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Factors Affecting the Adoption and Use of ChatGPT in Higher Education

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ABSTRACT

The current study aims at assessing the factors which could affect students' use of ChatGPT. The study proposed a theoretical model that included five factors. Data were collected from 136 students using a questionnaire. The data were analyzed using two steps: CFA for measuring the model and SEM for analyzing the relationships and testing hypothesis. The findings revealed that both performance expectancy and facilitating conditions significantly influenced students' intentions to use ChatGPT. Contrary to expectations, both social influence and effort expectancy had insignificant effects. By elucidating the core factors influencing the utilization of ChatGPT, this study can provide valuable insights for policymakers. Furthermore, this study contributes to the existing literature and lays the foundation for future research seeking a deeper understanding of the factors influencing the use of other AI technologies in teaching and learning.

KEYWORDS

AMOS, Artificial Intelligence, ChatGPT, Open AI, SEM, UTAUT

INTRODUCTION

Artificial intelligence (AI) has played a big role in increasing digitalization of societies. AI has the capability for automating duties or tasks, processing large amounts of data, and providing predictive insights that revolutionize many aspects in daily life (Yang, 2022). AI was identified as a technology that can mimic humans in its responses, producing responses that can be interpreted as signs of intentionality and judgment (Shubhendu & Vijay, 2013). The advancement of technology, for instance, neural networks and machine learning, has led to deeper discussions about the definition of artificial intelligence (Wang, 2019). The difficulties lay in the artificiality of parameters and approaches in which computers are not like the intelligence of humans: they are considered to be less intelligent than humans overall but can deal with calculating large numbers faster.

In addition, discussions regarding the expected potential effects of AI have begun to gain prominence. For example, there is a concern about job loss due to the implementation of AI (Pavlik, 2023). Furthermore, the discussion and consideration of AI in education is still in its early stages. According to Celik (2023), educators have not yet recognised its potential for learning and teaching.

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Despite calls for the further implementation of AI, some educators resist utilising software which collects students' data or remain sceptical of IT companies which show technology to be a solution for all concerns in education (Stockman & Nottingham, 2022).

Currently, the world seems to be paying attention to a new technology named ChatGPT. ChatGPT is a chatbot which uses AI power and was developed by OpenAI. It has been supplied with a large body of language, which allows it to generate texts in response to users' prompts. ChatGPT was established in November 2022 and then was available for free to users with an OpenAI account (OpenAI, 2023). It produces and generates texts that simulate human language (OpenAI, 2023). ChatGPT relies on machine learning and algorithms for processing large contents of text, such as websites, books, Wikipedia, and news articles (Scharth, 2022). By analysing and processing data terabytes, its models learn the structure and patterns of language, which enables ChatGPT to provide users with meaningful and relevant content based on their requests.

However, the rise of ChatGPT brings concerns regarding its potential effect on universities. Some have proposed that universities should, instead of using applications for assessment, reconsider the role of assessment in enhancing learning. Others have suggested that ChatGPT could be utilised to enhance students' critical thinking, writing, and other skills. In this way, ChatGPT can be considered an essential and valuable technological tool to innovate learning, teaching, and assessment, transforming the human relationship to knowledge. When comparing ChatGPT with other emerging technologies, ChatGPT provides resources and materials for several types of learners' levels, supporting learners with disabilities, assisting in advanced training sessions, and enhancing teaching, such as in lessons planning, personalised learning, evaluation and assessment, etc. (Kasneci et al., 2023). Furthermore, ChatGPT provides personalised assistance to support students' learning to help enhance their learning, engagement, and outcome (Alshahrani, 2023). Thus, several educational institutions and universities started implementing ChatGPT to gain all of its benefits in supporting their academic courses and enhancing students' learning.

Universities are concerned about how ChatGPT could impact the role of learning and teaching in the future, as its power is game-changing and wide (Lim et al., 2023). As they account for the potential effects of ChatGPT, some researchers and academics have begun to examine its advantages and challenges, considering various topics, such as creating faking citations and resources (Cooper, 2023), writing assignments, essays and enhancing the writing process (Sullivan et al., 2023). Most discussion has paid attention to its uses for medical majors (Gilson et al., 2023). Furthermore, others conducted interviews about ChatGPT's potential effects in education (Lund & Wang, 2023), while some focused on its power in publishing, research, and other related issues (Perkins, 2023). Utilising ChatGPT in academia is new and still under exploration. In addition, most studies have focused on academics' views of ChatGPT and its future uses (Howell & Potgieter, 2023; Lund et al., 2023; Jeon & Lee, 2023; Tsigaris & da Silva, 2023), while students and factors affecting their intention toward using ChatGPT have received little attention (Tiwari et al., 2023). Moreover, there is a lack of knowledge regarding how students accept and use ChatGPT and the factors affecting them toward using it (Tiwari et al., 2023; Abdaljaleel et al., 2023; Raman et al., 2023). Understanding the factors which can affect students' intention to utilize ChatGPT is essential, especially if the aim is to enhance its adoption and use among them (Tiwari et al., 2023), Thus, this current study will cover this gap and propose a theoretical model for assessing the factors which could affect students' use of ChatGPT. The purpose of this study is to investigate the factors influencing the use of ChatGPT and contribute to policy formulation and educational strategies for the effective use of ChatGPT.

LITERATURE REVIEW

ChatGPT

The current literature review highlights the important role of ChatGPT in supporting the educational field and enhancing students' learning activities. ChatGPT can provide the educational field with

several supported services, such as in terms of students' assignments, tests and reducing other repetitive works and generating creative content (Firaina & Sulisworo, 2023). Repetitive works refer to the regular work in instructors' roles, such as lesson planning, grading, and conducting assignments. Furthermore, ChatGPT could contribute significantly to enhance students' productivity and assist students' improvement of their language skills and motivation. These types of support could enable students to continue using ChatGPT (Fauzi et al., 2023). Additionally, ChatGPT integrates a variety of teaching methods. For example, it can facilitate project-based learning and enhance students' interaction, satisfaction, and willingness to use ChatGPT (Topsakal & Topsakal, 2022).

Additionally, the utilization of ChatGPT has gained more interest among students due to its potential in enriching their learning experiences. It could assist in providing them with personalised and quick feedback. ChatGPT has the ability to address students' needs, offer instant feedback, and facilitate the comprehension of complicated concepts. Thus, it has become a promising application which assists in promoting students' cognitive advancement and participation by supporting their learning pace and providing a continuous sort which enhances the process of knowledge acquisition (Sánchez, 2023). Furthermore, students could use ChatGPT for receiving grammatical suggestions and corrections to gain improvement and detailed feedback of their writing (Osorio, 2023).

Reviewing the literature reveals that the ChatGPT uses in the fields of education remain in the early stages and are being investigated. Most studies have paid attention to its uses for medical majors (Gilson et al., 2023). Moreover, some have focused on its effects on education in general (Lund & Wang, 2023), while others have examined specific areas, such as writing and authorship (Perkins, 2023). Most studies considered the use of ChatGPT by academics, as well as their views on its future, while its use among students has received little attention. Because ChatGPT was developed lately, there is a lack of knowledge about how students intend to utilise it. Thus, this current study will propose a model to examine some factors of these intentions using the well-established unified theory of the acceptance and use of technology model (UTAUT).

The UTAUT has been adopted for examining the use of different technologies, for instance, in mobility (Almaiah et al., 2019; Hoi, 2020), blended learning (Chen, 2011; Dakduk et al., 2018), platforms of e-learning (Zacharis & Nikolopoulou, 2022), and systems of learning management (Zwain, 2019). Understanding factors which may influence students' use of any technology is essential if the aim is to attract them (Adzharuddin & Ling, 2013). To the best of our knowledge, the UTAUT model has not previously been used for examining students' intentions to utilize ChatGPT in an Arab context. Thus, the current study aims at filling that gap and enhancing the current literature by proposing a theoretical model based on UTAUT for examining factors that could affect students' utilization of ChatGPT.

THEORETICAL FRAMEWORK

This study employs UTAUT which was established by Venkatesh et al. (2003). This model is chosen because it is considered a robust, widely used model for analysing technology adoption in many different fields, including education (Alshammari, 2021; Ibrahim & Jaafar, 2011; Wong et al., 2013). This UTAUT contains four main constructs (performance expectancy [PE], effort expectancy [EE], social influence [SI], and facilitating conditions [FC]) that affect the behaviour intention [BI].

PE refers to users' beliefs that they will benefit from using a piece of technology. EE concerns the ease with which they can use it. SI refers to the important people in the users' life who think that they must or must not utilize a specific technology. FC refers to the users' beliefs about the infrastructure and technical assistance available for utilising a specific technology.

The UTAUT was used for examining various technologies, for example, mobile phones (Hoi, 2020), blended learning (Dakduk et al., 2018), and virtual classrooms (Alshammari, 2021). However, due to the recent advent of ChatGPT and its role in education, it has not yet been utilised to examine

this program, particularly in the Arab context. Thus, the study aims at proposing a model and examining factors which may affect students' intentions to utilize ChatGPT.

Research Questions

This study aims at answering the following questions:

What factors affect the students' intention to utilize ChatGPT for their learning?

Research Hypotheses

PE refers to how much users expect using a specific technology will enhance their performance or help them complete a targeted task (Venkatesh et al., 2003). It plays a significant role in whether technology is adopted in an academic setting (El-Masri & Tarhini, 2017). This finding is in line with some studies, which showed the significant effect of PE on the users' intentions to adopt various technologies: for instance, classroom technology (Kumar & Bervell, 2019), mobile learning (Arain et al., 2019), and learning management systems (Raman & Don, 2013). Thus, we have developed the following hypothesis:

H1: PE will have a positive effect on the students' intentions to use ChatGPT.

EE refers to the amount of work users expect it will take to use a specific technology (Venkatesh et al., 2003). Recent studies have shown its significant effect on the users' intentions to utilize technology, for instance, mobile learning (Raza et al., 2022) and Google Classroom (Jakkaew & Hemrungrote, 2017). Thus, we have developed the below hypothesis:

H2: EE will have a positive effect on the students' intentions to use ChatGPT.

SI refers to the users' perceptions regarding people who are important to them and think that they should utilize a specific technology (Venkatesh et al., 2003). Many studies reported that SI is essential in affecting the users' intentions to adopt and use different technologies, such as mobility (Nikolopoulou et al., 2020), e-learning applications (Samsudeen & Mohamed, 2019) and systems of learning management (Ain et al., 2016). Thus, we have developed the below hypothesis:

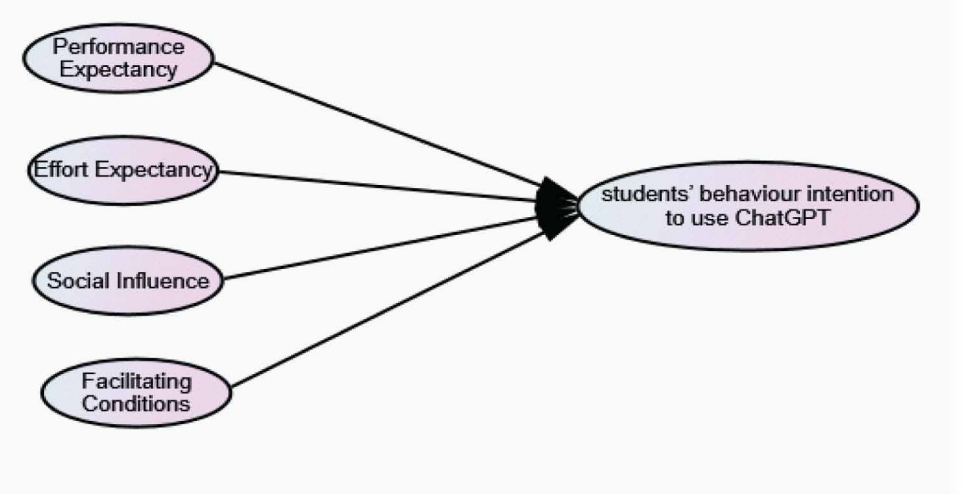
H3: SI will have a positive effect on the students' intentions to use ChatGPT.

FC refers to the level of users who believe that the technical and organizational assistance exists and supports their use of a particular technology (Venkatesh et al., 2003). FC has been reported to be a critical factor that affects the users' intentions to use different education technologies, such as e-learning applications (Osei et al., 2022), mobility (Kang et al., 2015), and augmented reality in higher education (Faqih & Jaradat, 2021). Thus, we have developed the below hypothesis:

H4: FC will have a positive effect on the students' intentions to use ChatGPT.

The proposed research model is illustrated in Figure 1.

Figure 1. Proposed Research Model



METHODOLOGY

Scale

The research instrument used for collecting data was a 5-point Likert scale. All items that measured constructs in the proposed model were adapted from Venkatesh et al.'s (2003) study. Some modifications, such as "using ChatGPT", were added. The construct of PE was addressed by four items, while EE was addressed by four items, SI was addressed by three items, and FC was addressed by four items. There were a total of 15 items. All items of the questionnaires are attached in Appendix 1.

Sampling and Data Processing

Two steps in the Analysis of Moment Structures (AMOSs) were conducted for running confirmatory factor analysis (CFA) and analysing the relationships among the constructs. For analysis using structural equation modeling (SEM) in AMOS, the minimum suggested sample size is 100 to 200 participants (Kock, 2018). The questionnaires were designed using Google Forms and distributed to a population of students at the University of Ha'il during their third semester of 2022–2023. One hundred thirty-six students participated and responded to the surveys. Thus, the number of participants was appropriate and met the suggestions of prior researchers (Kock, 2018). Then, the received data were analysed. SPSS was applied to analyse the descriptive information of respondents, while SEM utilising AMOS was conducted to perform CFA, analyse the relationships, and test the hypotheses. The following section discusses the results of these analyses.

RESULTS

Part 1: Analysis of Respondents' Information

One hundred thirty-six students responded and participated in the questionnaires. Table 1 presents the respondents' demographic information: gender, academic program, and college. In terms of gender, most respondents were female (78; 57.4%) and fewer were male (58; 42.6%). Most students were enrolled in a bachelor's program (109; 80.1%), followed by students enrolled in a master's program

(19; 14.0%), and those pursuing a higher degree (8; 5.9%). Furthermore, the respondents were enrolled in different colleges: the majority were enrolled in the education college (50; 36.8%), followed by the college of art (28; 20.6%), the college of computer science (25; 18.4%), and the college of science (19; 14.0%). The college of health informatics had the fewest respondents (2; 1.5%). Table 1 shows demographic information.

Part 2: Confirmatory Factor Analysis "CFA"

CFA is an analysis technique used for developing and validating measurement models, which can handle multiple correlations, measurement errors, and many constructs at once. Construct, discriminant, and convergent validity have to be considered before applying SEM analysis and testing the relationships among constructs (Awang, 2015).

Construct validity is met once all model fit indices meet the values recommended in the literature (Awang, 2015). CFA was run. The values for these indices and the construct correlations are shown in Figure 2.

As shown in Figure 2, the model fit indices achieved the recommended level. Thus, construct validity was met. These values are shown in Table 2.

Then, convergent validity had to be checked. Convergent validity is met when values for composite reliability (CR) and average value extracted (AVE) are above 0.60 and 0.5 (Hair et al., 2010). The output showed that CR and AVE were greater than the suggested values, meaning that convergent validity was attained. Table 3 shows the CR and AVE values.

Discriminant validity was then assessed for ensuring that each construct in the model was distinct from the others. Table 4 shows the correlations between the constructs. Values in bold refers to the square roots of AVE. Discriminant validity is attained once these values are greater than the others (Awang, 2015). Thus, the results which are presented in Table 4 confirm the achieved discriminant validity.

Table 1. Demographic Information

Demographic Information of Respondents	Frequency	Percent
Sex		
Male	58	42.6
Female	78	57.4
Academic program		
Bachelor	109	80.1
Master	19	14.0
Higher diploma	8	5.9
Colleges		
Education	50	36.8
Computer science	25	18.4
Business management	4	2.9
Art	28	20.6
Health informatics	2	1.5
Science	19	14.0
Applied college	8	5.9
Total	136	100.0

Figure 2. CFA Output

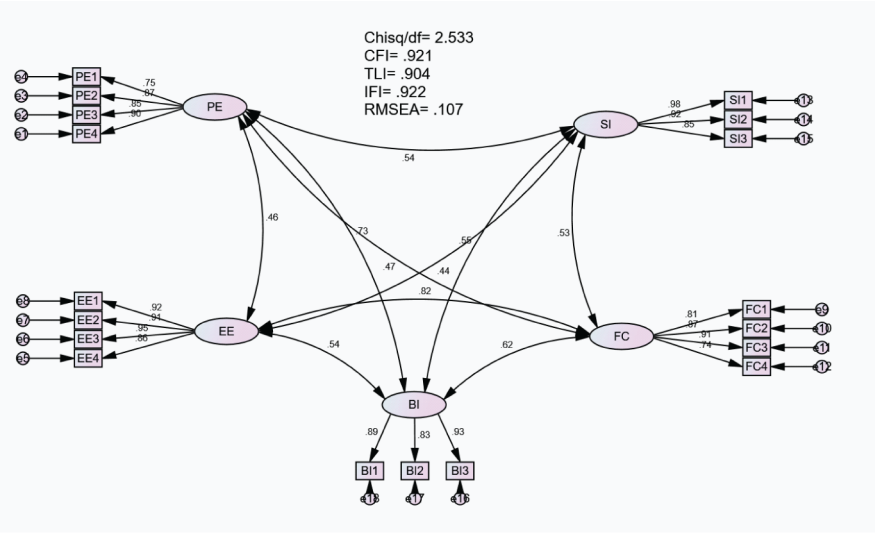


Table 2. Model Fit Indices

"Name of Category"	"Name of Index"	"Index"	"Acceptance Value"	"Results"
"Absolute fit"	RMSEA	0.107	<0.15	Achieved (MacCallum et al., 1996)
"Incremental fit"	CFI	0.921	<0.90	Achieved (Awang, 2015)
	TLI	0.904	<0.90	Achieved (Awang, 2015)
	IFI	0.922	<0.90	Achieved (Awang, 2015)
"Parsimonious fit"	Chisq/*df*	2.533	<3.0	Achieved (Awang, 2015)

Table 3. Values of CR and AVE

	CR	AVE
SI	0.943	0.846
PE	0.907	0.711
EE	0.951	0.831
FC	0.901	0.696
BI	0.916	0.785

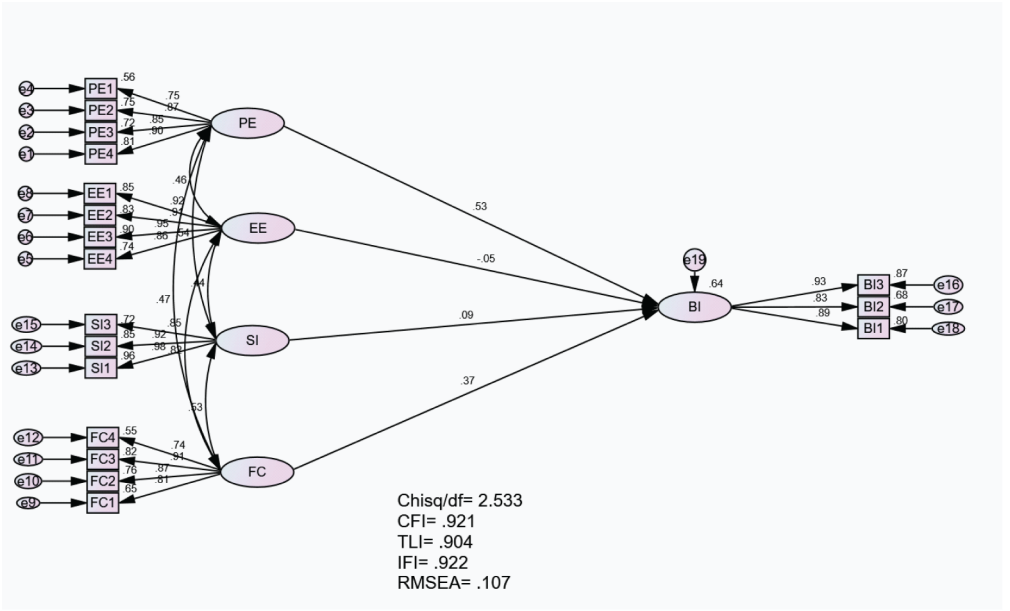
Standardised Estimate

SEM has two main categories of outputs: standardised and unstandardised estimates. The standardised estimate is essential for assessing the coefficient beta, R^2, and factor loading, while the unstandardised estimate is used for computing the critical ratio and testing hypotheses. The standardised estimate was run first and is presented in Figure 3.

Table 4. Discriminant Validity Index

	SI	PE	EE	FC	BI
SI	**0.920**				
PE	0.541	**0.843**			
EE	0.442	0.463	**0.911**		
FC	0.531	0.465	0.822	**0.834**	
BI	0.550	0.729	0.539	0.623	**0.886**

Figure 3. Standardised Estimate



The value of R^2 shown for the BI construct was 0.64, meaning that 64% of the students' intentions to use ChatGPT could be explained by these factors: EE, PE, FC, and SI. This result demonstrates that the model has a high explanatory power. Cohen (1988) states that R^2 values of 0.12 or less mean that a model has a low explanatory power, whereas values ranging between 0.13 and 0.25 mean a medium explanatory power, and values above 0.26 indicate a high explanatory power. Thus, the R^2 of 0.64 for the dependent construct in this model confirms that it has a high explanatory power in relation to students' intentions to use ChatGPT.

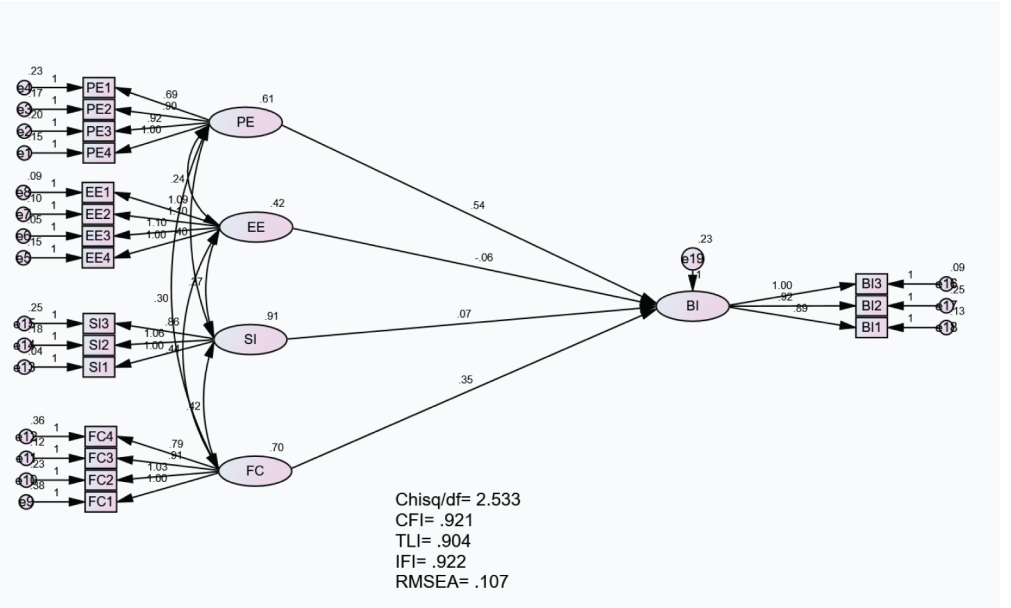
Unstandardised Estimate

The regression beta weight and critical ratio are calculated through the unstandardised estimate to test the hypotheses. The unstandardised estimate was run, and its output is shown in Figure 4.

Hypothesis Testing Results

PE refers to how much the users expect using a specific technology will enhance their performance or help them complete a targeted task, while EE refers to the amount of work users expect it will take to use a specific technology. Furthermore, SI refers to the users' perceptions regarding people

Figure 4. Unstandardised Estimate



who are important to them to think that they should utilize a specific technology, whereas FC refers to the environmental factors necessary for using ChatGPT. The results confirmed that the factors of PE and FC had a significant positive effect on the students' intentions to use ChatGPT ($\beta = 0.542$, $p < .05$; $\beta = 0.353$, $p < .05$). Thus, H1 and H4 were supported. Surprisingly, EE and SI did not have a significant effect ($\beta = 0.060$, $p > .05$; $\beta = 0.074$, $p > .05$). This finding is in contrast with the original model of UTAUT conducted by Venkatesh et al. (2003), who found significant effects of both EE and SI on user behaviour. Thus, H2 and H3 were not supported. Table 5 presents hypothesis testing results.

DISCUSSION

The study aims at proposing a theoretical model and assessing factors which may affect students' intentions to utilize ChatGPT. The results were interesting: PE and FC had a significant positive effect on these intentions, while the constructs of EE and SI were insignificant.

PE was a vital construct that significantly affected the students' intentions to utilize ChatGPT. This is in line with some prior studies (e.g., Yifan et al., 2023; Hoi, 2020; Min et., 2008; Wu & Chen, 2017; Yuan et al., 2015). The findings imply that once the students perceived using ChatGPT as useful, then that would build a positive intention toward using it, and then they would use it during

Table 5. Hypothesis Testing Results

			Estimate	S.E.	C.R.	*P*	Results
BI	<---	PE	.542	.085	6.375	***	Supported
BI	<---	EE	–.060	.150	–.397	.691	Not supported
BI	<---	SI	.074	.067	1.105	.269	Not supported
BI	<---	FC	.353	.128	2.763	.006	Supported

their learning activities. Furthermore, the findings revealed that PE was an important factor that determines and predicts the use of ChatGPT. ChatGPT has the ability to provide a personalised and adaptive learning experience, which might play a vital role in those positive relationships. It could respond and understand effectively to students' learning styles and needs by utilising advanced language algorithm processing. Hence, learners perceive personalised and customised support and feedback, which would lead to aiding them to overcome the challenges and achieving the learning objectives. That personalised experience would likely improve students' performance expectancy and engage them with using ChatGPT more effectively and frequently. Accordingly, the developers and designers of ChatGPT must focus on enhancing the quality and usefulness of the software, such as the benefits students can gain using ChatGPT, to encourage them to perceive it as useful, which then would affect their intention toward using it.

However, the construction of EE did not affect the students' intentions. This is in line with some previous studies (e.g., Ayaz & Yanartas, 2020; Handayani & Sudiana, 2015; Sa'idah, 2017) but contrasts with studies conducted by Fauz et al., (2018), Marto et al. (2019), and Sultana (2020). It may imply that the students do not perceive that there are any difficulties with using ChatGPT. Therefore, effort does not affect their intentions. Furthermore, most students live in the digital age, where they have daily access to many different technologies and smart devices. Thus, they might not find using ChatGPT as difficult. Thus, it does not play any role in affecting their intention toward using it. Another possible explanation might be that most students find ChatGPT as less complex nowadays and more convenient, especially with the current emerging advanced technologies with greater sophistication in products of information technology. Nowadays, several user-friendly and modern technologies consider the important role of user attributes with their designing. Thus, students might not find any difficulties with using a particular technology. Hence, that might not affect their intention toward using it.

SI had an insignificant effect on the students' intentions to utilise ChatGPT. This is consistent with the findings of studies conducted by Handayani and Sudiana (2015), Sa'idah (2017), Sultana (2020), and Wong et al. (2013), but contrasts with other studies by Marto et al. (2019), Sultana (2020), and Sallam et al. (2023). The results imply that when the students use ChatGPT, they do not expect any assistance or support from their social connections, including friends, teachers, and family. Another possible explanation is that the sense of need does not increase with age. Thus, SI may have less effect on university students than younger students; they could be less likely affected by other people's opinions regarding a technology (Wong et al., 2013). Furthermore, Venkatesh et al. (2003) highlighted that PE significantly affected users' behaviour intention toward using a technology, which is the case in this study, SI could be revealed to be insignificant. The other explanation of these findings is that few items, only three, were used for measuring the SI construct. Thus, that might affect the current finding. Future studies with more items that measure the SI construct are needed. Moreover, it might be that students nowadays pay less attention to other opinions regarding the use of ChatGPT, as they found using it as useful (performance), which affected their intention toward using it.

The results also showed that FC significantly affected the students' intentions to utilize ChatGPT. This finding matches some previous studies (Ismarmiaty & Etmy, 2018) but contrasts with others (e.g., Sa'idah, 2017; Sultana, 2020). It implies that the students who have access to the necessary resources and technical support will use ChatGPT. Therefore, they should be provided with access to experts and technical assistance if they have any difficulties using ChatGPT. This will make them more likely to use the program. Furthermore, the findings revealed that administrators and policymakers at universities should provide students with the appropriate facilities such as Wi-Fi, computers, supporting resources, and rapid access to the internet in order to build a positive intention among students regarding the use of ChatGPT, which will lead to positively affect their intention toward using it.

Theoretical Implications

First of all, to the best of our knowledge, no previous studies have used a UTAUT model to consider AI applications, such as ChatGPT, specifically in an Arab context, and this study is the first to use it to analyse ChatGPT, thus enriching the literature. Furthermore, the proposed research model was found to have a high explanatory power (64%), demonstrating that it has identified factors which affect the students' intentions to utilize ChatGPT. Furthermore, the study yielded findings that were consistent with some previous studies and inconsistent with others, making the study interesting in terms of understanding the phenomenon of the students' use of ChatGPT.

Practical Implications

The findings provide a deep explanation regarding the factors which could affect students' intentions to use ChatGPT. They should be interesting to educational experts, instructors, and the developers of ChatGPT. For instance, PE significantly affected the students' intentions to use ChatGPT. This implies that when students understand the benefits of ChatGPT for their learning, it affects their intentions and leads to a positive attitude toward the program. Thus, academics and lecturers should explain these benefits to students and encourage them to use the program effectively to assist them in their learning. Furthermore, FC also affected the students' intentions significantly. Thus, institutes and universities could increase students' use of ChatGPT by providing them with the essential forms of assistance, such as technical support, knowledge, and free access to the internet and computer labs. This would make students more likely to use ChatGPT.

LIMITATIONS AND CONCLUSION

This study included some limitations. For instance, although the sample size was appropriate for SEM AMOS analysis, it might have affected the generalizability. Further studies could use a larger sample to lead to a more representative result. In addition, this study focused on examining the original factors in the UTAUT model and yielded interesting results. Future studies may focus on extending that model by examining additional factors, such as system quality or students' satisfaction with ChatGPT. Moreover, since this study was conducted on the students who used ChatGPT in a university in Saudi Arabia, it is necessary to conduct studies on students from various universities and grades to increase the generalizability of research results. Also, additional studies are needed to understand more deeply about factors influencing the use of ChatGPT. For example, studies considering personal or social factors influencing the use of ChatGPT are needed. This current study has examined the factors which affect the students' intentions to utilize ChatGPT through applying the UTAUT model. Out of the four hypotheses, two hypotheses were supported, and the other two were rejected. PE and FC significantly affected the students' use of ChatGPT, while EE and SI did not. Furthermore, the proposed research model had a high explanatory power (64%), demonstrating that it has the power for explaining the factors which affect students' utilization of ChatGPT.

CONFLICTS OF INTEREST

The author of this publication declares there is no conflict of interest.

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