

Antecedents of adoption and usage of ChatGPT among Jordanian university students: Empirical study**Ra'ed Masa'deh^{a*}, Salwa AL Majali^b, Maha Alkhaffaf^c, Ramayah Thurasamy^d, Dmaithan Almajali^c, Khalid Altarawneh^e, Ala'aSaeb Al-Sherideh^f and Ibrahim Altarawni^g**^aThe University of Jordan, Jordan^bAl Ain University, United Arab Emirates^cApplied Science Private University, Research Unit, Middle East University, Jordan^dUniversiti Sains Malaysia^eMutah University, Jordan^fZarqa University, Jordan^gAqaba University of Technology, Jordan**CHRONICLE****ABSTRACT***Article history:*

Received: August 15, 2023

Received in revised format: September 25, 2023

Accepted: November 26, 2023

Available online: November 26, 2023

Keywords:

ChatGPT

Perceived ease of use

Credibility

Usefulness and enjoyment

This research uses Technology Acceptance Model to explore the elements influencing students' attitudes toward using Chat Generative Pre-Trained Transformer (ChatGPT), a recently developed artificial intelligence (AI) tool, for learning and educational purposes. Using Amos version 23 structural equation modelling and 880 student survey responses, the suggested model was empirically tested. According to the report, students think well of ChatGPT utilization in the classroom. Credibility, Usefulness and ease of use, all influence how positively people feel about using this technology in a classroom setting. The study's findings, however, did not support the notion that students' adoption and use of ChatGPT was insignificantly influenced by perceived enjoyment. Moreover, the results conclude that attitude mediates the relationship between usefulness and intention to use ChatGPT. The research will help businesses, educational institutions, and the global community by providing insight into how students view the ChatGPT service within a learning environment. Additionally, the application boosts learners' confidence and interest, which improves general awareness and literacy. Finally, the research will facilitate developers of AI in the betterment of their product and service delivery and regulators in regulating the use of AI-based bots. Owing to its recentness, there is not much study currently available on ChatGPT use in education. This research adds significantly to the extant knowledge on the adoption of advanced education technologies by examining the adoption characteristics of ChatGPT, a novel AI-based tool involving students. Additionally, there is a dearth of research in the literature on students' adoption of ChatGPT for educational purposes. Such a gap was filled as this study identified the factors affecting students' adoption of ChatGPT in the classroom.

1. Introduction

Artificial intelligence (AI) recreates business, health and society; it is an emerging domain of computer science (Çelik, 2023; Vrbka and Rowland, 2020). Artificial Intelligence (AI) and chatbots are examples of technologies that have their roots in scientific research from the 1950s (King & ChatGPT, 2023). As a concept, “artificial intelligence” can be perceived as the capacity of a given system to accurately construe the external data, learn from them, before applying the knowledge from such learning for accomplishing certain goals and tasks, by way of flexible adaptation (Haenlein et al., 2019). Artificial

* Corresponding author.

E-mail address: r.masadeh@ju.edu.jo (R. Masa'deh)

ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

© 2024 by the authors; licensee Growing Science, Canada.

doi: 10.5267/j.ijds.2023.11.024

intelligence (AI) refers to systems and programs that simulate the intelligence of man (Tlili et al., 2023). Artificial intelligence (AI) has become more widely used in education, where it may be used to provide individualized instruction, dynamic evaluations, as well as purposeful interactions within blended learning settings (Zhang & Aslan, 2021). However, it has been suggested that if AI develops further, more individuals will become dependent on technology for information and study, which will destroy education and dull down society. Equally, it has been indicated that AI systems might be a good substitute for essential administrative, staff, and professor positions (Keiper et al., 2023). Furthermore, a range of educational benefits has been offered by e-learning resources such as mobile apps, gamification, video conferencing, AI-driven adaptive platforms, gamification, virtual reality, and collaborative tools (Sankey & Marshall, 2023; Assaraira et al., 2022). Nonetheless, AI also has disadvantages including poor connectivity, the possibility of distraction, a lack of interpersonal interactions, and high cost (Ali et al., 2023). AI integration increases productivity and personalization as it provides data-driven insights and adapts content to user preferences. Somehow, ethics, teacher preparation, and human interaction are still essential for delivering a successful and comprehensive educational experience. In line with the development of technology, it has been expected that AI will become increasingly common, and so, there needs to be consistent efforts to resolve the issues associated with privacy and preserve the important role of educators (Nguyen et al., 2023; Kasim, 2022).

The AI language model known as the Chat Generative Pre-Trained Transformer (ChatGPT) utilizes improved natural language processing (NLP) and provides users with customized instructional support. Still, there are drawbacks to this model, for instance, its responses and empathy are inaccurate at times, to input phrasing (Hariri, 2023). Still, with these advancements, e-learning tools are increasingly integrated with AI and are easier in usage. At the same time, efforts are ongoing in dealing with the issues of bias and data privacy associated with the AI model. As an AI tool, ChatGPT has been introduced to the public to test its usage. Notably, its ability in describing scientific topics and producing creative jokes, has made ChatGPT a tool of great interest among the public. This tool has been demonstrating potential as the next epochal general-purpose technology. ChatGPT was launched in November 2022 by Open AI. This tool encompasses conversational interaction between GPT users. In a conversation, ChatGPT could react to human-sounding text input from the user. Its dialogue format allows it to respond to subsequent questioning, challenge incorrect premises, admit faults, and turn down unbecoming requests. In this regard, a GPT-3.5 series model that completed its training at the beginning of year 2022, was used in the interface construction. Microsoft Azure's AI supercomputing power was used in training ChatGPT and GPT-3.5. The Instructed GPT model, that is set up to obey commands and provide more information in response to prompts, is the ancestor of the ChatGPT model (Cotton et al., 2023; Fujs et al., 2022; Jaafar et al., 2021).

ChatGPT is trained on an immense data set of human talks, and this has made the system capable of producing responses to a broad range of topics and cues (Open AI, 2022). Among its many abilities are precise text translation, marketing copy creation, news and report summarization, and coding. It can understand long texts and provide precise answers (Lee, 2023). Customer support, content creation, and language translation are just a few of the many uses for the chatbot, which may generate responses in varied languages (Keiper et al., 2023). Furthermore, the OpenAI Application Programming Interface allows developers to incorporate the Chatbot into their own platforms and applications, and it also provides access to the ChatGPT (Open AI, 2022).

Since its launch, ChatGPT has quickly attracted the interest of both academics and corporations in the online community. People use this cutting-edge equipment mostly for research and teaching all across the world. The community is trying to find answers to the questions that medical research has highlighted (Sharma and Thakur, 2023). ChatGPT is increasingly popular in the engineering domain as well (Qadir, 2022). Accessibility is among ChatGPT's most talked-about advancements. The tool is available to everyone, especially when they want to learn and resolve problems. Meanwhile, as ChatGPT is open to all users, it might potentially be dangerous because it can be utilized to find information in favor of bad objectives inside the community.

Moreover, the tool is outdated and unable to respond to inquiries on current trends beyond 2021. Still, despite its challenges, ChatGPT is of value to both education and learning (Lee, 2023). Owing to its recentness, there is not much study available currently on ChatGPT use in education, and so, this research adds significantly to the body of knowledge on the adoption of advanced education technologies by examining the adoption characteristics of ChatGPT, a novel AI-based tool for students. Additionally, there is a dearth of research in the literature on students' adoption of ChatGPT for educational purposes. This study fills this gap by identifying the factors that influence students' adoption of ChatGPT in the classroom.

2. Literature review and development of hypotheses

Alongside the advancements in AI systems, there has been an increase in the academic literature on Chabot research. For a very long time, Chabot had been employing natural language processing (NLP) in understanding user inquiries and matching them with the most pertinent database responses. In order to provide clients with prompt responses and resolve NLP issues in real time, Chabot adopts language models (Cotton et al., 2023). Despite the quick advancement of AI technology, service delivery researchers generally hold the opinion that, in order for AI to be successfully or even practically applied in service delivery, there must be a high degree of user acceptability (Belanche et al., 2020). Some studies (Balakrishnan et al., 2021; Lim & Zhang, 2022; Shannak et al., 2010) relied on Technology Acceptance Model (TAM) (Davis et al., 1989); TAM proposes that users' intention to use technology is propelled by two factors namely perceived usefulness of the technology and perceived ease of use.

In their study employing TAM, Giovanis et al. (2012) found perceived usefulness and ease of use as the two main elements impacting people's intention to use new technology. TAM is simple to expand or adapt, which makes it useful in a variety of study domains (Min et al., 2021; Song et al., 2021). TAM has been studied in a variety of situations and contexts, including in university education, online learning and secondary education (Wojciechowski & Cellary, 2013). Perceived usefulness (PU), perceived ease-of-use (PEOU), attitude toward usage (ATT), and behavioral intention to use (BI) are the four dimensions that TAM suggests. Additionally, "trust" has been included as a new variable to the model. To ascertain the needs and directions for future study, it is therefore imperative to discuss the problems and difficulties related to TAM. Consequently, several researchers have proposed adding other factors to TAM. Nonetheless, earlier research suggested extensions to TAM by adding variables such as students' attitudes, perceived enjoyment, and perceived credibility. To determine their compatibility, this study added these variables to TAM.

2.1 Perceived usefulness

A person's subjective assessment of and conviction in the effectiveness of deploying particular information technology or work procedures is known as perceived usefulness (Lin et al., 2007). In this regard, the hypothesis of TAM is grounded upon the idea that perceived usefulness and perceived ease of use have the greatest impact on users' views and plans to use technology (Davis, 1989). Perceived usefulness is the degree to which a person is confident that the use of certain will enhance their performance (Davis et al., 1989; Davis, 1993). Additionally, Bashir and Madhavaiah (2015) found that perceived usefulness has an immediate effect on online banking technology adoption - the authors employed TAM in examining the use of internet banking in India. Other studies by Çelik (2008) and Chong et al. (2013) have validated the positive effect of perceived usefulness on digital banking adoption.

In the present study, perceived usefulness describes how college students view ChatGPT's advantages and benefits when utilizing it for studying. Studies have shown a high and positive correlation between perceived usefulness and the desire to embrace and adopt different technologies, even though the effect of perceived usefulness on behavioral intentions has not yet been thoroughly examined (Kwak et al., 2022), such as in the use of mobile learning (Al-Azawei & Alowayr, 2020) and e-government system (Hooda et al., 2022). Based on the findings, the current study postulates that the perceived usefulness and advantages of utilizing ChatGPT in the learning process will greatly boost the intentions of higher education students to use ChatGPT for learning. The study thus proposed the following two hypotheses:

H₁: *Perceived usefulness has a positive impact on the attitude of students towards using ChatGPT for educational purposes.*

H₂: *Perceived usefulness is positively and significantly associated with behavioral intentions to use ChatGPT.*

2.2 Perceived ease of use

Perceived ease of use is the most significant and frequently suggested antecedent in the assessment of mobile payment adoption (Warsono et al., 2023). According to Belanche et al. (2019), new technology adoption is primarily dictated by two factors namely perceived usefulness and ease of use. Both these factors are important and reliable predictors of users' attitude and intention toward new technologies. Appositely, Davis (1989) had proposed through TAM that by fostering a more positive attitude toward new technology, perceived ease of use will positively influence perceived usefulness and will indirectly influence intention to use. Past research has examined the degree to which perceived ease of use influences intention to use and perceived usefulness of mobile payments. It has also examined the popularity of mobile payments and the extent to which perceived ease of use influences intention to use by encouraging a more positive attitude toward new technology (Abdul-Halim et al., 2022).

TAM has been used to clarify and predict the adoption of many information technologies, and numerous studies have demonstrated its effectiveness as a psychometric instrument for evaluating consumers' acceptance of technology (Abbasi et al., 2022). Several studies have found that perceived ease of use and perceived usefulness are the important predictors of long-term use (Peng and Lai, 2012). Furthermore, previous research has found that perceived ease of use is strongly linked to future and current usage, as well as the attitude toward users' acceptance of a system (Davis, 1989). This demonstrates how simple it is to use ChatGPT and how useful it is perceived to be. Therefore, in this background, the following hypothesis has been proposed:

H₃: *Perceived ease of use has a positive impact on the attitude of students to use ChatGPT for educational purposes.*

2.3 Perceived credibility

Trust is "a person's confidence in his or her anticipation of what the other person will do based on their previous interactions, despite the fact that the other person's behavior cannot be guaranteed" (Gefen, 2000). In this regard, a study by Suh and Han (2002) was the first to have used the factor of "trust" as a factor that would have an impact on internet banking adoption. In another related study, Alsajjan and Dennis (2010) highlighted the need to include trust as a strong element of TAM was highlighted in their comparison research on user acceptance of internet banking between the UK and Saudi Arabia. They found that trust affects the acceptance of digital banking favorably. According to Yousafzai et al. (2009), a bank's capacity in engaging in digital banking appears to be dictated by the trust that its clientele has placed in it.

Numerous studies that use TAM to look at the factors that have effect on this adoption have found a favorable correlation between consumers' trust and their likelihood to use online banking (Bashir & Madhavaiah, 2015). According to Mukherjee

and Nath (2003), trust is a multidisciplinary phrase that incorporates concepts from information systems, organizational behavior, sociology, psychology, marketing, and economics. For consumers, lack of confidence in a new technology will cause reluctance to adopt, and this finding is vital in any financial transaction (Howcroft et al., 2002). In another study, Kim et al. (2022) added the factor of trust to TAM in examining online banking information systems adoption and results showed significant positive effect of trust on perceived usefulness and behavioral intention.

Trust has been reported as a crucial factor in understanding the behaviour of technology adoption (Van Pinxteren et al., 2019). Chi et al. (2021) developed the Social Service Robot Interaction Trust (SSRIT) framework that demonstrates trust in interactions with AI robots as a notion that the interaction that customer has with AI social robots can produce favorable outcomes of service. From the outcomes, the authors concluded that the trust that customers have towards human–robot interaction entails a higher-order construct resulting from the assessment of different factors. The SSRIT framework by Chi et al. (2021) suggests that the readiness of customers in engaging with robots may be impacted by their confidence in human-robot interaction. People who experience perceived credibility tend to put their faith in others because of their admirable behaviors (Singh and Sinha, 2020). Trust fosters the formation of enduring customer relationships and is crucial for the adoption of new technology (Partel et al., 2019). This underlines the significance of the trustworthiness of ChatGPT. The evaluated literature generated the following hypothesis:

H₄: *Perceived credibility has a positive impact on the attitude of students towards using ChatGPT for educational purposes.*

2.4 Perceived enjoyment

Baabdullah (2018) accordingly mentioned the concept of hedonic desire, which is a primary motivator for an action, and in the context of technology usage, it has been reported that individuals driven by hedonic wants are more inclined to trust technology (Baabdullah, 2018). Additionally, the SSRIT framework brought forth by Chi et al. (2021) suggests that confidence of customers in human–robot interaction is dictated by whether or not robot usage will match the service expectations of these customers. Consequently, students with a strong hedonic motivation are more likely to trust ChatGPT because of their demand for novelty, resulting in a greater level of trust. The following hypothesis was proposed based on the reviewed literature:

H₅: *Perceived enjoyment has a positive impact on the attitude of students towards using ChatGPT for educational purposes.*

2.5 Student attitude

An attitude is a person's inclination to respond positively or negatively to an object, person, institution or event, or to any other distinguishable component of the individual's environment (Ajzen, 1989). Attitude consists of behavioral, cognitive and affective components (De Luna et al., 2019). Both TAM (Davis, 1989) and the theory of planned behavior (Ajzen, 1991) consider attitude to be an important construct that determines the user's behavior or intent to adopt certain technology. Moreover, attitudes have been a consistent determinant of mobile payment uptake (De Luna et al., 2019; Masa'deh et al., 2013). According to Gupta and Arora (2017), attitudes have a beneficial effect on the uptake of mobile banking services. Many thinkers have argued that attitude consists of affective and cognitive components (Kabra et al., 2023; Montano and Kasprzyk, 2015). Davis (1985) asserted that perceived usefulness and perceived ease of use have beneficial effects on attitudes toward information technology. Put another way, people are more inclined to adopt a technology positively when they perceive it as being more beneficial and easier to use. Numerous information technologies have been predicted and explained by TAM, and the suggested connections have often been confirmed (Larue and Watling, 2021). Adu-Gyamfi et al. (2022) used TAM to explain drivers' perceptions of the onboard monitoring system. In addition, research indicates that perceived usefulness can strongly influence the intention to continue using e-government systems (Hamid et al., 2016), attitudes regarding the use of the internet for online commerce (Sahoo et al., 2022) and the behavioral intention to use driver support systems (Rahman et al., 2018). Thus, attitude plays a significant part for any revolutionary technology such as ChatGPT. Therefore, the following hypothesis was proposed in this study:

H₆: *Students' attitude has a positive impact on the intention towards ChatGPT adoption for educational purposes.*

The Theory of Planned Behavior (TPB) has been used to explain the current research on the relationship between consumer sentiments and behavioral intention (Ajzen, 1991). The TPB states that it is reasonable to assume that the presence of an individual's intention will result in the performance of a particular behavior. Though various stimuli may influence a consumer's choice, not all consumer behaviors can be predicted in accordance with their intention; still, a higher degree of intention can predict the likelihood of actual conduct (Ajzen, 1991). According to the TPB, one of the main antecedents used to predict behavioral intention is attitude, which measures one's belief about the relationship between an object and particular outcomes (Ajzen, 1991). Put another way, a larger degree of behavior intention is expected in relation to the higher degree of consumer attitudes toward the traits involved in undertaking a certain behavior. Therefore, the following hypothesis was proposed in this study:

H₇: *Attitude mediates the relationship between usefulness and behavioral intention towards using ChatGPT.*

Based on the above discussion a research model was developed as shown in Fig. 1.

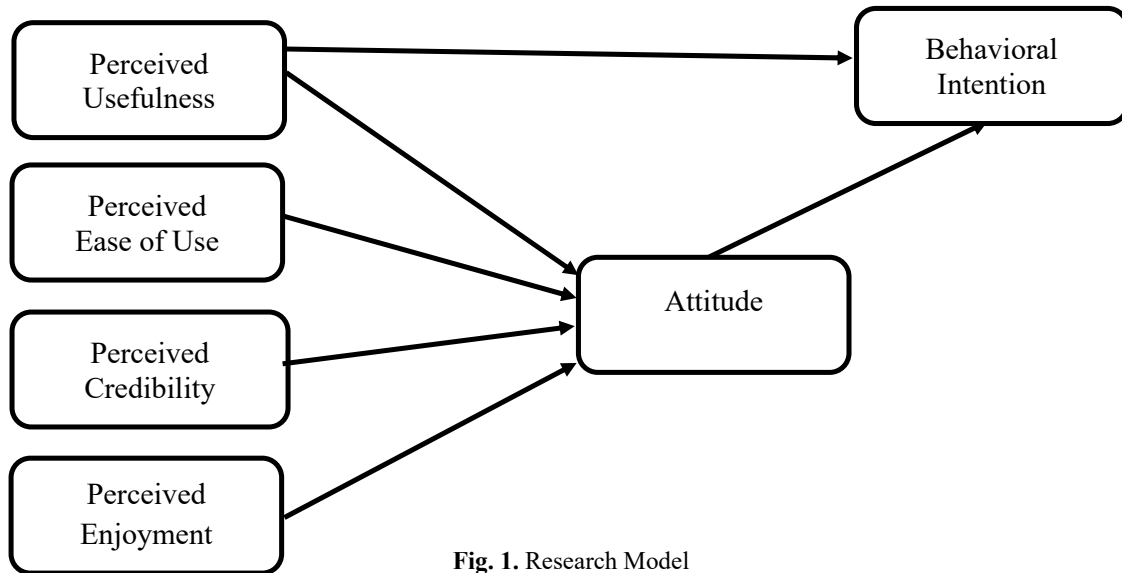


Fig. 1. Research Model

3. Material and methods

The present study is the first that meets the academic requirements and looks at students' use of ChatGPT in a unique way. A model was proposed in this study, and it includes TAM and context-specific dimensions such as perceived usefulness (PU), perceived ease of use (PEOU), perceived credibility (CR), perceived enjoyment (PN), attitude (ATT), and intent to use ChatGPT (BI). This study presents a way for university and higher education administrators to understand students' viewpoints when implementing ChatGPT in the classroom. The reasons driving ChatGPT popularity will motivate developers to design ChatGPT with students' requirements in mind.

3.1 Sample characteristics

The characteristics of the study samples are discussed, most respondents were within the younger population. Majority of the respondents (51.4%) were female, and only 48.6% were male. As far as the educational qualification of the respondents is concerned, the majority had a bachelor's degree. A large proportion of our sample had a specialization of business.

3.2 Sampling and data collection

A technique of non-probability purposive sampling was used to obtain the responses. The target audience for this study were ChatGPT-savvy millennials born between the middle of the 1990s and the beginning of the 2000s. Also, millennials are seen as a digitally savvy age group with heightened trend awareness (Aslam et al., 2022). Including millennials is prompted by the AI industry's need to pay attention to younger generations, who are more likely to be early adopters of emerging technologies (Szymkowiak et al., 2021). In accordance with the methodology of Han et al. (2021) and Wang and Chen (2019), a video link was provided to respondents (2019). These were the YouTube videos that demonstrate how to use ChatGPT. The respondents were invited to complete the questions after viewing the films. The purpose of the video was to explain to respondents how ChatGPT operates.

Students attending various public and private universities in Jordan were the intended respondents. The poll was built using Google Documents, and connections to the site were placed on the social media accounts of many universities so that students could access it from the beginning of the first semester of the academic year 2022–2023. Based on the data provided by most of the management and social science studies, the majority of academics believed that a sample size of 200–500 respondents would be sufficient (Siddiqui, 2013). The sample size can also be decided by the number of questions in the questionnaire; for each question, 5–10 replies would be acceptable (Bhat & Tariq, 2022). Upon the completion of the survey, 942 questionnaires were collected. Sixty-two of the surveys were excluded from the final analysis because the respective respondents did not complete the questionnaires in full. All completed survey questionnaires were examined for any missing information. The items were evaluated using a five-point Likert scale, with 1 signifying strong disagreement and 5 denoting strong agreement.

3.3 Research instrument

Using the right tool to get the right data from respondents is essential to validate the research instruments and scales. In research, instruments deemed appropriate for data collection are constructed through a thorough process that involves scale development, selection, and validation. Using the same methods, the present study altered the designs of earlier investigations. Measurements from earlier TAM-related research were used to create the constructs. Accordingly, Table 1 displays the operational definitions of the study constructs based on the current body of literature. Four subject matter experts were consulted

after the measuring items were developed and chosen in order to ensure their (the measuring items') validity and accuracy. Following encouraging comments from subject matter experts, the authors conducted pretesting with thirty ChatGPT users. The results of the preliminary testing led to significant improvements and reorganization of the questionnaire. Furthermore, an assessment was conducted on the measures' internal and external validity. The survey questions were written in both Arabic and English. In order to collect data, a survey questionnaire was established, and it comprised two main sections: the first section comprised demographic data about ChatGPT, such as age, gender, education, and specialization, and the second section comprised construct components that were gathered from earlier research (refer to Table 1).

Table 1**Measurement model**

Variables	Items
Perceived usefulness Davis (1989), Shen et al. (2022)	Valuable in education Improves learning quality Tasks can be completed more quickly Learning becomes more effectiveness
Perceived ease of use Davis (1989), Shen et al. (2022)	Easy to use Easy to master Simple and less mental efforts Clear and comprehensible interaction
Perceived credibility Gong and Nass (2007)	Trustworthy Dependable Assured safety and confidentiality
Perceived enjoyment Shen et al. (2022), Venkatesh et al. (2012)	Enjoyable Entertaining Fun
Attitude toward ChatGPT Davis (1989), Shen et al. (2022)	Positive attitude toward usage Learning is interesting Positive attitude toward learning Positive general opinion
Behavioral intention to use ChatGPT Davis (1989), Shen et al. (2022)	Intention to use in future Potential usage for learning experience Frequent usage Will use for Education

4. Data analysis*4.1 Confirmatory factor analysis*

In this study, the factor loadings of the set of the observed variables were evaluated using several methods namely confirmatory factor analysis (CFA). Composite reliability (CR), convergence validity, and convergent validity. The obtained outcomes can be viewed in the following Table 2 (CFA) and Table 3 (discriminant validity).

Table 3**Measurement Model Assessment**

Latent Variable	Indicator	FL	FLS	AVE (> 0.50)	CR (> 0.70)	Cronbach's Alpha
Perceived Usefulness	PU1	0.731	0.534	0.578	0.845	0.902
	PU2	0.805	0.648			
	PU3	0.799	0.638			
	PU4	0.701	0.491			
Perceived Ease of Use	PEOU1	0.828	0.686	0.595	0.897	0.882
	PEOU2	0.696	0.484			
	PEOU3	0.679	0.461			
	PEOU4	0.863	0.745			
	PEOU5	0.741	0.549			
	PEOU6	0.802	0.643			
Perceived Credibility	CR1	0.822	0.676	0.605	0.821	0.84
	CR2	0.726	0.527			
	CR3	0.782	0.612			
Perceived Enjoyment	PN1	0.82	0.672	0.623	0.832	0.802
	PN2	0.816	0.666			
	PN3	0.729	0.531			
Attitude	ATT1	0.789	0.623	0.61	0.862	0.868
	ATT2	0.766	0.587			
	ATT3	0.819	0.671			
	ATT4	0.747	0.558			
Behavioral Intention	BI1	0.845	0.714	0.635	0.897	0.901
	BI2	0.709	0.503			
	BI3	0.808	0.653			
	BI4	0.831	0.691			
	BI5	0.785	0.616			

FL = Factor Loading, FLS = Factor Loading Squared, AVE= Average Variance Extracted, CR= Composite Reliability

It can be observed in Table 2 that all the items' loadings fell in the range between 0.679 and 0.863. Based on Bollen's (2014) recommendations (factor loading should be 0.50 at minimum, or ideally 0.70 or higher), the results are considered acceptable. The evaluation of convergent validity in factor loadings is through composite reliability (CR) and average variance extracted (AVE), and the obtained values of composite reliability were between 0.821 and 0.901, which were higher than the proposed value of 0.7. Hence, good internal consistency can be affirmed. Furthermore, the obtained values of average variance extracted (AVE) were between 0.578 and 0.635 which were larger than the proposed value of 0.50. As such, based on Hair et al. (2011), the latent variables all showed convergent validity.

Table 3
Discriminant Validity

Variable	1	2	3	4	5	6
Perceived Usefulness	.578					
Perceived Ease of Use	.545	.595				
Credibility	.411	.362	.605			
Attitude	.502	.428	.475	.623		
Perceived Enjoyment	.463	.355	.542	.479	.61	
Behavioral Intention	.520	.514	.569	.527	.530	.635

The AVE analysis results can be viewed in Table 2, and clearly, the values are all greater than 0.5. As for discriminant validity Table 3 shows that all the values on the diagonal (square root of the AVE) are larger than any correlation coefficients between constructs, thus confirming our measures are distinct.

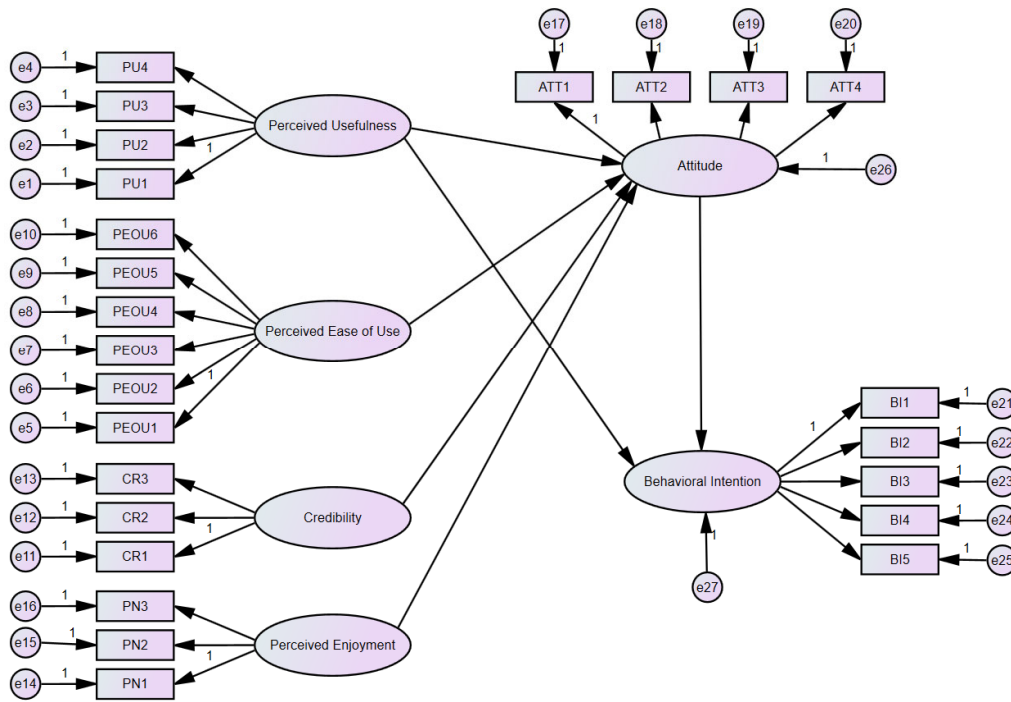


Fig. 1. Final best fitting CFA model

4.2 Goodness of fit

The model's goodness of fit was evaluated using a number of indicators. These indicators were Standardized Root Mean Squared Residual (SRMR), comparative fit index (CFI), Tucker and Lewis's index of fit (TLI), normed fit index (NFI), and root mean square error of approximation (RMSEA). The suggested cut-off values of model fit are as follows: Chi-square χ^2 ($P > 0.05$); Normed Chi-Square (χ^2 / df) $1.0 \leq \chi^2 / df \leq 3$; $RAMSE \leq 0.10$, $NFI \geq 0.90$; $CFI \geq 0.90$; $IFI \geq 0.90$; $TLI \geq 0.90$ (see Table 4).

Table 4
Final Measurement Model Fit

χ^2	χ^2/df	SRMR	CFI	TLI	NFI	IFI	RMSEA
3.226	3.226	0.003	0.986	0.995	0.982	0.984	0.05

From the results displayed in Table 4, the SRMR value is lower than 0.08, CFI value is greater than 0.95, TLI value is greater than 0.90, NFI and IFI values are greater than 0.90, and RMSEA value is less than or equal 0.1. Based on Hu and Bentler

(1999) for SRMR, NFI and IFI, based on Kline (2005) for CFI, based on Sharma et al. (2005) for TLI, and based on Brown (2015) on RMSEA, the model has excellent fit. As such, the hypothesized model has good fit.

4.3 Testing the hypotheses

The postulated hypotheses were tested using the variance-based Structural Equation Model (SEM), Amos version 23 is appropriate because it could model relationships between multiple dependent and independent variables simultaneously. The following subsections present the results.

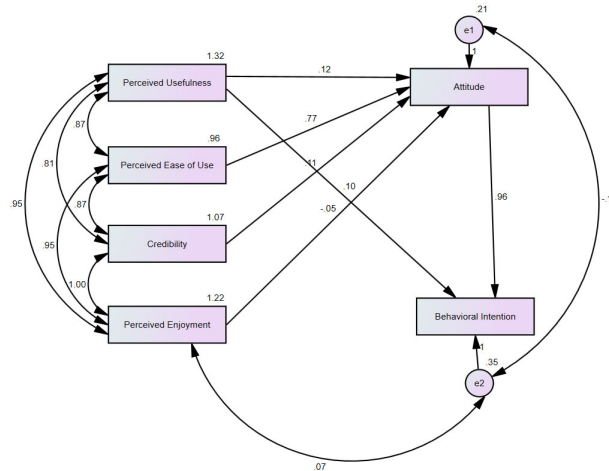


Fig. 2. The SEM model for the hypotheses

Table 5 Hypotheses Testing Results

Hypothesis	Relationships	Std. Beta	Std. Error	t-value	p-value	Conclusion
H1	PU → BI	0.100	0.031	3.263	0.001	Supported
H2	PU → ATT	0.122	0.022	5.587	p< .001	Supported
H3	PEOU → ATT	0.772	0.035	22.004	p< .001	Supported
H4	CR → ATT	0.108	0.029	3.743	p< .001	Supported
H5	PN → ATT	-0.051	0.034	-1.481	0.139	Not Supported
H6	ATT → BI	0.964	0.039	25.000	p< .001	Supported
H7	PU → ATT → BI	0.118	0.031	3.806	p< .001	Supported

Table 5 shows the results of the hypothesis testing. First, we tested the relationship between the predictors and Attitude. PU→ATT ($\beta = 0.122, p < 0.01$), PEOU→ATT ($\beta = 0.772, p < 0.01$), CR→ATT ($\beta = 0.108, p < 0.01$) while PN→ATT was not significant. Thus, H2, H3 and H4 was supported while H5 was not supported. PU→BI ($\beta = 0.100, p < 0.01$) and ATT→BI ($\beta = 0.964, p < 0.01$) were positively related to Intention thus supporting H1 and H6 of this study. Finally, we tested the mediation analysis following the Preacher and Hayes (2004) method by bootstrapping the indirect effect. PU→ATT→BI ($\beta = 0.118, p < 0.01$) was significant with no 0 straddling the lower and upper limit thus confirming H7.

5. Discussion

This study examined how students' acceptance and use of ChatGPT, a recently developed AI-based technology, affected their TAM-based education. The following factors were examined in this study: the attitude and intention to use ChatGPT, as well as perceived usefulness, perceived ease of use, perceived credibility, and perceived enjoyment among students. Our quantitative survey's findings validated the suggested paradigm. It was discovered that perceived usefulness (H2) positively impacted the attitudes of the students towards utilizing ChatGPT. Earlier studies incorporating the use of AI-based learning tools provided more evidence (Pillai et al., 2023; Shen et al., 2022). Using different queries of AI tool, students from different backgrounds are able to find answers on different matters, and this will improve their knowledge. Consequently, students will become knowledgeable about the concepts and developments in the domain of their interest. Students also found the tool valuable in education because it increases their learning quality and facilitates their completion of academic task quickly and effectively.

H1 was accepted as Perceived usefulness directly contributed to a higher likelihood of intentions to use ChatGPT for learning among higher education students. It means that if higher education students perceive using ChatGPT as requiring little effort and being useful for their daily studies, they are more likely to have a higher intention to use ChatGPT for their learning. These findings are in line with some prior studies, which were also built on the UTAUT (Parhamnia, 2022).

Moreover, our findings demonstrated that perceived ease of use was effectively positive. This can be because of perceived ease of use and potential opportunities associated with ease of use (or little effort to use) when humans interact with AI or robots (Al-Khateeb et al., 2023; Lim et al., 2023), and so, H3 was accepted. Perceived ease of use and attitude seemed significant among students in the context of learning and education. This result is inconsistent with Abdul-Halim et al. (2022) who reported in their study that students perceived ChatGPT as challenging to use, and they were not confident that the tool would turn them into experts. Some students perceived ChatGPT as a complicated tool, requiring a significant amount of mental effort in its usage. This situation may be attributed to the challenges students often face during ChatGPT usage like heavy traffic on the website as ChatGPT is the latest technological breakthrough in information science, and so, a large number of users would be exploring the tool at the same time, causing heaving traffic to the Open AI server.

Furthermore, the results in our study concluded that the responses provided by ChatGPT were often clear and comprehensible to user, and this may motivate some students from using the tool, especially for those looking for a quick fix to a problem. Additionally, attitude to use ChatGPT was significant and positively influenced by perceived credibility (H4) and this finding was in line with Kim et al. (2022) and Kabra et al. (2023). Students viewed ChatGPT as a dependable and trustworthy educational instrument. They use the program to find answers to a variety of queries and issues. They also concluded that the tool can be safely used and that the answers given will be kept private. This indicates that students may trust the responses delivered to be true and private while the data supplied or questions posed to the bot are assured to be confidential. It was discovered that students were using ChatGPT since they were interacting with an intelligent agent.

According to yet another research, students' negative attitudes toward ChatGPT have been influenced by their perceived enjoyment. This finding is not in line with Sehabuddin and Oktarina (2022), Mishra et al. (2022) and Chang et al. (2023). The tools were not fun, according to the respondents. They thought the responses the gadget offered were not funny. Overall, the respondents' attitudes were insignificant and negative and so, H5 was rejected.

Moreover, the student respondents demonstrated positive intent by saying they will utilize ChatGPT for their studies in the future when it came to measuring the behavioral intention to use the learning-based AI tool (Kabra et al., 2023). They have made the decision to make frequent use of the bot in order to improve their educational experience going forward. This suggests that the instrument will undoubtedly have a bright future and serve as a ground-breaking invention for college and high school students alike and so, H6 was accepted. Lastly, this study discovered that a user's attitude and behavioral intention to use ChatGPT are influenced by perceived usefulness. Indeed, the relationship between behavioral intention and perceived usefulness of ChatGPT mediated by users' attitudes regarding its use. Put another way, if students think ChatGPT is helpful for the activity they wanted to complete, they will consciously use it and so, H7 was accepted.

6. Implications

The results of this study will have a wide range of effects on academics, businesses, and the whole society. First, the study's various emphasized characteristics will increase the general public's accessibility to technology. The factors generating the positive behavioral intention to utilize this tool in an educational and learning environment are its usefulness, credibility, and ease of use. People who continue to seek AI aid for solutions will have improved literacy and general awareness since, as this research has shown, the tool is beneficial for education and learning. As more information is presented through computer interaction; this will have a profound effect on how human brains learn and evolve.

Second, when communicating with ChatGPT, users acquire inspiration that is quite positive. Simultaneously, people perceive the source of the answer supplied by the bot as reliable. The tool has gained a lot of traction and is being discussed in social contexts both online and offline. Students feel comfortable using this tool as a result. Our findings about these qualities can help communities outside of just the student body. Customers, shareholders, managers, executives, and other significant stakeholders connected to the companies would also be better informed on many topics of interest. They can obtain responses to queries produced by ChatGPT on any topic, including marketing, finance, accounting, economics, operations, and human resource development. ChatGPT also allows users to seek answers to the problems faced in their daily affairs, and also answers for dealing with complex dealings.

Third, Scholars might find the wealth of data produced by ChatGPT interesting. This might require the researchers to conduct a thorough search throughout a large body of scholarly literature. It might be easy for scientists and researchers alike to gather information, respond to research questions, and write theses and reports.

7. Conclusion and future research

The present study looked into the users' and students' attitudes regarding ChatGPT uptake using a quantitative approach. A model that clarifies students' behavioral intentions to adopt and use ChatGPT for learning and teaching was accordingly proposed. According to the research, students were motivated to utilize ChatGPT because they believed it to be a reliable and helpful tool in educational settings. However, much like any other technology, ChatGPT will face some significant difficulties. For morally and responsibly-minded reasons, ChatGPT use must be regulated by the government, businesses, and academic institutions. If not, it would be harmful to young people's education and personal growth. Even with improvements, there are

still issues with ChatGPT, such as factual mistakes, the promotion of bias, a lack of thorough understanding, and safety concerns.

There has been a contention that ChatGPT may have been trained on data that contain inaccuracies and that there may have been some gaps in the training process. This causes the bot to produce output that is erroneous. Students and learners who look for knowledge may receive inaccurate results that hinder their ability to study and grow in their careers (Lee, 2023). For the researcher's community, it has been found that the system produces fake citations thereby negatively impacting the literature review process (Cooper, 2023). This can affect the research and publications for authors and scholars (Perkins, 2023).

While robotic brains would be at work, the quantity of helpful material available to users with only a click would simultaneously hinder creativity and curiosity in problem-solving by human brains. The development of human brains can be slowed down by excessive use of artificial brains, at least in children and young people. Governments and tech businesses may help tackle these problems by determining how much of the answers should be provided by AI technologies like ChatGPT and how much should be left up to the human intellect.

Furthermore, the sample size and universe of the current study were constrained to a specific country (Jordan). Moreover, this study measured the intention to adopt and use ChatGPT by the students in education which is altogether a novel idea. Additionally, the collected data were based on the students' responses, which is a result of experience gained in a short span of time. Future scholars can also consider studies with larger sample sizes in different countries. Moreover, the resultant impact of using ChatGPT among learners, scholars and academicians may be examined in the schools, colleges or similar other organizational settings.

References

- Abdul-Halim, N. A., Vafaee-Zadeh, A., Hanifah, H., Teoh, A. P., & Nawaser, K. (2022). Understanding the determinants of e-wallet continuance usage intention in Malaysia. *Quality & quantity*, 56(5), 3413-3439.
- Abbasi, G. A., Sandran, T., Ganesan, Y., & Iranmanesh, M. (2022). Go cashless! Determinants of continuance intention to use E-wallet apps: A hybrid approach using PLS-SEM and fsQCA. *Technology in Society*, 68, 101937.
- Adu-Gyamfi, G., Song, H., Nketiah, E., Obuobi, B., Adjei, M., & Cudjoe, D. (2022). Determinants of adoption intention of battery swap technology for electric vehicles. *Energy*, 251, 123862.
- Ajzen, I. (2014). Attitude structure and behavior. In *Attitude structure and function* (pp. 241-274). Psychology Press.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.
- Al-Azawei, A., & Alowayr, A. (2020). Predicting the intention to use and hedonic motivation for mobile learning: A comparative study in two Middle Eastern countries. *Technology in Society*, 62, 101325. <https://doi.org/10.1016/j.techsoc.2020.101325>
- Al-Khateeb, M., Al-Mousa, M., Al-Sherideh, A., Almajali, D., Asassfeha, M., & Khafajeh, H. (2023). Awareness model for minimizing the effects of social engineering attacks in web applications. *International Journal of Data and Network Science*, 7(2), 791-800.
- Ali, M., Wood-Harper, T., & Wood, B. (2023). Understanding the technical and social paradoxes of learning management systems usage in higher education: A sociotechnical perspective. *Systems Research and Behavioral Science*. <https://doi.org/10.1002/sres.2945>
- Alsajjan, B., & Dennis, C. (2010). Internet banking acceptance model: Cross-market examination. *Journal of business research*, 63(9-10), 957-963.
- Aslam, W., Ahmed Siddiqui, D., Arif, I., & Farhat, K. (2022). Chatbots in the frontline: drivers of acceptance. *Kybernetes*, 52(9), 3781-3810. <https://doi.org/10.1108/K-11-2021-1119>
- Assaraira, T. Y., Alhindawi, N., Bani-Mohammad, S., Al-Anber, Z. A., & Albashaireh, Z. A. (2022). The Jordanian universities experience in integrating online learning and its quality assurance. *The International Arab Journal of Information Technology*, 19(3A), 544-565.
- Baabdullah, A.M. (2018). Consumer adoption of mobile social network games (M-SNGs) in Saudi Arabia: the role of social influence, hedonic motivation and trust. *Technology in Society*, 53, 91-102.
- Balakrishnan, J., Dwivedi, Y.K., Hughes, L., & Boy, F. (2021). Enablers and inhibitors of AI-powered voice assistants: a dual-factor approach by integrating the status quo bias and technology acceptance model. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-021-10203-y>
- Bashir, I., & Madhavaiah, C. (2015). Consumer attitude and behavioural intention towards internet banking adoption in India. *Journal of Indian Business Research*, 7(1), 67-102.
- Belanche, D., Casalo, L.V., & Flavian, C. (2019). Artificial intelligence in FinTech: understanding robo-advisors adoption among customers. *Industrial Management and Data Systems*, 119(7), 1411-1430.
- Belanche, D., Casalo, L.V., Flavian, C., & Schepers, J. (2020). Service robot implementation: a theoretical framework and research agenda. *The Service Industries Journal*, 40(3/4), 203-225.
- Bhat, M.A., & Tariq, S. (2022). Impact of Job Burnout on Performance: A Study among Hospital Employees of J&K, India. *BIMTECH Business Perspectives*, 1-17.
- Çelik, H. (2008). What determines Turkish customers' acceptance of internet banking?. *International Journal of Bank Marketing*, 26(5), 353-370.
- Celik, I. (2023). Towards Intelligent-TPACK: an empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, 138, 107468.
- Chang, Y.-W., Hsu, P.-Y., Chen, J., Shiau, W.-L., & Xu, N. (2023). "Utilitarian and/or hedonic shopping – consumer motivation to purchase in smart stores. *Industrial Management and Data Systems*, 123(3), 821-842.
- ChatGPT (2022). ChatGPT: optimizing language models for dialogue. *OpenAI*, available at: <https://openai.com/blog/chatgpt/> (accessed 22 Jun 2023).
- Chi, O.H., Jia, S., Li, Y., & Gursoy, D. (2021). Developing a formative scale to measure consumers' trust toward interaction with artificially intelligent (AI) social robots in service delivery. *Computers in Human Behavior*, 118, 106700.

- Chong, A.Y.L., Chan, F.T., Goh, M., & Tiwari, M.K. (2013). Do interorganisational relationships and knowledge-management practices enhance collaborative commerce adoption?. *International Journal of Production Research*, 51(7), 2006-2018.
- Cotton, D.R., Cotton, P.A., & Shipway, J.R. (2023). Chatting and cheating: ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1-12.
- Davis, F.D. (1985). A technology acceptance model for empirically testing new end-user information systems: theory and results. Doctoral dissertation, Massachusetts Institute of Technology.
- Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- De Luna, I.R., Liebana-Cabanillas, F., Sanchez-Fernandez, J., & Muñoz-Leiva, F. (2019). Mobile payment is not all the same: the adoption of mobile payment systems depending on the technology applied. *Technological Forecasting and Social Change*, 146, 931-944.
- Fujs, D., Vrhovec, S., & Vavpotič, D. (2022). Towards personalized user training for secure use of information systems. *The International Arab Journal of Information Technology*, 19(3), 307-313.
- Gefen, D. (2000). E-commerce: the role of familiarity and trust. *Omega*, 28(6), 725-737.
- Giovanis, A.N., Binioris, S., & Polychronopoulos, G. (2012). An extension of TAM model with IDT and security/privacy risk in the adoption of internet banking services in Greece. *EuroMed Journal of Business*, 7(1), 24-53.
- Gong, L., & Nass, C. (2007). When a talking-face computer agent is half-human and half-humanoid: human identity and consistency preference. *Human Communication Research*, 33(2), 163-193.
- Gupta, A., & Arora, N. (2017). Consumer adoption of m-banking: a behavioral reasoning theory perspective. *International Journal of Bank Marketing*, 35(4), 733-747.
- Haenlein, M., Kaplan, A., Tan, C.W., & Zhang, P. (2019). Artificial intelligence (AI) and management analytics. *Journal of Management Analytics*, 6(4), 341-343.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed, a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.
- Hamid, A.A., Razak, F.Z.A., Bakar, A.A. and Abdullah, W.S.W. (2016). The effects of perceived usefulness and perceived ease of use on continuance intention to use e-government. *Procedia Economics and Finance*, 35, 644-649.
- Han, N., Chen, J., Xiao, G., Zhang, H., Zeng, Y., & Chen, H. (2021). Fine-grained cross-modal alignment network for text-video retrieval. *Proceedings of the 29th ACM International Conference on Multimedia*, 3826-3834.
- Hariri, W. (2023). Unlocking the potential of ChatGPT: a comprehensive exploration of its applications, advantages. *Limitations, and Future Directions in Natural Language Processing*, arXiv preprint arXiv:2304.02017.
- Hooda, A., Gupta, P., Jeyaraj, A., Giannakis, M., & Dwivedi, Y.K. (2022). The effects of trust on behavioral intention and use behavior within e-government contexts. *International Journal of Information Management*, 67, 102553. <https://doi.org/10.1016/j.ijinfo-mgt.2022.102553>
- Howcroft, B., Hamilton, R., & Hewer, P. (2002). Consumer attitude and the usage and adoption of home-based banking in the United Kingdom. *International Journal of Bank Marketing*, 20(3), 111-121.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.
- Jaafar, N. A., Ismail, N. A., & Yusoff, Y. A. (2021). Usability study of enhanced salat learning approach using motion recognition system. *The International Arab Journal of Information Technology*, 18(3A), 414-421.
- Kabra, G., Ghosh, V., & Joshi, Y. (2023). Factors influencing adoption of cloud computing services in HEIs: a UTAUT approach based on students' perception. *International Journal of Business Information Systems*, 42(1), 103-122.
- Kasim, Ö. (2022). An efficient ensemble architecture for privacy and security of electronic medical records. *The International Arab Journal of Information Technology*, 19(2), 272-280.
- Keiper, M.C., Fried, G., Lupinek, J., & Nordstrom, H. (2023). Artificial intelligence in sport management education: playing the AI game with ChatGPT. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 33, 100456.
- Kim, J., Merrill, K., Jr, Xu, K., & Kelly, S. (2022). Perceived credibility of an AI instructor in online education: the role of social presence and voice features. *Computers in Human Behavior*, 136, 107383.
- Kline, T. J. (2005). *Psychological testing: A practical approach to design and evaluation*. Sage publications.
- Kwak, Y., Seo, Y.H., & Ahn, J.W. (2022). Nursing students' intent to use AI-based healthcare technology: path analysis using the unified theory of acceptance and use of technology. *Nurse Education Today*, 119, 105541.
- Larue, G.S., & Watling, C.N. (2021). Acceptance of visual and audio interventions for distracted pedestrians. *Transportation Research Part F: Traffic Psychology and Behaviour*, 76, 369-383.
- Lee, H. (2023). The rise of ChatGPT: exploring its potential in medical education. *Anatomical Sciences Education*, pp. 1-6. <https://doi.org/10.1002/ase.2270>
- Lim, J.S., & Zhang, J. (2022). Adoption of AI-driven personalization in digital news platforms: an integrative model of technology acceptance and perceived contingency. *Technology in Society*, 69, 101965. <https://doi.org/10.1016/j.techsoc.2022.101965>
- Lin, C.H., Shih, H.Y., & Sher, P.J. (2007). Integrating technology readiness into technology acceptance: the TRAM model. *Psychology and Marketing*, 24(7), 641-657. <https://doi.org/10.1002/mar.20177>
- Masa'deh, R., Shannak, R., & Maqableh, M. (2013). A structural equation modeling approach for determining antecedents and outcomes of students' attitude toward mobile commerce adoption. *Life Science Journal*, 10(4), 2321-2333
- Min, S., So, K.K.F., & Jeong, M. (2021). Consumer adoption of the uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. *In Future of Tourism Marketing*, Routledge, pp. 2-15.
- Mishra, A., Shukla, A., & Sharma, S.K. (2022). Psychological determinants of users' adoption and word-of-mouth recommendations of smart voice assistants. *International Journal of Information Management*, 67, 102413.
- Montano, D.E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. *Health Behavior: Theory, Research and Practice*, 70(4), 231.
- Mukherjee, A., & Nath, P. (2003). A model of trust in online relationship banking. *International Journal of Bank Marketing*, 21(1), 5-15.
- Nguyen, A., Ngo, H.N., Hong, Y., Dang, B., & Nguyen, B.P.T. (2023). Ethical principles for artificial intelligence in education. *Education and Information Technologies*, 28(4), 4221-4241.
- OpenAI (2022), available at: <https://openai.com/blog/chatgpt/> (accessed 10 March2023).

- Parhamnia, F. (2022). Investigating mobile acceptance in academic library services based on Unified Theory of Acceptance and Use of Technology Model (UTAUT-2). *The Journal of Academic Librarianship*, 48(5), 102570.
- Partel, V., Kakarla, S.C., & Ampatzidis, Y. (2019). Development and evaluation of a low-cost and smart technology for precision weed management utilizing artificial intelligence. *Computers and Electronics in Agriculture*, 157, 339-350.
- Perkins, M. (2023). Academic integrity considerations of AI large language models in the postpandemic era: ChatGPT and beyond. *Journal of University Teaching and Learning Practice*, 20(2).
- Pillai, R., Sivathanu, B., Metri, B., & Kaushik, N. (2023). Students' adoption of AI-based teacher-bots (T-bots) for learning in higher education. *Information Technology and People*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/ITP-02-2021-0152>
- Qadir, J. (2022). *Engineering education in the era of ChatGPT: promise and pitfalls of generative AI for education*. TechRxiv.
- Rahman, M.M., Strawderman, L., Lesch, M.F., Horrey, W.J., Babski-Reeves, K., & Garrison, T. (2018). Modelling driver acceptance of driver support systems. *Accident Analysis and Prevention*, 121, 134-147.
- Sahoo, D., Harichandan, S., Kar, S.K., & Sreejesh, S. (2022). An empirical study on consumer motives and attitude towards adoption of electric vehicles in India: policy implications for stakeholders. *Energy Policy*, 165, 112941.
- Sankey, M.D., & Marshall, S.J. (2023). Perspective chapter: the learning management system of 2028 and how we start planning for this now. *Higher Education-Reflections from the Field*. *IntechOpen*. DOI: 10.5772/intechopen.110120
- Sehabuddin, A., & Oktarina, N. (2022). E-Learning adoption; how is students' behavior during the covid19 pandemic?. *Dinamika Pendidikan*, 17(1), 48-61.
- Shannak, R., Obeidat, B., & Almajali, D. (2010). Information technology investments: A literature review. *Proceedings of the 14th IBIMA Conference on Global Business Transformation through Innovation and Knowledge Management: An Academic Perspective, Istanbul-Turkey*, 23rd-24th June, pp.1356-1368
- Sharma, G., & Thakur, A. (2023). ChatGPT in Drug Discovery. <https://doi.org/10.26434/chemrxiv-2023-qgs3k>
- Sharma, G. P., Verma, R. C., & Pathare, P. (2005). Mathematical modeling of infrared radiation thin layer drying of onion slices. *Journal of food engineering*, 71(3), 282-286.
- Shen, S., Xu, K., Sotiriadis, M., & Wang, Y. (2022). Exploring the factors influencing the adoption and usage of augmented reality and virtual reality applications in tourism education within the context of COVID-19 pandemic. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 30, 100373.
- Siddiqui, K. (2013). Heuristics for sample size determination in multivariate statistical techniques. *World Applied Sciences Journal*, 27(2), 285-287.
- Singh, N., & Sinha, N. (2020). How perceived trust mediates merchant's intention to use a mobile wallet technology. *Journal of Retailing and Consumer Services*, 52, 101894. <https://doi.org/10.1016/j.jretconser.2019.101894>
- Song, H., Ruan, W.J., & Jeon, Y.J.J. (2021). An integrated approach to the purchase decision making process of food-delivery apps: focusing on the TM and AIDA models. *International Journal of Hospitality Management*, 95, 102943.
- Suh, B., & Han, I. (2002). Effect of trust on customer acceptance of internet banking. *Electronic Commerce Research and Applications*, 1(3/4), 247-263.
- Szymkowiak, A., Melovic, B., Dabic, M., Jeganathan, K., & Kundi, G.S. (2021). Information technology and gen Z: the role of teachers, the internet, and technology in the education of young people. *Technology in Society*, 65, 101565.
- Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, 10(1), 15.
- Van Pinxteren, M.M.E., Wetzels, R.W.H., Ruger, J., Pluymaekers, M., & Wetzels, M. (2019). Trust in humanoid robots: implications for services marketing. *Journal of Services Marketing*, 33(4), 507-518.
- Venkatesh, V., Thong, J.Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157-178.
- Vrbka, J., & Rowland, Z. (2020). Using artificial intelligence in company management. *Digital Age: Chances, Challenges and Future 7*, Springer International Publishing, 422-429.
- Wang, Y., & Chen, H. (2019). The influence of dialogic engagement and prominence on visual product placement in virtual reality videos. *Journal of Business Research*, 100, 493-502.
- Warsono, H., Yuwono, T., & Putranti, I. (2023). Analyzing technology acceptance model for collaborative governance in public administration: empirical evidence of digital governance and perceived ease of use. *International Journal of Data and Network Science*, 7(1), 41-48.
- Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Computers and Education*, 68, 570-585.
- Yousafzai, S., Pallister, J., & Foxall, G. (2009). Multi-dimensional role of trust in internet banking adoption. *The Service Industries Journal*, 29(5), 591-605.
- Zhang, K., & Aslan, A.B. (2021). AI technologies for education: recent research and future directions. *Computers and Education: Artificial Intelligence*, 2, 100025. <https://doi.org/10.1016/j.caeai.2021.100025>

