI ($\beta = 0.289, p = 0.042 < 0.05$; $\beta = 0.479, p = 0.049 < 0.05$; $\beta = 0.520, p = 0.012 < 0.05$; $\beta = 0.390, p = < 0.001$ respectively) and significantly influence USE of ChatGPT for learning ($\beta = 0.310, p = < 0.001$; $\beta = 0.669, p = 0.039 < 0.05$; $\beta = 0.320, p = < 0.001$; $\beta = 0.110, p = < 0.001$ respectively). Additionally, BI significantly and positively influences USE ($\beta = 0.590, p = 0.039 < 0.05$). The results indicated that hypotheses (H1, H2, H3, H4, H5, H6, H7, H8) were confirmed concerning the impacts of ChatGPT. Furthermore, the results confirmed that PE, EE, SI, and FC significantly influence BI, which in turn significantly influences the actual use. Additionally, the results showed a significant and positive relationship between BI and the use of ChatGPT that supports H9.

Regarding the second model that involved Gemini's choice, all relationships were tested and showed significant relationships with $p < 0.001$ (Table 3, Figure 2). More specifically, PE, EE, SI, and FC have significant and positive influences on BI ($\beta = 0.379, p = < 0.001$; $\beta = 0.593, p = < 0.001$; $\beta = 0.319, p = < 0.001$; $\beta = 0.469, p = < 0.001$) and a significant and positive effect on USE ($\beta = 0.422, p = < 0.001$; $\beta = 0.610, p = < 0.001$; $\beta = 0.649, p = < 0.001$; $\beta = 0.290, p = < 0.001$). Furthermore, BI was found to significantly and positively influence the USE of Gemini for learning ($\beta = 0.661, p = < 0.001$). The results indicated that hypotheses (particularly H1; H2; H3; H4) were confirmed concerning Gemini. These hypotheses suggested that PE, EE, SI, and FC would have a significant positive effect on BI. The results showed that hypotheses related to the use of Gemini (H5, H6, H7, H8, H9) were supported. This suggests that PE, EE, SI, and FC have a significant positive effect on the use of Gemini. Additionally, the study results showed a significant positive relationship between BI and the use of Gemini that supports H9.

The robustness of the structural model was confirmed by the two significant coefficients of ($R^2 = 0.469$) for ChatGPT and ($R^2 = 0.712$) for Gemini (see Table 3 and Table 4). In this study, the ratio of USE is explained by BI, PE, EE, SI, and FC in the regression model. In fact, by applying BI, PE, EE, SI, and FC, we can explain around 47% of the variance in USE for ChatGPT and 71% of the variance in USE for Gemini. For the sake of methodological rigor, we have used the methodology of Baron and Kenny (1986) to verify and approve the mediating role of BI in the relationship between (PE, EE, SI, FC) and USE for ChatGPT. We are going to do the same for the choice of Gemini. This approach involves a succession of four sequential steps. Firstly, we confirmed that the relationship between (PE, EE, SI, FC) and USE is significant for potential mediation. The model shows that (PE, EE, SI, FC) have significant and positive effects on USE ($\beta = 0.310, p = < 0.001$; $\beta = 0.669, p = 0.039 < 0.05$; $\beta = 0.320, p = < 0.001$; $\beta = 0.110, p = < 0.001$) respectively. Concerning the Gemini model, it displays the following results which are significantly better than the former ($\beta = 0.422, p = < 0.001$; $\beta = 0.610, p = < 0.001$; $\beta = 0.649, p = < 0.001$; $\beta = 0.290, p = < 0.001$). Secondly, we demonstrated that (PE, EE, SI, FC) have a significant influence on the mediation construct, in this case, BI. The ChatGPT model shows that (PE, EE, SI, FC) respectively have a significant and positive effect on BI ($\beta = 0.289, p = 0.042 < 0.05$; $\beta = 0.479, p = 0.049 < 0.05$; $\beta = 0.520, p = 0.012 < 0.05$; $\beta = 0.390, p = < 0.001$). Additionally, the Gemini model displays the following results ($\beta = 0.379, p = < 0.001$; $\beta = 0.593, p = < 0.001$; $\beta = 0.319, p = < 0.001$; $\beta = 0.469, p = < 0.001$). Once again, the results of the second model outperform those of the first. Thirdly, we confirmed that the relationship between the mediating construct and USE is significant. The results showed that BI significantly and positively influences USE for ChatGPT ($\beta = 0.590, p = 0.039 < 0.05$). For Gemini, it was more significant and positive ($\beta = 0.661, p = < 0.001$). To conclude, the study results support hypotheses (H10, H11, H12, and H13) and confirm that BI mediates the relationship between the predictor variables (PE, EE, SI, FC) and the USE (use of ChatGPT or Gemini). This means that the predictor variables influence USE not only directly but also indirectly through their impact on BI.

Fourthly, we checked the type of mediation by applying the bootstrapping technique, offered to us by AMOS. This shows in Table 4 that the links between (PE, EE, SI, FC) and USE remained significant after adding BI as a mediating variable, respectively ($\beta = 0.543, p = 0.045 < 0.05$; $\beta = 0.674, p = 0.037 < 0.05$; $\beta = 0.429, p = 0.016 < 0.05$; $\beta = 0.241, p = 0.022 < 0.05$) sup-orting H10, H11, H12 and H13. Thus, we find that mediation by BI is partial between (PE, EE, SI, FC) and USE. According to Table 4, the Gemini model shows a non-significant link between (PE, EE, SI, FC) and USE after adding BI as a mediator ($\beta = 0.622, 0.060 > 0.05$; $\beta = 0.650, 0.051 > 0.05$; $\beta = 0.531, 0.062 > 0.05$; $\beta = 0.678, 0.074 > 0.05$) supporting H10, H11, H12, and H13. This confirms the mediating role of BI is perfect between (PE, EE, SI, FC) and the USE of such chatbot. To that end, the study results suggest that BI partially mediates the relationship between PE, EE, SI, FC, and USE. This indicates that both direct and indirect factors influence students' use of ChatGPT and Gemini.

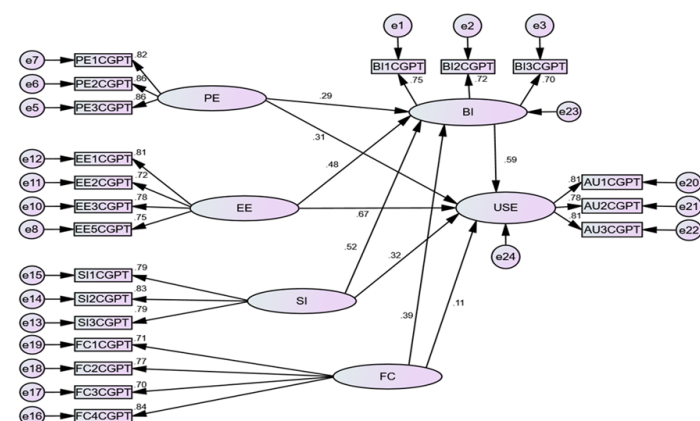


Figure 1. ChatGPT's structural model.

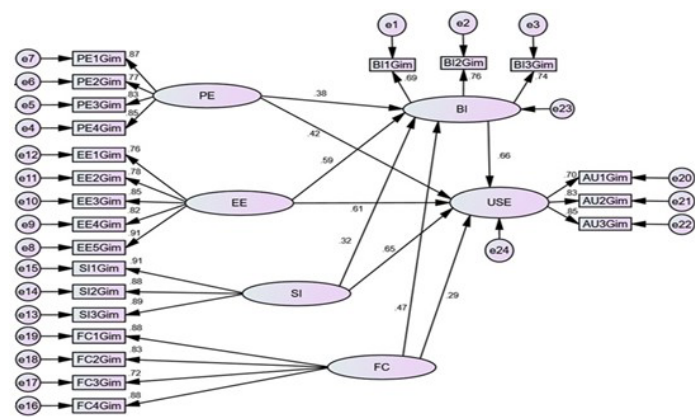


Figure 2. Gemini's structural model.

The results of the interviews

As discussed earlier in the Methods section, interviews were conducted to probe the results of the questionnaire. The interviewees confirmed that incorporating AI tools into educational settings has become a "today's learning method", "essential tool", and "necessary tool". They argued that chatbots give improbable assistance in quick and easy steps, particularly in-home tasks, assignments, individual and group projects, and research tasks. There was an agreement among the majority of participants that Gemini and ChatGPT are the most widely used chatbots among them.

Table 3. Results of the structural model.

Hypotheses	Direct paths	ChatGPT				Gemini			
		β	C-R T-value	R ²	Result	β	C-R T-value	R ²	Result
H1	PE $\rightarrow$ BI	0.289**	5.742		Supported	0.379**	6.694		Supported
H2	EE $\rightarrow$ BI	0.479**	3.299		Supported	0.593**	2.175		Supported
H3	SI $\rightarrow$ BI	0.520**	3.217		Supported	0.319**	2.327		Supported
H4	FC $\rightarrow$ BI	0.390***	8.313		Supported	0.469**	9.421		Supported
H5	PE $\rightarrow$ USE	0.310***	7.211		Supported	0.422**	9.943		Supported
H6	EE $\rightarrow$ USE	0.669**	8.041		Supported	0.610**	7.467		Supported
H7	SI $\rightarrow$ USE	0.320***	4.026		Supported	0.649**	3.655		Supported
H8	FC $\rightarrow$ USE	0.110***	7.229		Supported	0.290**	8.018		Supported
H9	BI $\rightarrow$ USE	0.590**	7.212		Supported	0.661**	8.057		Supported
	USE Through BI			0.469				0.712	

ChatGPT Model fit: ($\chi^2 (50, N = 410) = 130.222, p < 0.001$, normed $\chi^2 = 2.604$, RMSEA = 0.067, RMR = 0.092, SRMR = 0.0547, GFI = 0.955, AGFI = 0.951, CFI = 0.986, TLI = 0.987, NFI = 0.982, IFI = 0.989, PCFI = 0.726 and PNFI = 0.742), $p < 0.001$.
 Gemini Model fit: ($\chi^2 (45, N = 410) = 90.304, p < 0.001$, normed $\chi^2 = 2.006$, RMSEA = 0.022, RMR = 0.098, SRMR = 0.0328, GFI = 0.987, AGFI = 0.981, CFI = 0.989, TLI = 0.988, NFI = 0.988, IFI = 0.990, PCFI = 0.719 and PNFI = 0.787), $p < 0.001$.

Table 4. Types of BI mediation.

Hypo	Indirect paths ChatGPT	ChatGPT					Gemini				
		Estimate	Lower	Upper	P	Mediation	Estimate	Lower	Upper	P	Mediation
H10	PE $\rightarrow$ USE	0.543	0.322	0.570	0.045	0.045-0.05 Partial Mediation	0.622	0.555	0.689	0.060	0.060-0.05 Full Mediation
H11	EE $\rightarrow$ USE	0.674	0.512	0.703	0.037	0.037-0.05 Partial Mediation	0.650	0.412	0.766	0.051	0.051-0.05 Full Mediation
H12	SI $\rightarrow$ USE	0.429	0.420	0.460	0.016	0.016-0.05 Partial Mediation	0.531	0.465	0.577	0.062	0.062-0.05 Full Mediation
H13	FC $\rightarrow$ USE	0.241	0.144	0.250	0.022	0.022-0.05 Partial Mediation	0.678	0.539	0.690	0.074	0.074-0.05 Full Mediation

Concerning performance expectancy, all interviewees perceived both chatbots as valuable tools and believed that utilizing them for academic purposes would enrich their academic performance. However, most of them believe that Gemini is more valuable than ChatGPT. They added that Gemini is more accurate than ChatGPT in text generation and gives up-to-date information. Furthermore, the majority of students agreed that both chatbots can handle complex tasks, but they preferred Gemini, especially with large attachments. Below is one of the student's comments:

Both tools are pretty good, but I preferred Gemini because it can summarize large files perfectly. Additionally, Gemini is really good at finding relevant sources from the web. The presented results from Gemini are more organized with clear headings followed by bullet points and a summary [GS14].

There was consent among the interviewees that Gemini and ChatGPT are effortless, user-friendly, and easier to use. They added that the platforms for both chatbots can be used by anyone even those who are not tech-savvy. Participants added that Gemini and ChatGPT support the Arabic language, which makes them easier to use. Notably, many participants preferred Gemini to ChatGPT in the area of effort expectancy. A key reason for this is that the interface of Gemini is well organized and straightforward. Below is one of the student's comments:

Logging into Gemini just requires a Google account and I have a good experience with the Google search engine. Personally, I found it easier to use Gemini than ChatGPT [GS02].

The interviewed students confirmed that their decision to use AI chatbots is influenced by their social circle, e.g. peers, friends, family, and educators. Consequently, students acknowledged receiving recommendations from their peers to utilize AI chatbots for academic purposes. While some students expressed a preference for ChatGPT based on feedback from friends who preferred its quicker results presentation, the majority received recommendations for Gemini over ChatGPT. Supporters of Gemini argued that ChatGPT is relatively less known than Gemini in their network, leading to more support for Gemini's use. Additionally, students noted that Gemini, developed by Google, enjoys widespread usage, adding to its credibility. Further evidence supporting these perspectives is provided below:

Google has good word-of-mouth and popularity so my instructor advised me to use Gemini for handling my research assignment [GS32].

Interviewees agreed that there is a lack of facilities that support the utilization of AI chatbots from their institutions. Students indicated that they had not received support or training to demonstrate the proper use of chatbots in academic settings. Additionally, there is no support from their institution leaders or the IT technical desk to empower the use of AI chatbots. They may receive guidance or support from some of their tutors. One more piece of evidence could be seen in the following comment:

Utilizing AI chatbots requires support such as a computer or AI lab, good internet access, technical support, training, and guidance on proper use. However, all of these resources do not exist or are unavailable [GS37].

Students argued that there is a "digital gap" between them and some of their instructors and institutions. They are keen to use AI chatbots to support their learning. However, they are not encouraged by their institutions to do this due to limited digital resources in public Egyptian higher education institutions to support digital transformation. There is no clear policy for integrating AI in education, despite the tourism industry being one of the industries that adopt technological innovations in many aspects to enhance customer experiences. This adds to the gap between graduates' skills shortage and gaps in relation to AI adoption skills required by industry. The absence of policies and guidelines on AI use for learning raises some ethical concerns about the responsible use of AI chatbots for learning.

Concerning graduate students' behavioral intention to use Gemini and/or ChatGPT for learning, interviewees reported positive intention to use both chatbots in academic settings. Participants explained that Gemini and ChatGPT provide instant assistance in handling complex tasks, unclear topics, and translation, summarizing books and articles, generating literature reviews, analyzing data, or writing parts of their research. They added that such tasks became easier with quality outputs. This efficiency can lead to better time management and improved academic performance, as they believe. Nevertheless, one of the interviewed students disagreed with their colleagues and commented that:

The regular usage of chatbots for education purposes will decrease some important skills, such as critical and writing skills. Additionally, the chatbot results are not adequate 100% and sometimes give fake citations [GS09].

However, students are using both chatbots in their studies and research process. This is because they have recognized the learning opportunities provided by these chatbots. Interviewees believed that they gained skills through Gemini or ChatGPT which benefit their education journey and lead to long-term success by enhancing their understanding of educational issues and improving their writing proficiency. A further explanation is in the following comment:

I frequently use these AI tools, whether Gemini or ChatGPT, for academic purposes. Certainly, I acquired valuable skills and knowledge every single minute of my usage. This will certainly enhance my academic success [GS11].

Discussion

This research is among the first studies that explore graduate students' perceptions of AI chatbots' use for learning purposes in public Egyptian higher education institutions. The re-sults of statistical data using SPSS and AMOS showed a positive significant influence of per-formance expectancy, effort expectancy, and social influence on graduate students' behavior-al intention and their actual usage of both ChatGPT and Gemini. This means that graduate students perceived both AI chatbots Gemini and ChatGPT positively; hence, they use them extensively in their academic lives. These findings are aligned with the UTAUT framework and previous studies (e.g. Strzelecki, 2023; Sobaih et al., 2024; Hasanein et al., 2024). Effort expectancy had the highest influence among the four dimensions of UTAUT on students' BI and actual use of AI chatbots for learning reasons. Graduate students found AI chatbots easy to use and user-friendly; hence, they developed high intentions and extensively used them for learning purposes, which supported previous research findings (Menon & Shilpa, 2023). Stu-dents are encouraged by their peers and some instructors informally to use these AI tools for learning purposes. These findings are aligned with previous studies (e.g., Strzelecki, 2023; Sobaih et al., 2024; Hasanein et al., 2024), which found that social influence affects students' intention and their actual use of AI chatbots for learning purposes. In contrast to the UTAUT framework (Venkatesh et al., 2003), and previous studies (e.g., Strzelecki, 2023) that found no significant direct effect of FC on BI to use ChatGPT in education. In addition to the re-cent research by Hasanein et al. (2024) that found a significant negative influence of FC on BI to use Gemini among Saudi Arabian students, the recent study has confirmed that FC pos-itively impacts students' BI to use AI chatbots for their learning. This can be attributed to the fact that this study involves graduate students in Egyptian higher education institutions, who often own smartphones and other smart devices that facilitate access to AI, compensating for the inadequate IT infrastructure at their institutions. This directly affected their BI to use AI for learning purposes.

The results of SEM showed that graduate students have more positive acceptance of Gemini over ChatGPT regarding all variables of the UTAUT framework. The interview results explained why graduate students prefer Gemini over ChatGPT in public Egyptian higher education institutions. They argued that Gemini has more free features and generates more accurate and up-to-date information than ChatGPT. Agreeing with Imran and Almusharraf (2024), the result of interviews with graduate students indicated that Gemini could deal with diverse data input, generate various content types, and deal with large size of attachments. Graduate students often favor Gemini over ChatGPT due to the simplicity of Gemini's interface, which makes it more user-friendly with well-organized presentation of results. This supports previous studies (e.g. Hasanein et al., 2024), which found that AI platforms like Gemini make information highly accessible to students. Reflecting on the work of Hasanein et al. (2024) and Sobaih et al. (2024), students confirmed that they are highly influenced by their surroundings; hence, they favor Gemini over ChatGPT. This could be due to the popularity and the image of Google products over OpenAI products among students. This also could be because students in Egypt often use free or unpaid versions of chatbots and hence they found the free version better than those of ChatGPT.

Despite graduate students utilizing AI chatbots on a daily basis for learning, the study results confirmed that public Egyptian higher institutions are not adequately prepared to support students' utilization of AI tools in the academic setting due to the absence of policy and poor digital infrastructure. The primary obstacle is the lack of technological infrastructure such as unavailability of computer labs, quick internet connections, and IT support. This result aligns with Sobaih et al. (2020) that Egyptian higher education institutions lack proper IT infrastructure and provide poor IT Support. Furthermore, the results indicated that incorporating AI chatbots requires a level of digital literacy among faculty members. However, it was gathered from students during the interviews that faculty members may suffer from a digital gap and limited knowledge about AI adoption for learning. This finding concurs with the work of Divino (2024), who states that the proper time to utilize AI in an education setting is when both faculty members and students are digitally literate.

The study results revealed a gap between graduate students and their institutions on the incorporation of AI chatbots in Egyptian higher education. Students demonstrate a strong desire to leverage AI chatbots for academic purposes and to enhance their academic performance. Conversely, policymakers have not embraced AI integration for academic purposes nor are there clear guidelines for their use or nonuse. This result aligns with Rudolph et al.'s (2023) findings that indicate that universities have a slow response toward the adoption of AI tools. In the Egyptian context, the public higher institutions lack the necessary IT infrastructure to facilitate this transition (Sobaih et al., 2020). Furthermore, policymakers and faculty members such as professors and their assistants did not pay sufficient attention to ethical concerns raised during AI chatbot use for learning.

As a result, students may engage in 'irresponsible usage' of AI chatbots. For example, a student might use a chatbot to generate text for research without the faculty possessing adequate AI detection software due to the unavailability of such software in public institutions (see Sobaih, 2024). Furthermore, the irresponsible usage of AI chatbots will contribute to a short-age of students' skills in the long run. This is especially true for tourism and hospitality careers, which require certain skills, such as language proficiency, interpersonal communication, and critical thinking. In the end, tourism and hospitality-related careers depend heavily on lever-aging new technology, such as AI. Hence, the policymakers in the colleges of tourism and hotel management should prioritize integrating technology-focused learning to equip their students with the skills required for their future careers. This requires a clear policy on AI use for learning.

Although the results confirmed that the students have high intent to use both AI chatbots, Gemini is more favorable for the students since they believe that Gemini is an integral tool for their academic endeavors. Additionally, the results confirmed that students had translated their intention into extensive usage of AI chatbots, especially Gemini. They argued that AI Chatbots provide them with required skills that enhance their academic performance. This result does not support the study finding of Hasanein et al. (2024), which indicates it is uncertain about the extent Gemini influences student academic performance. Reflecting previous studies (e.g., Kouam & Muchowe, 2024; Van Wyk, 2024; Sobaih, 2024), the results demonstrated that graduate students are increasingly employing AI chatbots in their daily academic tasks such as research assistance, generating text like literature review, proper translations, convert the text into PowerPoint presentations, and lesson summarizing. Notably, Gemini has emerged as a preferred choice for paraphrasing text among graduate students.

The study results send important messages to scholars, policymakers in public Egyptian higher education, faculty members, and students alike. Earlier studies (e.g., Hasanein et al., 2024, Sobaih, 2024; Kouam & Muchowe, 2024; Van Wyk, 2024) have confirmed that AI chatbots are widely used by higher education students for different purposes and anticipated a continuous war between AI chatbots with significant impacts on education (Rudolph et al., 2023). The current study adds to this debate on the battle of AI chatbots in the higher education context. The results of this study showed that BI has a partial mediation influence on the link between the four dimensions of UTAUT and the actual use of ChatGPT for learning purposes. However, it has a perfect mediation in the link between the four dimensions of UTAUT and the actual use of Gemini for learning purposes. This means that BI could change the relationship between the four dimensions of UTAUT and the actual use of Gemini for learning reasons. Hence, positive BI among graduate students should be ensured to enhance the actual use of AI chatbots for learning purposes.

Conclusion

This study responds to the extensive utilization of AI chatbots by students of higher education for learning purposes. The study compares the most popular chatbots, ChatGPT and Gemini, among graduate students in higher education institutions in Egypt. The study results confirmed that students perceive Gemini and ChatGPT as valuable tools that positively enhance their performance and productivity. Furthermore, they found both chatbots to be user-friendly and easy to learn. The study's statistical results show that graduate students have more positive acceptance and use of Gemini than ChatGPT. The interview with students showed that students are using both chatbots but prefer to utilize Gemini because they believe it is easier to use than ChatGPT, is more organized, tags along the popularity of Google, and has more free features. The results also showed that student decisions to use chatbots were often impacted by recommendations from their social circles, with Gemini standing out as a more widely known and endorsed option. Albeit the lack of adequate facilities and formal support for utilizing AI chatbots in their higher education environment, students are inclined to incorporate both Gemini and ChatGPT for academic purposes. Students expressed a strong intention to continue using chatbots extensively. They believed that leveraging Gemini and ChatGPT not only supports handling complex tasks but also acquires valuable skills that contribute to long-term educational success. The results confirm that the war on AI chatbots is at a growth stage and has not yet reached its maturity, confirming that it will continue to grow extensively in the next few years. This requires quick responses from decision-makers to better integrate these AI tools for learning.

This study focused on graduate students in public Egyptian higher institutions providing tourism and hospitality disciplines which are classified as a social science. Hence, results cannot be widespread to other disciplines or sciences without further investigation. Students in other sciences, such as medicine, engineering, and agricultural sciences, might have different perceptions, as Elshaer et al. (2024) found that study discipline could moderate students' use of AI tools in their learning. This study did not examine the role of gender, age, and experience in the findings, which could also have an effect on the results, albeit this is worth further investigation in future research. Future studies could examine student real experience with AI adoption in their learning journey, such as their engagement, knowledge construction, and critical reflection and its linkage with their overall academic performance. Future studies could build on current study findings by exploring how students in other disciplines (rather than tourism and hospitality), such as medicine, engineering, and agricultural sciences, perceive and utilize these AI chatbots. Understanding these distinct perspectives could provide valuable insights into how different fields may adapt AI technology to enhance learning outcomes. Based on the recent study findings, the study offers the following recommendations for policymakers in higher education institutions and educators, whether in the Egyptian context or at the global level.

Recommendations for policymakers in higher education institutions:

1. Facilitating multi-stakeholder discussions involving students, teaching and learning experts, faculty members, IT professionals, and industry professionals to explore all aspects of integrating AI chatbots in education, and translate the outcomes of these discussions into actionable regulations, guidelines, and handouts (Gimpel et al., 2023).
2. Encouraging IT professionals and faculty members to offer proper and up-to-date training matching the rapid development of AI chatbots to students (e.g., toolkit, guidebook) on the responsible use of AI chatbots for educational purposes.
3. Organizing dialogue sessions and training workshops for students that focus on academic integrity and ethical considerations concerning the use of AI chatbots, such as Gemini and ChatGPT.
4. Updating academic integrity policies and honor codes to incorporate the use of AI tools such as chatbots, and establish clear, accessible guidelines for employing language models in teaching and learning. These guidelines should outline appropriate usage and specify the consequences of academic cheating (Rudolph et al., 2023).
5. Promoting and facilitating research among academic staff on the effective integration of AI tools in the education field and overcoming the disadvantages of these tools (Rudolph et al., 2023).
6. Equipping higher education institutions with adequate and robust IT infrastructure (such as IT support units, computer labs, and Wi-Fi), particularly in developing countries like Egypt.
7. Enhancing the digital literacy of academic staff through targeted training programs and resources that focus on technology integration. This will enable educators to confidently incorporate digital tools into their educational approach and stay updated on emerging technologies, ultimately fostering a more engaging learning environment for students.

Recommendations for educators:

1. It is crucial for educators to have a balanced blend of automation and the human touch in education. While chatbots can simplify tasks, and duties and provide feedback, educators must remain vital in offering emotional support (Sobaih & Gharbi, 2024), guidance, and mentorship, which are irreplaceable by AI systems.

2. Educators may include AI tools in class discussions and assignments and teach their students how to use chatbots responsibly, in addition to highlighting the advantages and disadvantages of these tools.
3. Educators should teach students to critically assess the information provided by AI chatbots. Highlighting the limitations of these tools will help students develop better analytical skills when using AI-generated content.
4. Because students highly intend to use both chatbots for academic purposes, educators should develop innovative assessment strategies that focus on evaluating learning processes instead of simply measuring outcomes.
5. Educators should familiarize themselves with various AI chatbots, such as ChatGPT and Gemini, as these tools can significantly enhance teaching and learning experiences. Given that students are increasingly familiar with these AI technologies, educators need to maintain a higher level of proficiency and expertise. This is because of the digital divide between students and their educators in their adoption of technology (Sobaih et al., 2016).

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