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UNLOCKING EDUCATIONAL POTENTIAL: EXPLORING STUDENTS' SATISFACTION AND SUSTAINABLE ENGAGEMENT WITH CHATGPT USING THE ECM MODEL

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ABSTRACT

Aim/Purpose	The main goal of this study is to investigate the factors affecting students' satisfaction and continuous usage of ChatGPT in an educational context, using the Expectation-Confirmation Model (ECM) as the theoretical framework. Specifically, this investigation focuses on identifying how user expectations, perceived usefulness, and satisfaction influence the continuous usage of ChatGPT in education.
Background	ChatGPT is an AI-based chatbot that can generate natural language and support multi-turn dialogue. ChatGPT can be used in education for various purposes, such as academic writing, language translating, coding assistance, and information searching. Research indicates that ChatGPT is highly beneficial for students. Specifically, it aids in time-saving by synthesizing information across diverse fields and offers feedback tailored to individual learning needs and progress. Moreover, it enhances learning experiences through a personalized learning process, as well as aids in the translation of learning materials into different languages for improved accessibility. Despite the potential of ChatGPT in education, there remains a gap in understanding the determinants of user satisfaction and continuous usage. Therefore, this study was conducted to bridge this gap by assessing the impact of expectation confirmation, perceived usefulness, and satisfaction on continuous usage of ChatGPT.

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Methodology	This research employed a quantitative approach, which utilized a five-point Likert scale questionnaire to measure four variables with a total of 14 items. Data were collected from 435 students from eight Vietnamese universities through non-probability convenience sampling. The internal consistency of the questionnaire was examined using Cronbach's alpha. Four-factors Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) were then employed through IBM SPSS 26 and AMOS 24 to assess the proposed model and hypotheses, allowing for a comprehensive examination of the relationships between 4 variables: perceived usefulness, expectation confirmation, satisfaction, and continuous usage.
Contribution	This paper contributes to the literature on ChatGPT in education by identifying how expectation confirmation and perceived usefulness affect students' satisfaction and their intention to continue using ChatGPT in their learning. This study also has practical implications for educators and students for applying ChatGPT in their learning and teaching. It provides recommendations for effective use of ChatGPT in education.
Findings	The study's results show that students with greater expectations, either met or surpassed by ChatGPT, perceived the tool as more beneficial and satisfying for their needs. Additionally, students who perceived ChatGPT as useful and valuable for their learning goals were more inclined to continue to use it. Furthermore, the findings indicate that higher satisfaction with the tool was associated with a greater likelihood of continuous usage. Nevertheless, the results did not reveal a significant relationship between perceived usefulness and satisfaction regarding ChatGPT. This implies that perceiving ChatGPT as useful does not guarantee satisfaction. This finding may be attributed to various factors influencing student satisfaction, such as price value, using habit, facilitating conditions, trust, reliability, and quality.
Recommendations for Practitioners	Educators and students should consider the findings of this study to make informed decisions about the use of ChatGPT in educational settings, emphasizing the importance of managing users' expectation confirmation and ensuring perceived usefulness and satisfaction on continuous usage.
Recommendations for Researchers	Researchers can use the findings of this study as a foundation for exploring a deeper understanding of user expectation confirmation and the factors influencing perceived usefulness and satisfaction with ChatGPT in diverse educational settings.
Impact on Society	This study contributes to the broader field of the application of AI technologies in education, potentially reshaping the dynamics of interaction between students and educators with AI technologies for educational purposes. Its contributions have the potential to elevate the overall quality of education by promoting the appropriate and effective use of AI technologies.
Future Research	Future research should investigate the roles of ChatGPT in education more deeply and explore its long-term effects on both learners and educators. This includes conducting comparative studies to evaluate the efficacy and advantages of ChatGPT-assisted learning in comparison to traditional teaching methods. Additionally, there is a crucial need to assess the broader impact of ChatGPT on students' academic performance, cognitive development, and critical thinking skills.

Keywords ChatGPT, Expectation-Confirmation Model (ECM), student satisfaction, continuous usage, CFA, SEM

INTRODUCTION

The educational practices in the 21st century have witnessed rapid change, largely due to advances in technology, especially the appearance of artificial intelligence (AI). Among the AI technologies, chatbots have been considered potential applications for use in various scenarios, which are driven by their integration into various instant messaging platforms. This integration has facilitated the development of diverse chatbot applications (Sreelakshmi & Prathap, 2020). Moreover, the infusion of AI into chatbot systems has extended its utility across educational spheres, comprising educators, students, and administrative functions (Vanichvasin, 2022). The rise of AI and chatbots leads to transformation in education and offers the potential to reshape learning paradigms and knowledge exploration (Kooli, 2023). Numerous studies have explored the potential of chatbot technology for educational applications (Bilquise et al., 2024; Ghayoomi, 2023; Kurni et al., 2023). In the study conducted by Mostafa and Kasamani (2021), it was identified that the users' behavioral intention to use chatbots was significantly influenced by various factors. These factors included trust in chatbots, perceived usefulness, perceived ease of use, price consciousness, perceived risk, social influence, and personal innovativeness. AI chatbots revolutionize education by seamlessly handling diverse tasks. These intelligent tools excel in providing personalized support to students, offering comprehensive institutional information, and more. Their versatility and adaptability make them invaluable assets in the modern educational landscape (Kurni et al., 2023). A recent study by Wu et al. (2023) explored the impact of chatbots on student expectations regarding learning achievement. The findings suggest that chatbots not only influence student perceptions but also offer practical benefits. The study highlighted the potential of AI-based tools to address student inquiries related to course content, thereby alleviating the workload of lecturers and teaching assistants. Moreover, in the context of higher education, Studente and Ellis (2020) also mentioned the benefits of chatbots in enhancing online students' experiences.

Within the contemporary educational landscape, AI chatbot technologies are gaining traction as transformative instruments for reshaping pedagogy. These AI-based tools transcend the provision of immediate support for students and educators by fostering interactive and individualized learning experiences. This can augment student engagement and improve learning outcomes in the classroom. Among the modern AI-based technologies, ChatGPT, a powerful linguistic model, has received great concerns from educators due to its potential to make changes in educational practices. It can generate natural language, demonstrate understanding capabilities, and support multi-turn dialogue (Tan, 2023). In the context of education, AI-based tools have shown improvements in students' creativity, critical thinking skills, and self-directed learning. Additionally, it helps alleviate burdens and enhances studying efficiency. In the case of using AI-based tools for educational purposes, Ngo (2023) emphasizes the significant benefits of ChatGPT use for students. Notably, university students perceive this generative AI tool as a valuable tool that saves time by synthesizing information across diverse fields while also providing tailored feedback to address individual learning needs and track progress. Furthermore, it enhances learning encounters by providing personalized and adaptive learning routes, along with aiding in the translation of educational materials into various languages for enhanced accessibility. Despite its potential, ChatGPT still has noticeable drawbacks that need to be acknowledged. Ngo (2023) identifies challenges like technical hurdles in integration and potential biases in its outputs due to training data. Additionally, the ability to generate realistic text raises concerns about spreading misinformation and the ethical implications of privacy, accountability, and potential job displacement. Addressing these issues is crucial for the responsible and ethical use of this powerful language model. According to Alawida et al. (2023), these concerns include the risk of providing sen-

sitive information and performing fraudulent acts. While chatbots hold promise for education, research by Bahrini et al. (2023) identifies potential drawbacks. Overreliance on chatbots could hinder critical thinking, and biased training data could lead to students receiving misleading information. Additionally, ethical concerns arise: chatbots might be misused for plagiarism, and student data collected during interactions raises privacy issues. By acknowledging these potential issues, educators and developers can work together to ensure chatbots are integrated responsibly and ethically within educational settings. Another concern that can be mentioned is the issue of students' information satisfaction when they use AI-based chatbots for learning purposes. To clarify this urgency, a recent study by Ashfaq et al. (2020) found that user satisfaction with chatbots is significantly correlated with their continuous use. While the adoption of AI-based chatbots in educational settings has received attention among researchers, educators, and practitioners, research on the use of these AI-based tools, particularly generative AI such as ChatGPT, in educational contexts has been limited. This is especially true regarding the utilization and impact of these chatbots on user satisfaction and continuous use, particularly when focusing on student users. This research gap inspired and motivated this study to explore the effects of ChatGPT on user satisfaction and continuous usage for educational purposes, as well as provide recommendations so that students can utilize AI-based chatbots with effectiveness.

This study applied the Expectation-Confirmation Model (ECM) to evaluate the factors impacting users' continuous usage of technology. The ECM, a widely acknowledged framework in Information Systems research, was developed by Bhattacherjee (2001), proposing that user satisfaction with technology is influenced by the extent to which their expectations of the technology are met or exceeded. Based on the research of Al-Sharafi et al. (2022), which integrated the ECM with Knowledge Management factors to understand the sustainable use of chatbots in educational contexts, this study aims to explore the factors influencing students' satisfaction and continuous usage of ChatGPT for education purposes. The ultimate goals of this study are to provide insights and recommendations for effective and continuous integration of ChatGPT into educational environments. This study focuses on evaluating the relationships between independent variables of Expectation Confirmation, Perceived Usefulness, and Satisfaction, and the dependent variable of Continuous Usage is also the main goal of this research. Specifically, this study seeks to answer the following questions:

RQ1: Does expectation confirmation influence students' perceived usefulness and satisfaction when using ChatGPT for learning purposes?

RQ2: Does perceived usefulness influence students' satisfaction and continuous usage of ChatGPT for learning purposes?

RQ3. Does satisfaction influence students' continuous usage of ChatGPT for learning purposes?

The following sections of this article are structured as follows: the literature review section begins with a thorough examination of the existing literature relevant to GPTs, ECM model and related components, followed by an exploration of the theoretical frameworks guiding this study. By synthesizing previous research and establishing theoretical underpinnings, this section sets the stage for the empirical investigation. Next, the methodology section provides comprehensive information on the research design, participant selection criteria, data collection procedures, and analysis methods such as Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), ensuring transparency and methodological rigor, as well as reproducibility of the study. The results section then presents the empirical findings, elucidating key outcomes, patterns, and trends observed in the data alongside relevant statistical analyses. It provides insight into the empirical evidence generated from this research. The next section is the Discussion, which section contextualizes the findings within the broader scholarly discourse and offers insights for future research directions, a critical analysis, and

interpretation of the findings in relation to the research questions and objectives, explores the implications of results, discusses their alignment with existing literature, and addresses any limitations or challenges encountered during the study. Finally, the conclusion section synthesizes the main objectives, key findings, and contributions of the study, reflecting on its implications for theory, practice, and policy while proposing avenues for further inquiry within the field of using ChatGPT for educational purposes.

LITERATURE REVIEW AND RESEARCH FRAMEWORK

In this section, we delve into the existing literature concerning Generative Pre-trained Transformers (GPTs) and specifically ChatGPT, aiming to provide a thorough understanding of these technologies, their benefits, and their potential applications across various domains, with a particular focus on education. We explore the challenges and risks associated with the utilization of ChatGPT within educational settings, drawing insights from relevant research in this area. Additionally, we introduce the Expectation-Confirmation Model (ECM), elucidating its components, applications, and empirical evidence across diverse contexts. By examining the interrelationships among ECM elements, we lay the groundwork for developing hypotheses and establishing a theoretical framework to guide our study.

GPTs and ChatGPT

The introduction of Generative Pre-trained Transformers (GPTs) marked a significant milestone, with GPT-1 being released in 2018, followed by the latest version, GPT-4, in March 2023. According to Olga (2023) and Su (2023), GPTs have ushered in a new era in the field of science, enabling the development of sophisticated natural language processing models capable of tasks such as language translation, information synthesis, and question-answering. These models, grounded in deep learning principles, leverage unsupervised learning to pre-train extensive volumes of text data, allowing them to recognize and utilize inherent patterns and structures within the data. The advent of GPTs represents a transformative revolution in higher education, empowering the creation of advanced language models that produce high-quality text akin to human writing. This breakthrough has opened new frontiers in learning, research, and instruction. In this dynamic era, the role of higher education is rapidly evolving as institutions strive to keep pace with the innovations introduced by AI-based GPTs (Aithal & Aithal, 2023). ChatGPT, created based on GPT-3 by OpenAI at the end of 2022, represents an advanced AI technology that has attracted substantial interest. Since its first introduction to the public, ChatGPT rapidly became a groundbreaking user application, demonstrating its utility across diverse sectors, including education and business.

The contemporary educational landscape is witnessing a notable surge in the adoption of AI-based tools, particularly exemplified by ChatGPT, a generative AI that transcends basic support functions to offer interactive and personalized learning experiences. This transformation has the potential to significantly enhance student engagement and, consequently, improve learning outcomes within academic settings. ChatGPT presents itself as a valuable tool for both learners and educators, offering functionalities such as generating concise summaries for complex texts, providing targeted responses to subject-specific inquiries, and offering personalized feedback to users (Da Silva et al., 2024). Moreover, ChatGPT can provide personalized feedback, propose learning enhancements, and promote critical thinking by prompting students with insightful questions and encouraging deeper analysis.

Additionally, its capacity to offer diverse and relevant educational materials contributes to enhancing student comprehension of course content (Al-Ghonmein & Al-Moghrabi, 2024). However, despite the promising applications of ChatGPT in education, its limitations necessitate careful consideration (Salloum et al., 2024). Research by Ngo (2023) highlights the model's potential to generate inaccurate or inappropriate responses, and the lack of a definitive success rate underscores the need for further evaluation. An et al. (2023) raise concerns about potential biases and discriminatory tendencies embedded within the training data while highlighting ChatGPT's prioritization of language generation over domain-specific expertise. This lack of specialized knowledge can lead to misleading answers

and require continued teacher oversight An et al. (2023). This raises concerns about academic integrity in higher education settings. Students relying on ChatGPT must concurrently cultivate strong critical thinking skills to navigate these risks effectively. Looking toward the future, research by Bao (2024) emphasizes the need to prioritize the integration of ChatGPT with existing educational systems. Given its general-purpose nature, targeted implementation requires the development of specific methods, such as embedding ChatGPT functionalities within the current automatic grading system. Mlambo's (2024) study revealed concerns among lecturers regarding unethical student use of ChatGPT, potentially leading to plagiarism and exposure to misinformation. Consequently, they recommend the establishment of clear guidelines and policies within higher education institutions to govern responsible use. Additionally, some lecturers expressed anxieties about ChatGPT's potential to hinder student creativity and independent thinking (Mlambo, 2024). This passage acknowledges the potential benefits of ChatGPT in education while critically evaluating its limitations. By addressing these limitations and fostering responsible use practices, educators and students can leverage ChatGPT's capabilities while minimizing potential drawbacks. Furthermore, the exploration of future research directions, such as domain-specific training and system integration, holds promise for maximizing the positive impact of ChatGPT on the educational landscape.

The Expectation-Confirmation Model (ECM)

The Expectation-Confirmation Model (ECM) is one of the research studies that contributed to the design and evaluation of "the theoretical information systems continuity model," which distinguishes between the acceptance of information systems and continuity behavior (Sreelakshmi & Prathap, 2020). This model was built by Bhattacherjee (2001) based on Oliver's (1980) Expectation-Confirmation Theory. The ECM has remained popular in examining consumer satisfaction (STS) while utilizing internet technologies (Eren, 2021). In a recent study, Alnaser et al. (2023) employed ECM to assess user satisfaction with AI, showing a significant linkage between expectation confirmation and user satisfaction. Moreover, Sharabati et al. (2022) demonstrated that user satisfaction has a significant influence on the sustained intent to employ a technology. In the case of using ECM, Dhiman and Jamwal (2022) indicated that when users perceive that the technological features of chatbots align with their task-related needs, their expectations are met. As discussed earlier, ECM proposes that user satisfaction is examined by the confirmation of their expectations and their perception of the usefulness of the technology (Sharabati et al., 2022). This implies that users are more inclined to continue using a technology if it meets their expectations. The ECM encompasses four main elements: Expectation Confirmation (EC), Perceived Usefulness (PU), Satisfaction (STS), and Continuous Usage Satisfaction (CUS), which interrelate intricately.

Expectation Confirmation (EC)

The first element of the ECM, Expectation Confirmation (EC), is the process through which customers assess their expectations before purchasing a product or service in comparison to their actual experiences after use (Oliver, 1980). In consumer behavior studies, expectation confirmation and perceived usefulness are two important variables that can help explain why consumers make repurchase decisions and adopt or reject new technologies. Studies have supported the relationship between expectation confirmation and perceived usefulness, indicating that when customers' expectations are confirmed, they experience satisfaction and perceive the technology as useful as it fulfills their needs. For instance, Dhiman and Jamwal (2022) revealed that expectation confirmation positively influences users' perceived usefulness when using chatbots. Moreover, numerous studies have established the association between expectation confirmation and perceived usefulness in educational contexts (Cheng et al., 2023; Li et al., 2022; Nurfitriyani & Legowo, 2023).

Furthermore, Bhattacherjee and Premkumar (2004) also reported that EC was a significant predictor of information technology user satisfaction. This relationship has been confirmed by several studies in different contexts, such as e-learning (Hashim et al., 2023) and Chatbot (Dhiman & Jamwal, 2022;

Sohail et al., 2021). After using the system for a while, users compare their perception of its performance with pre-acceptance expectations, leading to either confirmation or disconfirmation, thereby influencing satisfaction levels and continuance intention (Liao et al., 2009). Notably, if users find that their expectations are met after using the technology, they are likely to have higher satisfaction and acknowledge the technology's utility. Al-Sharafi et al. (2022) discovered that students' satisfaction when utilizing chatbots for learning was positively influenced by EC. This implies that when students' expectations align with their experiences of using ChatGPT for educational purposes, their satisfaction increases.

Perceived Usefulness (PU)

The second element of the ECM, Perceived Usefulness (PU), is a key determinant of satisfaction with an information system. PU refers to the subjective estimation of future users regarding the potential of employed technology to enhance individual or team-based organizational performance (Malik & Annuar, 2021). When users believe that an information system would be useful to them, they are more likely to be satisfied with it (Davis et al., 1989). This observation was verified by Bolodeoku et al. (2022) and Cascella et al. (2023), who reported that the PU of technology had more influence on employee satisfaction, organizational support, and productivity compared to employee commitment. Moreover, users tend to derive satisfaction from information technology when they perceive tangible benefits (J. Y. Thong et al., 2006).

According to Hamid et al. (2016), PU is significant and positively influences the intention to continue using a technology. Individuals who establish positive "parasocial interactions" with an AI chatbot exhibit higher levels of PU and intention to use (Chan & Hu, 2023; Park & Kim, 2023). This suggested that if a person feels connected with a technology, he or she is more likely to use it. Similarly, Selamat and Windasari (2021) identified PU as a strong determinant of technology usage because it influences an individual's motivation to use technology. This study also revealed that when users believe a technology can help them achieve their goals, they have a higher possibility to use it. As a result, this finding is similar to the results of a study by Ashfaq et al. (2020) and Shen et al. (2023), which found that users who perceive a chatbot as beneficial are more likely to continue using it. In the context of ChatGPT, PU is considered a determining factor for continuous usage (CUS), particularly when aligned with students' educational goals, including academic writing, coding, search engine operations, and social media interactions (Aljanabi et al., 2023). Furthermore, Tan (2023) and Cooper (2023) discovered that students who considered ChatGPT relevant to their learning goals had a high probability to continue using it.

Satisfaction (STS)

The third element of the ECM, Satisfaction (STS), refers to the difference derived from subtracting a user's initial expectations of a product or service from their subsequent assessment of its performance (Xu et al., 2007). Therefore, individuals who are satisfied with an information system product or service believe in its usefulness and are motivated to continue using it (Jiménez-Bucarey et al., 2021; Kim et al., 2009). STS with ChatGPT is an overall feeling that develops over time as users interact with the AI chatbot. Sarkar et al. (2020) and Kuhail et al. (2023) discovered that users who experience satisfaction with technology are more inclined to maintain loyalty and persist in using that technology in the long term. According to Hassan et al. (2023), satisfaction is a strong predictor of users' intention to continue using chatbot e-service. This suggests that chatbot developers should provide favorable experiences to users. Subsequently, they should create user-friendly interfaces, offer access to extensive information, and make chatbots engaging and personable to the users. Furthermore, Baidoo-Anu and Ansah (2023) revealed the potential of ChatGPT to benefit students and educators by facilitating "personalized and interactive learning," creating "formative assessment activities," and providing continuous feedback to enhance teaching and learning processes.

Continuous Usage (CUS)

The last element of the ECM, Continuous Usage (CUS), was defined by Jahanmir et al. (2020) as the possibility that users will continue to use a technology over a long period. The dual-factor theory introduces two crucial factors that influence users' ongoing acceptance of information systems: promotion factors and inhibition factors (Huang et al., 2023). Notably, the studies by Lin et al. (2014), Y. Wang and Lin (2021) and Sharabati et al. (2022) revealed the positive relationship between user satisfaction and continuous usage systems. Nguyen et al. (2021) and Romero-Rodríguez et al. (2023) also figured out the positive impacts of perceived usefulness and satisfaction on users' intentions to continue usage of a chatbot application.

Research Framework

The theoretical framework of this study was established based on the Expectation-Confirmation Model (ECM) (Bhattacherjee, 2001) to investigate the relationships of its key factors: Expectation confirmation, Perceived usefulness, Satisfaction, and Continuous usage of ChatGPT for learning. Drawing from the existing literature, the following hypotheses were formulated, and the proposed framework for this study is presented in Figure 1.

H1. EC significantly and positively influences PU of ChatGPT for learning purposes.

H2. EC significantly and positively influences STS of using ChatGPT for learning purposes.

H3. PU significantly and positively influences STS of using ChatGPT for learning purposes.

H4. PU significantly and positively influences CUS of ChatGPT for learning purposes.

H5. STS significantly and positively influences CUS of ChatGPT for learning purposes.

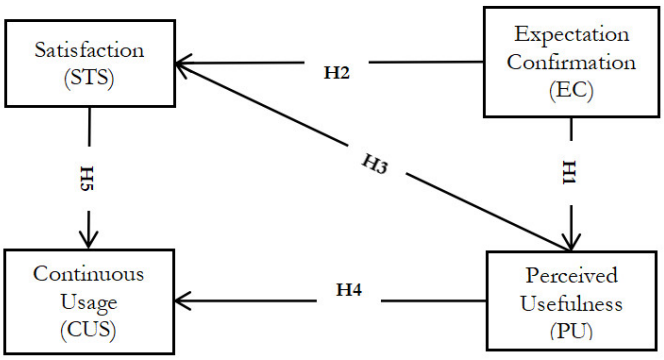

Figure 1. The proposed research framework

METHODOLOGY

In this section, we outline the research design employed, describing the systematic process undertaken in conducting the study. This includes a comprehensive explanation of the research process, detailing the rationale behind the chosen methodologies and procedures. We also discuss the selection of participants and the rationale behind their inclusion, as well as describe the demographics and characteristics that informed the selection criteria. Additionally, the development of the instruments utilized for data collection is explained, providing insight into their construction and validation process. The procedures for collecting data are described, detailing the methods employed for gathering data, including the approach taken to engage participants. Furthermore, the data analysis methodology is explained, outlining the computational techniques utilized and the specific analytical tools employed to derive meaningful insights from the collected data.

RESEARCH DESIGN

In this study, a quantitative approach was utilized, employing a 5-point Likert scale questionnaire to collect data, using Google Forms. The selection of a 5-point Likert scale for data collection in this study was informed by its efficiency, ease of implementation, and suitability for measuring opinions, attitudes, or behaviors, as proposed by Joshi et al. (2015). Unlike other methods, such as interviews or focus groups, which yield qualitative data, the Likert scale offers a structured and quantifiable approach to gathering information from a large number of participants. This scalability makes it ideal for studies aiming to capture a broad range of perspectives, such as those exploring user experiences with technology in educational settings (Joshi et al., 2015). Due to the challenges of organizing in-person interactions with participants spread across different geographical locations, an online survey was considered as the most appropriate tool for data collection. This allowed participants to complete the survey at their own convenience and from various locations. The research comprised the following steps: defining the problem and establishing research objectives, constructing a research framework based on a literature review, selecting the appropriate methodology, conducting both pilot and empirical surveys, and ultimately, analyzing and interpreting the results. The research process is presented in Figure 2.

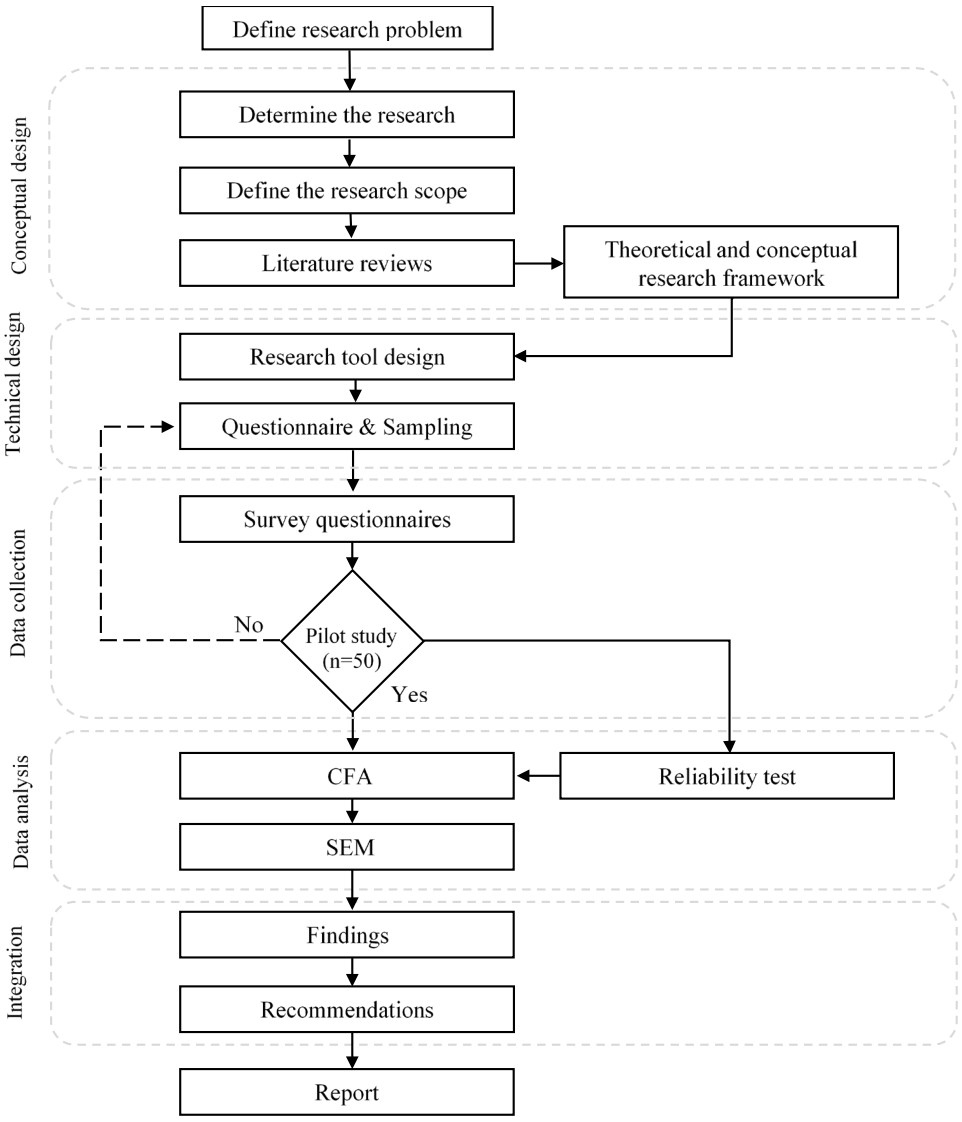

Figure 2. Research process

PARTICIPANTS AND INSTRUMENTS

The study enlisted participants from eight Vietnamese Universities, comprising students with a minimum of three months of prior experience in utilizing ChatGPT for educational purposes, irrespective of their academic majors. These students employed ChatGPT for various learning objectives, including information search and synthesis, translation, coding assistance, and more. A total of 435 valid responses were selected and utilized to evaluate the research framework and test the hypotheses. The majority of participants were male (n = 269, 61.84%), with a smaller proportion being female (n = 166, 38.16%).

A structured questionnaire was designed and utilized to collect data using Google Forms. The questionnaire comprised three sections. The initial section of the questionnaire requested participants to provide essential demographic information such as gender and education institution. The second section assessed ChatGPT usage patterns more deeply. It aimed to explore not only the frequency of usage but also the specific ways in which participants engaged with the technology and their level of experience in using ChatGPT. Questions in this section addressed usage purposes, duration of use, and related factors. The third section utilized a 5-point Likert scale, ranging from 1 (totally disagree) to 5 (totally agree), to examine participants' perceptions across the study's variables. These variables comprised 14 items and encompassed crucial factors, including Expectation Confirmation (EC1 – EC4), Perceived Usefulness (PU1 – PU3), Satisfaction (STS1 – STS4), and Continuous Usage (CUS1 – CUS3). The selection of variables in this study (Table 1) was informed by previous research, particularly the work of Najeeb et al. (2018) on job satisfaction investigation utilizing the ECM model and the study by Al-Sharafi et al. (2022) on the sustainable use of AI-based chatbots for educational purposes employing the ECM model and a hybrid SEM-ANN approach. The adoption of variables from these studies was purposeful, as they are well-established and validated within prior research, aligning closely with the objectives of this study.

Table 1. Variables and items

Variables	Codes	Items
Perceived usefulness	PU1	"ChatGPT's functionality makes my experience better."
	PU2	"The pros of using ChatGPT outweigh the cons."
	PU3	"Generally, I find ChatGPT's features to be worthwhile."
Expectation confirmation	EC1	"My experience using ChatGPT exceeded my expectations."
	EC2	"ChatGPT provided better services than I thought it would be."
	EC3	"ChatGPT offered more advantages than I had initially expected."
	EC4	"Overall, ChatGPT confirmed the majority of my anticipated outcomes."
Satisfaction	STS1	"I found my experience of using ChatGPT to be very fulfilling."
	STS2	"I was very happy and content with my experience of using ChatGPT."
	STS3	"My experience with ChatGPT was very contenting."
	STS4	"My experience with ChatGPT was truly delightful."
Continuous usage	CUS1	"I plan to maintain my use of ChatGPT instead of discontinuing it."
	CUS2	"I intend to continue opting for ChatGPT over other available methods."
	CUS3	"I would prefer to sustain my use of ChatGPT if possible."

DATA COLLECTION AND ANALYSIS

The data collection and analysis adhered to the research design, employing a rigorous process to ensure the accuracy and robustness of the findings. Initially, a pilot study was conducted to assess the questionnaire's reliability and the internal consistency of its items, utilizing Cronbach's alpha analysis. In this study, 50 participants were involved, and data from their responses were collected and analyzed. Cronbach's alpha values were computed for all items and variables in the questionnaire. Cronbach's alpha is a statistical measure used to evaluate the internal consistency or reliability of a set of scale or test items, with values ranging from 0 to 1. A higher value closer to 1 indicates greater internal consistency among items. According to Taber (2017), a commonly accepted threshold for Cronbach's alpha is .7. In this pilot study, Cronbach's alpha values obtained for all items and variables ranged from .7 to .9, indicating a satisfactory level of consistency among the items. This range indicates a sufficient level of consistency among the items, which suggests that the items in the questionnaire are measuring the same underlying construct reliably. When all Cronbach's alpha values exceeded .7, as in this case, it signified that the questionnaire was internally consistent and reliable. This means that the items are effectively measuring what they are intended to measure and are providing consistent results. Therefore, none of the items need to be eliminated from the questionnaire based on their individual contribution to the overall reliability.

In the empirical study, an online survey was conducted using Google Forms, employing a non-probability convenience sampling technique due to its efficiency and cost-effectiveness. According to Ayhan (2011) and Wiśniowski et al. (2020), in situations where a complete population list is unfeasible, the non-probability sampling method is considered the most appropriate choice. Hence, in this study, the convenience sampling method was adopted, and participants were selected based on accessibility and availability within a designated time frame. This strategic decision was made to simplify data collection and accommodate the practical constraints of the research environment, ultimately enhancing the study's efficiency and effectiveness (Stratton, 2021). To ensure a thorough representation of the student population, the questionnaire was distributed across various platforms, engaging students from a diverse range of higher educational institutions in Vietnam. Additionally, in prioritizing ethical principles and safeguarding participant privacy, clear information regarding the study's purposes and participants' right to provide to ensure informed consent. Throughout the process, anonymity was upheld, with no personal identifiers like names or email addresses being collected. Moreover, participants' data is utilized exclusively for research purposes as delineated in the informed consent process, precluding any sharing or utilization or commercial purposes.

After the data collection phase, quantitative analysis was employed for this study. First, IBM SPSS26 was utilized for descriptive analyses to provide a comprehensive overview of the data. To enhance the credibility of the measurement instruments within the Expectation-Confirmation Model (ECM), Confirmatory Factor Analysis (CFA) was performed. AMOS 24 software was selected for both CFA and Structural Equation Modeling (SEM) due to its advanced analytical capabilities, as recommended by Hair et al. (2014). This choice ensured efficient analysis for investigating the relationships among student expectations, perceived usefulness, satisfaction, and the continuous usage of ChatGPT in education.

RESULTS

This section encompasses several key analyses. First, a measurement model assessment is presented to evaluate the internal consistency reliability of the variables, as determined by Cronbach's alpha value. Second, confirmatory factor analysis (CFA) is utilized to assess the fit of the proposed model with the observed data, taking into account various model fit indices. Additionally, structural equation modeling (SEM) is deployed to investigate the structural relationships within the research framework.

Measurement Model Assessment

Cronbach's alpha was employed as a statistical tool to evaluate the internal consistency reliability of the items under each factor (Taber, 2017). The Cronbach's alpha coefficients for the items under each factor were found to be .714 for PU, .763 for EC, .736 for STS, and .732 for CUS. These coefficient values reflect a sufficient internal consistency reliability of the scales used in the variable. According to Taber (2017), a commonly accepted threshold for Cronbach's alpha is between .7 and .9, indicating satisfactory internal consistency. In this study, all the obtained Cronbach's alpha coefficients meet the recommended values, indicating a sufficient reliability level. This outcome demonstrated the accuracy and stability of the data collected.

Furthermore, to ascertain the convergence validity, this study employed the Average Variance Extracted (AVE). The AVE value is a statistical measure used in SEM to assess the convergent validity of constructs. It represents the average about of variance captured by the items of a construct relative to the measurement error (Fornell & Larcker, 1981). A higher AVE value indicates that the items of a construct are collectively explaining a proportion of the variance. Fornell and Larcker (1981) suggested that convergent validity is achieved when a latent construct explains at least fifty percent of the variance in its associated indicators. Therefore, to meet the criteria for convergent validity, the AVE value should be .5 or higher. The obtained AVE value of this study ranged from .558 to .585, providing further confirmation of the research's convergent validity. Additionally, this study utilized the Average Variance Extracted - Shared Variance (AVE-SV) proposed by Fornell and Larcker (1981) criterion to assess discriminant validity. In the AVE-SV approach, the discriminant validity is assessed by comparing the squared root of AVE for each construct with the squared correlations between that construct and all other constructs in the model. To confirm discriminant validity, it is expected that the AVE of each construct is greater than the correlations with other constructs in the model (Fornell & Larcker, 1981; Grewal et al., 2004). The value in Table 2 suggests that the study has confirmed discriminant validity, as the square root of the AVE for each construct is higher than its correlations with other constructs. This ensures that each construct is indeed distinct from the others, meeting the criterion for discriminant validity.

Table 2. Discriminant validity

	CUS	EC	PU	STS
CUS	.760			
EC	.517	.751		
PU	.573	.598	.765	
STS	.559	.574	.733	.747

Note: The highlighted value indicated the squared root of AVE

Confirmatory Factor Analysis (CFA)

To evaluate the proposed model's alignment with the observed data, a four-factor Confirmatory Factor Analysis (CFA) was employed. This analysis assessed the consistency between the model's latent variables and the measured variables. Table 3 shows the results of the CFA, which emphasized a satisfactory alignment between the proposed model and the empirical data. The Chi-Square values yielded a ratio of 1.078 (CMIN/DF), within the accepted range of 1 to 3. This indicated a satisfactory fit, consistent with the established guideline of Ullman (2010). The Goodness of Fit Index (GFI) was .976, above the recommended threshold of .90, indicating a good fit between the proposed model and the observed data (Anggriani et al., 2020). The Comparative Fit Index (CFI) was excellent at .997, surpassing the recommended .95 threshold, indicating a strong agreement between the proposed model and the observed data, suggesting an adequate fit (Bentler, 1990). Moreover, the Tucker-Lewis Index (TLI) obtained a value of .996, which was higher than the acceptable threshold of .90, further confirming the adequate alignment between the proposed model and the empirical data (Bentler, 1990). With a Standardized Root Mean Square Residual (SRMR) of .027 and a Root

Mean Square Error of Approximation (RMSEA) of .013, both below the recommended thresholds of <.08 and <.06, respectively, the model exhibited a strong fit in terms of both comparative and residual aspects (Hu & Bentler, 1999). Additionally, the *p*-value (PClose) was 1, exceeding the significance level of 5%. These indices collectively highlighted a robust and well-fitting model, affirming alignment between the proposed framework and empirical data (Hu & Bentler, 1999).

Table 3. Model fit results

Measure	Value obtained	Threshold
CMIN/DF	1.078	Between 1 and 3
GFI	.976	> .90
CFI	.997	> .95
TLI	.996	> .90
SRMR	.027	< .08
RMSEA	.013	< .06
PClose	1	> .05

Structural Equation Modeling (SEM) Analysis

Structural Equation Modeling (SEM) was used to analyze structural relationships in the proposed research framework (Figure 3). Table 4 shows the interconnections investigated within this quantitative research, employing a significance level of 5%. A crucial analysis finding was the validation of the central role undertaken by students' EC in shaping their PU of ChatGPT. This validation was substantiated by a strong positive path coefficient (H1: β = .666, C.R. = 8.882, *p*-value < .001), affirming the proposition that preconceived notions significantly impact on how students perceive ChatGPT's usefulness. Furthermore, the study discovered the substantial impact of EC in fostering STS with ChatGPT. This linkage was substantiated by a notable path coefficient (H2: β = .961, C.R. = 5.288, *p*-value < .001), signifying that as students perceive ChatGPT as beneficial, their satisfaction levels increase. However, the postulated association (H3) between PU and STS did not garner empirical substantiation (H3: β = -.021, C.R. = -.094, *p*-value = .925). This finding aligns with prior studies conducted by Daneji et al. (2019) and Maheshwari (2023), suggesting that user satisfaction may be influenced more substantially by factors such as system quality, information quality, or perceived learning value rather than solely relying on the perceived usefulness of the tool. In educational contexts, the overall quality of the system, the relevance and reliability of the information provided, and the perceived value in facilitating learning experiences may play pivotal roles in shaping user satisfaction. The analysis results revealed the significant influence of both PU and STS on the CUS of ChatGPT. This discovery concurrently validated the fourth (H4) and fifth (H5) hypotheses at 5% of significant, revealing positive path coefficients (H4: β = .55, C.R. = 2.498, *p*-value = .012; H5: β = .373, C.R. = 2.309, *p*-value = .021). This indicated that students who perceive ChatGPT as valuable and experience higher levels of satisfaction, are more likely to continuously integrate it into their educational journey.

Table 4. The SEM analysis results

Hypothesis	Path	β	C.R.	*p*-value	Result
H1	EC → PU	.666	8.882	***	Accepted
H2	EC → STS	.961	5.288	***	Accepted
H3	PU → STS	-.021	-.094	.925	Rejected
H4	PU → CUS	.550	2.498	.012	Accepted
H5	STS → CUS	.373	2.309	.021	Accepted

*Note: PU = Perceived usefulness; EC = Expectation confirmation; STS = Satisfaction; CUS = Continuous usage; ***: p-value <.001*

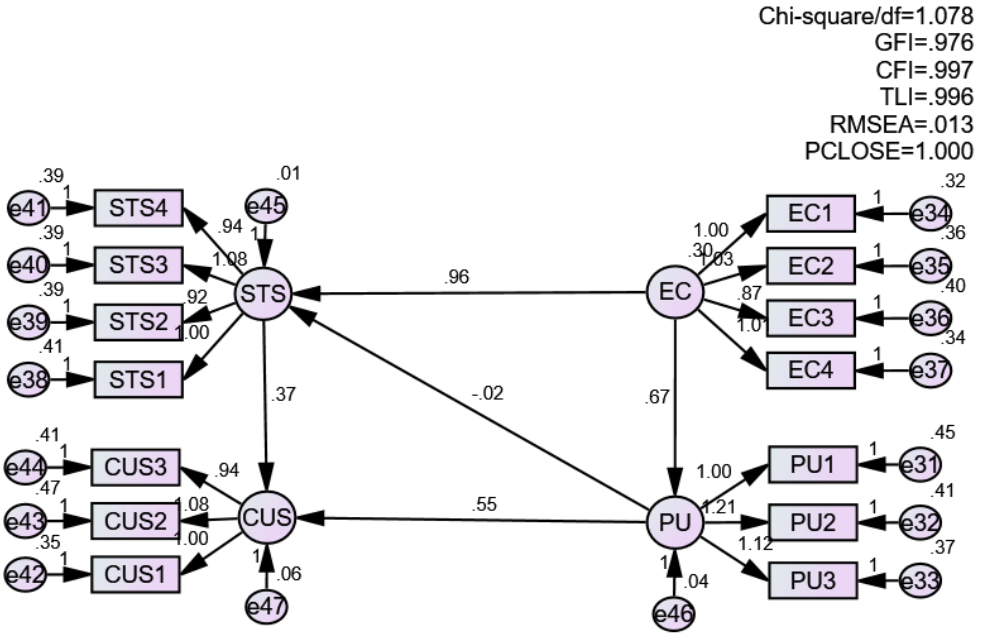

Figure 3. The Structural Equation Model (SEM)

In the structural equation modeling (SEM) diagram (Figure 3), the representation of variables and their interrelationships is depicted through specific shapes and numbers: circles are used to represent latent variables, which are theoretical constructs inferred from directly measured variables, while rectangles indicate observed variables that are directly measured. Additionally, numerical values next to the circles, such as .39 and 1 near the circle labeled e41, represent the estimated variance and regression weight, respectively. These values highlight the strength and direction of the relationships between the variables; values closer to 1 indicate a stronger relationship.

Table 5 displays the squared multiple correlations results, which specified the proportion of variation in the dependent variable that was accounted for by the predictor variables in the respective variables. The variable PU demonstrated sufficient explanatory power with an *R*-squared value of .753, signifying that 75.3% of the variation in the dependent variable can be explained by the predictor variables associated with it. Similarly, the STS variable exhibited a high *R*-squared of .948, suggesting that a significant 94.8% of the variation in the dependent variable was explained by the predictor variables associated with STS. The CUS variable also contributed significantly to the explanation of variance with *R*-squared value of .737, which implied that 73.7% of the variability in the dependent variable was explained by the predictor variables within the CUS variable.

Table 5. Squared multiple correlations results

Variables	*R*-squared
PU	.753
STS	.948
CUS	.737

Note: PU = Perceived usefulness; STS = Satisfaction; CUS = Continuous usage

In summary, the results section demonstrated the reliability and validity of the measurement model, with satisfactory Cronbach's alpha coefficients and confirmatory factor analysis (CFA) fit indices. Structural equation modeling (SEM) revealed significant relationships among research constructs, confirming the positive impact of expectation confirmation (EC) on perceived usefulness (PU), satisfaction (STS), and continuous usage (CUS) of ChatGPT. The result of the squared multiple correlations

further underscored the explanatory power of the predictor variables in elucidating the variation in the dependent variables. Overall, these findings provide a robust foundation for advancing our understanding of the factors influencing students' acceptance and continuous usage of ChatGPT in education, setting the stage for further discussion in the subsequent section.

DISCUSSION

This study investigates the factors influencing students' satisfaction and continuous usage of ChatGPT for educational purposes. The Expectation-Confirmation Model (ECM) was applied to analyze the relationship between students' expectation confirmation (EC), perceived usefulness (PU), satisfaction (STS), and continuous usage (CUS) of ChatGPT.

First, the study revealed that students' EC had a significant positive impact on their PU of ChatGPT (H1: $\beta = .666$, C.R. = 8.882, p-value < .001). This finding supports the ECM, positing that users form initial expectations based on their prior knowledge, experience, and information sources and then compare these expectations with the actual performance and outcomes of the technology (Bhattacherjee, 2001). Students who had higher expectations and witnessed their fulfillment or surpassing found ChatGPT to be more beneficial for their purposes (Cooper, 2023). This result is similar to the findings of previous studies, which have found a positive relationship between EC and PU in various technology contexts, such as e-learning (Rajeh et al., 2021) or mobile banking (Lee et al., 2023). This suggests that students' expectations hold a significant influence over their perceptions of ChatGPT's usefulness. Therefore, effective management of these expectations is critical to successful outcomes that can be achieved through a range of strategic approaches. These include diverse communication channels such as websites, social media, newsletters, videos, and podcasts. Additionally, the demonstration of technological functionality and usability is conducted through live or recorded sessions, tutorials, and webinars. To enhance engagement, interactive and captivating training methods like games, dialogues, and simulations are implemented. Through the adoption of these strategies, developers and educators can elevate students' expectations of ChatGPT and ensure that these expectations are met or exceeded, which can lead to higher PU, STS, and behavioral intention.

Second, the study found that EC had a significant positive impact on students' STS with ChatGPT use (H2: $\beta = .961$, C.R. = 5.288, p-value < .001). This finding is consistent with the ECM, suggesting that users' satisfaction is determined by the degree of confirmation or disconfirmation of their expectations (Bhattacherjee, 2001). Moreover, the result of this study is consistent with the study of Sohail et al. (2021), who investigated user satisfaction with an AI-powered customer relationship management chatbot and found that EC was positively associated with STS. This result is in accordance with previous studies that exposed a positive relationship between EC and STS in various technology contexts, such as e-government (Alzahrani et al., 2017) and cloud computing (Ziebell et al., 2019). This finding indicates that students' STS with ChatGPT is influenced by their initial expectations, and thus, it is important to meet or exceed these expectations through high-quality performance and outcomes. This means that the developers and educators should ensure that ChatGPT delivers the expected benefits, features, and functions to the students and that the students are able to achieve their desired goals and outcomes by using this tool. By doing so, the developers and educators can increase the students' satisfaction with ChatGPT, which may lead to higher behavioral intention and loyalty.

Third, it is intriguing and somewhat surprising that the study found no significant impact of PU on STS when utilizing ChatGPT (H3: $\beta = -.021$, C.R. = -.094, p-value = .925). This finding contradicts some recent studies that indicated a positive relationship between students' PU and STS when using ChatGPT. Accordingly, Chan and Hu (2023) found that performance expectancy, which is similar to PU, had a significant effect on the behavioral intention to use ChatGPT. Another study by Kuhail et al. (2023) found that most papers on educational chatbots reported improved learning and subjective satisfaction as evidence of chatbot effectiveness. These studies found that students who reported

finding ChatGPT helpful for their academic performance also experienced higher levels of satisfaction. However, the finding of no significant effect of PU on students' STS when using ChatGPT may also be explained by other factors that influence student satisfaction, such as hedonic motivation, price value, habit, and facilitating conditions (Romero-Rodríguez et al., 2023). Students may enjoy using ChatGPT for fun or pleasure, regardless of its usefulness for their learning. Students may also consider the cost and accessibility of ChatGPT as important factors for their satisfaction. Therefore, PU may not be the only or the most important determinant of student satisfaction when using ChatGPT. Similarly, Bilquise et al. (2024) found that students' PU of academic advising chatbots was positively related to the responsiveness, friendliness, and reliability of the chatbot. Therefore, if ChatGPT does not provide appropriate responses or interaction styles or design principles for the educational context, students may not perceive it as useful, regardless of their satisfaction level. Besides, ChatGPT is a technology that may have some limitations and errors in its output. The level of trust and satisfaction users have in information systems can be influenced by factors, like perceived reliability and quality which may not always be high. Therefore, students may not rely on ChatGPT as a reliable and accurate source of information or feedback for their learning (Shen et al., 2023). Moreover, the deviation from previous research findings could be attributed to the evolving nature of technology and its integration into educational settings. As ChatGPT and similar AI tools become more sophisticated, students' expectations and perceptions may also shift (Chan & Zhou, 2023). For instance, early adopters might have been more forgiving of technological limitations, leading to a positive bias in satisfaction reports. However, as the novelty wears off and the user base grows, a more critical evaluation of the tool's practical benefits is likely to occur (L. Wang et al., 2023). Furthermore, the context in which ChatGPT is used can greatly affect perceived usefulness (PU). In a research setting, where accuracy and depth of information are paramount, ChatGPT's occasional inaccuracies or surface-level responses might not meet the high standards required, thus not significantly impacting student's STS (Qasem, 2023; C. L. Thong et al., 2023). On the other hand, in a casual learning environment, the ease of interaction and immediate feedback provided by ChatGPT could be highly valued, regardless of the occasional errors (Tlili et al., 2023). This finding implies that future studies should explore how hedonic motivation, price value, habit, and facilitating conditions affect the students' perceptions of ChatGPT's usefulness and satisfaction. Moreover, researchers should examine the influence of trust, reliability, and quality of ChatGPT on students' perceptions of usefulness and satisfaction. Such inquiries will contribute to a more comprehensive and nuanced understanding of the determinants shaping students' PU and STS when utilizing ChatGPT in education.

Fourth, this study discovered that PU had a significant influence on students' continuous usage of ChatGPT (CUS) (H4: $\beta = .55$, C.R. = 2.498, p-value = .012). This is an interesting finding that is consistent with some recent studies on the factors affecting the usage of ChatGPT. In a study conducted by Cascella et al. (2023), PU was found to be a significant predictor of students' intention to use ChatGPT for academic purposes, which can help them improve their learning outcomes and performance. PU is also reported to have a positive effect on user satisfaction and loyalty to ChatGPT, increasing the users' trust and confidence in ChatGPT's reliability and accuracy (Salah et al., 2023). Moreover, this finding is consistent with recent studies that have found PU to be a positive and significant predictor of continuance intention or behavior toward various information systems, such as mobile payment apps (Al Amin et al., 2024) and e-learning platforms (X. Wang et al., 2022). This suggests that students tend to keep using an information system if they find it helpful for their objectives or assignments. The students may find ChatGPT useful for practicing their language proficiency, improving their critical thinking, or exploring new ideas and perspectives. It may also indicate that students perceive ChatGPT as a valuable and beneficial tool that can support their academic goals and achievements. Therefore, it is important to understand the factors influencing PU of ChatGPT among students.

Fifth, the study found that student's STS has a significant positive effect on CUS of ChatGPT (H5: $\beta = .373$, C.R. = 2.309, p-value = .021). This finding supports ECM, which asserts that user satisfaction with technology influences behavioral intention to use it (Bhattacherjee, 2001). This finding is aligned

with recent studies that have explored the potential of ChatGPT in education. Specifically, ChatGPT can be used as a useful tool to improve students' language skills and promote active learning (Yan, 2023). According to Jiménez-Bucarey et al. (2021), students who are more satisfied with their e-learning experience are more likely to reuse ChatGPT because they have higher motivation, engagement, and confidence in their learning outcomes. On the other hand, if students are not satisfied with ChatGPT, they may lose interest in using it or trusting it (Kuhail et al., 2023). This finding also suggests that students' satisfaction with ChatGPT impacts their continuous usage of the tool. Therefore, it is essential to ensure and enhance their satisfaction levels by testing for reliability, responsiveness, and quality. This means that the developers and educators should check if ChatGPT provides accurate and consistent responses, if ChatGPT responds quickly and appropriately to the students' queries and feedback, and if ChatGPT meets the standards and expectations of the educational context. By doing so, the developers and educators can increase the students' satisfaction with ChatGPT, which will lead to higher continuous usage and loyalty.

The results of this study uncovered the relationships among students' expectation confirmation, perceived usefulness, satisfaction, and continuous usage of ChatGPT in education. These findings provide valuable insights for educators, researchers, and developers in implementing ChatGPT as a tool for educational activities. Specifically, educators should integrate ChatGPT into their teaching strategies in a way that aligns with the curriculum and learning outcomes. For instance, educators could use ChatGPT to supplement traditional teaching methods by providing students with additional resources for self-study or to facilitate group discussions. This would not only enhance the learning experience but also provide opportunities for students to engage with the material in a more interactive manner. For researchers, these findings highlight the need for further investigation into the factors that influence students' satisfaction with AI tools in education. Future research could explore the impact of individual differences, such as learning styles and technology readiness, on the effectiveness of ChatGPT as an educational tool. Additionally, longitudinal studies could provide insights into how students' perceptions of ChatGPT evolve over time and how this affects their continuous usage. Developers of AI educational tools like ChatGPT should especially focus on improving the accuracy and depth of the tool's responses. This could involve training the AI on a wider range of educational materials and incorporating feedback mechanisms that allow the AI to learn from its interactions with users. Moreover, developers should consider the design and user interface of the tool to ensure it is intuitive and user-friendly, which can significantly affect students' satisfaction and willingness to continue using the tool.

In addition, the study still has potential limitations in its methodology and data analysis. For instance, the characteristics of the sample population could limit the generalizability of the findings. If the participants predominantly belong to a specific demographic or educational background, this could skew their familiarity with and attitude toward AI tools like ChatGPT. The survey design is another critical aspect; the validity and reliability of the instruments used to measure variables such as expectation confirmation, perceived usefulness, and satisfaction are paramount. The self-reported nature of these measures may introduce biases like social desirability or recall bias, which should be acknowledged and discussed. Additionally, the construct validity and discriminant validity of the measures warrant scrutiny to ensure they accurately reflect the intended constructs. Finally, the statistical methods employed in data analysis must be examined for assumptions that could influence outcomes, such as multicollinearity or the choice of statistical models. By transparently discussing these factors, the research will be more nuanced, strengthening its implications for educational technology.

CONCLUSION

This study aimed to investigate the factors that influence students' satisfaction and continuous usage of ChatGPT – a linguistic model that can generate natural language, demonstrate understanding capabilities, and support multi-turn dialogue – for educational purposes. The study applied the Expec-

tation-Confirmation Model (ECM) to analyze the relationship between students' expectation confirmation (EC), perceived usefulness (PU), satisfaction (STS), and continuous usage (CUS) of ChatGPT for their learning. The study employed a five-point Likert scale questionnaire to collect data from 435 students who had prior experience in using ChatGPT for educational purposes. The data were analyzed using Cronbach's alpha test, confirmatory factor analysis (CFA), and structural equation modeling (SEM).

The study's results revealed that EC had a significant positive impact on both PU and STS of ChatGPT. This indicated that students who had higher expectations met or exceeded by ChatGPT, perceived the tool as more beneficial and satisfying for their needs. The results also showed that PU had a significant positive impact on CUS of ChatGPT. This suggested that students who perceived ChatGPT as useful and valuable for their learning goals were more likely to continue using it. Moreover, the results demonstrated a significant positive impact of STS on CUS of ChatGPT, indicating that students who experienced higher satisfaction with the tool were more likely to continue using it. However, no significant relationship was found between PU and STS of ChatGPT. This finding contradicted some previous studies that found a positive relationship between PU and STS of various information systems. This finding may be explained by other factors that influence student satisfaction, such as hedonic motivation, price value, habit, facilitating conditions, trust, reliability, and quality.

This study's findings provide meaningful insights and implications for educators, researchers, and developers who are implementing ChatGPT as a tool for educational activities. The study suggests that effectively managing and improving students' expectation confirmation, perceived usefulness, and satisfaction with ChatGPT is crucial for promoting its continuous usage. The study advocates for exploring additional factors that may influence students' perceptions and behaviors towards ChatGPT, aiming to gain a deeper understanding of both its potential and challenges in education. The study contributes to the literature on the application of ChatGPT in education, as well as the application of the ECM in the educational context. It demonstrates how customizing ChatGPT to meet Vietnamese students' educational and cultural needs can elevate learning. By understanding the specific ways in which ChatGPT can enhance learning outcomes, educators can integrate this technology into their curriculum and tailor their pedagogical strategies to foster more personalized and engaging learning experiences. Moreover, integrating ChatGPT in teaching strategies can enhance critical thinking, creativity, and digital literacy, meeting 21st-century educational standards. Equally important, investigating ChatGPT's use in various learning models can also enrich curriculums and foster cross-disciplinary learning, aligning with Vietnam's increasing digital literacy and demand for innovative educational tools, thereby advancing educational quality and societal technological progress.

This study has some limitations. These include the use of non-probability convenience sampling, reliance on self-reported data, and a lack of qualitative data, introducing potential biases that could be mitigated in future research. To address these concerns, future studies should consider employing stratified random sampling to ensure a more representative cross-section of the population. This approach can help minimize selection bias and enhance the external validity of the findings. Furthermore, triangulation of data sources, including interviews, observations, and secondary data, can provide a more robust understanding of the phenomena under study and reduce the reliance on self-reported data, which is often subject to social desirability bias. In terms of data collection methods, implementing longitudinal designs could offer valuable insights into the long-term effects of ChatGPT on education. Such designs allow for the observation of changes over time and can help establish causality. Finally, it is crucial to integrate qualitative methods to gain deeper insights into the subjective experiences of students using ChatGPT. Qualitative data, collected through methods such as focus groups or open-ended survey questions, can complement quantitative findings and provide a more comprehensive view of the impact of ChatGPT on critical thinking skills and other cognitive

outcomes. By incorporating these specific strategies and methodologies, future research can overcome the limitations of the current study and contribute more effectively to the field of educational technology.

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