



Research article

Understanding learners' perceptions of ChatGPT: A thematic analysis of peer interviews among undergraduates and postgraduates in China

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ABSTRACT

ChatGPT, an artificial intelligence (AI)-driven language model engineered by OpenAI, has experienced a substantial upsurge in adoption within higher education due to its versatile applications and sophisticated capabilities. Although prevailing research on ChatGPT has predominantly concentrated on its technological aspects and pedagogical ramifications, a comprehensive understanding of students' perceptions and experiences regarding ChatGPT remains elusive. To address this gap, this study employed a peer interview methodology, conducting a thematic analysis of 106 first-year undergraduates and 81 first-year postgraduate students' perceptions from diverse disciplines at a comprehensive university in East China. The data analysis revealed that among the four factors examined—grade, age, gender, and major—grade emerged as the most influential determinant, followed by age and major. Postgraduate students demonstrated heightened awareness of the potential limitations of ChatGPT in addressing academic challenges and exhibited greater concern for security issues associated with its application. This research offers essential insights into students' perceptions and experiences with ChatGPT, emphasizing the importance of recognizing potential limitations and ethical concerns associated with ChatGPT usage. Additionally, the findings highlight ethical concerns, as students noted the importance of responsible data handling and academic integrity in ChatGPT usage, underscoring the need for ethical guidance in AI utilization. Moreover, further research is essential to optimize AI use in education, aiming to improve learning outcomes effectively.

1. Introduction

ChatGPT, an advanced AI-driven language model created by OpenAI, has made significant strides in various sectors, demonstrating its versatility and efficacy in healthcare [1], finance [2], and entertainment [3]. In the educational sector, however, its reception has been mixed, marked by both enthusiasm and apprehension. Educators have generally shown a positive attitude toward integrating Information and Communication Technology (ICT) in their teaching, recognizing benefits such as improved information access,

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enhanced communication, and increased student engagement [4–7,81]. ChatGPT, in particular, has been utilized in higher education for diverse purposes, including assignment feedback, collaborative learning facilitation, and personalized learning experiences [8–10]. Research conducted by Soc and Heng [82] identified five primary advantages of using ChatGPT. These include the development of learning assessments, the improvement of teaching methods, the provision of individual virtual tutoring, assistance in outlining essays or research papers, and the facilitation of idea generation.

In contrast, prior research has shown that educators have expressed reservations and concerns regarding the adoption of ChatGPT [11,83]. These risks mainly involved academic integrity issues [12], unfair learning assessment [13,14], inaccurate information [15, 16], and overreliance on AI [14,17,18]. For instance, numerous cases of cheating and misconduct have been widely reported in the media [19,20]. As a result of these growing concerns surrounding the responsible use and potential misuse of ChatGPT, educational institutions have implemented prohibitions on the use of this relatively new chatbot [21].

However, the growing interest and potential for widespread student adoption of ChatGPT highlight the importance of understanding learner perceptions, which are crucial in determining the tool's effectiveness and integration into educational processes [22]. The collection of studies on ChatGPT's role in education presents varied perspectives. Firat's [23] research, encompassing views from scholars and students in four countries, highlighted themes such as the evolution of educational systems and the need for research on AI's ethical implications. Shoufan [24] revealed through a two-stage study with computer engineering students both an admiration for ChatGPT's capabilities and concerns about its accuracy and integrity, suggesting areas for educator guidance and model improvement. Bonsu and Baffour-Koduah [25] investigated Ghanaian students' attitudes towards ChatGPT, finding positive perceptions and usage intentions, although there was no direct correlation between these factors. Finally, Ngo [84] focused on university students' perceptions of ChatGPT, shedding light on its potential integration into educational processes. These studies collectively enrich the understanding of ChatGPT's impact in diverse educational contexts.

The review of the literature reveals a significant gap in research on ChatGPT, particularly regarding the in-depth analysis of factors that influence learners' perceptions at different academic levels. While the existing studies provide valuable insights into general attitudes towards ChatGPT and its potential applications in education, there is a lack of comprehensive research exploring how perceptions of ChatGPT vary among students in different stages of their academic journey and across various fields of study. Additionally, the impact of cultural and contextual factors on students' perceptions of ChatGPT remains an area underexplored. Addressing these gaps could lead to a more nuanced understanding of how ChatGPT is perceived and used across diverse student populations and educational settings.

This study aims to address these gaps by exploring the perceptions and experiences of undergraduate and postgraduate students in China regarding ChatGPT. It seeks to provide a deeper understanding of how students perceive and utilize ChatGPT in their daily academic and personal activities, contributing to the broader discourse on AI integration in higher education. The research questions guiding this study are as follows.

Question 1: What are the different perceptions of ChatGPT among undergraduates and postgraduates?

Question 2: How do gender and discipline impact the perceptions of ChatGPT among undergraduates and postgraduates?

2. Understanding of ChatGPT

In recent years, AI technology has gained substantial prominence as a result of extensive research and development efforts. One notable application of AI is the AI chatbot, which utilizes complex deep-learning algorithms trained on large datasets to generate responses similar to those of humans [26]. In November 2022, OpenAI unveiled ChatGPT, a natural language processing model consisting of 175 billion parameters [27]. ChatGPT is considered one of the most powerful NLP systems, given its massive number of parameters, making it one of the largest language models available [11]. As such, ChatGPT occupies a significant position in the current technological landscape.

ChatGPT exhibits numerous distinctive attributes and advantages that have attracted interest across diverse domains. One of its principal strengths resides in its capacity to generate human-like, coherent, and contextually pertinent responses to user queries [27]. Another characteristic of ChatGPT, which has enchanted millions of users in a brief span, pertains to its proficiency in delivering accurate responses to user inquiries in real-time [15]. Furthermore, ChatGPT demonstrates the ability to produce high-quality, error-free text that is arduous to discern from human-authored content [28]. The content generated by ChatGPT is notably personalized and original, as it relies on the input furnished by users and the specific context provided [29].

Despite the numerous advantages of ChatGPT, it is crucial to acknowledge the limitations associated with this AI technology. A significant concern pertains to the occasional production of erroneous or misleading information by ChatGPT, which can potentially propagate errors or inaccuracies present in its training data [27,30]. Moreover, ChatGPT's outputs may reflect biases inherent in the training data, leading to discrimination based on factors such as gender or race, thereby raising ethical concerns [31]. Efforts are underway to mitigate these biases and enhance the fairness of AI language models such as ChatGPT [32]. Additionally, the high-quality human-like text generated by ChatGPT has raised concerns regarding its potential misuse for fabricating disinformation or deepfake text, which could have serious consequences in various fields such as journalism, politics, and social media [33]. Finally, while ChatGPT's natural language understanding capabilities have significantly improved, there are still instances where it may not fully comprehend the context or nuances of user queries, leading to less relevant or accurate responses [28].

3. Application and perception of ChatGPT in higher education

ChatGPT offers an array of opportunities in education. Educators can harness ChatGPT to generate various content types, such as

course outlines, presentations, codes, quizzes, grading rubrics, and scholarly papers. Conversely, students can employ it for assistance in addressing questions, composing essays, and obtaining formative feedback on their work [34,35]. According to Rudolph et al. [36], students can benefit from hands-on learning experiences, as ChatGPT is adept at creating diverse problem-solving situations. Furthermore, ChatGPT can furnish individualized tutoring for students. Notably, ChatGPT presents numerous significant advantages to learners.

The use of AI-assisted grading presents a promising potential for educators to reduce their workload and increase the time allocated for lesson planning. GPT-3, for instance, offers the possibility of creating personalized exams or quizzes that cater to individual students' needs and abilities [8,37]. In addition, GPT-3 has demonstrated its capability to produce various types of written content, including articles [38] and stories [39], with text quality that is challenging to distinguish from human-authored pieces [40]. This could be particularly advantageous in language-focused or critical thinking courses, as GPT-3 can generate questions that align with each student's proficiency level and challenge them to showcase their knowledge and skills [41].

Firaina & Sulisworos' [85] study revealed that ChatGPT proved helpful in assisting users in locating information and ideas, translating text, and providing supplementary questions to enhance their understanding of a topic. Nevertheless, it remains imperative to cross-check and validate the information supplied by ChatGPT against more reliable and accurate sources.

Talan & Kalinkara, Y [42]. compared the performance of ChatGPT in an anatomy course with that of undergraduate students. The results indicated that ChatGPT was capable of producing accurate responses within seconds; however, it faced limitations in interpreting visual aids such as diagrams, shapes, and tables. Moreover, if a question is ambiguous or incomprehensible, ChatGPT may generate an incorrect response. To address this issue, it is advisable to rephrase the question in a clear and concise manner.

Qadir [15] highlighted that ChatGPT offers the potential for personalized and effective learning by providing students with tailored feedback, explanations, and realistic virtual simulations. However, it is crucial to consider its limitations, as generative AI systems rely on their training data, which may perpetuate biases or disseminate misinformation. The use of generative AI in education also raises ethical concerns, such as the potential for dishonest usage by students and job displacement due to technological advancements. While the current state of generative AI, exemplified by ChatGPT, is both impressive and imperfect, it serves as a preview of future developments in the field.

4. Learners' perceptions of chatbots in higher education

The literature on chatbots in higher education encompasses several key themes pertinent to understanding learners' perceptions of ChatGPT. These themes include student satisfaction and perceived usefulness, the impact on learning outcomes, engagement and motivation, barriers to adoption and usability concerns, and acceptance and adoption of chatbots in higher education.

Studies emphasize the significance of student satisfaction and perceived usefulness in shaping learners' perceptions of chatbots. Winkler and Söllner [86] revealed that students generally held positive views of chatbots when they provided relevant, accurate information and were user-friendly. This indicates that ChatGPT's efficacy in delivering accurate information and ease of use may be crucial for fostering positive student experiences.

Moreover, research has investigated the effect of chatbots on student learning outcomes, such as knowledge retention and comprehension. Abbasi et al. [87] and Deng & Yu [43] found that students interacting with a chatbot in the university exhibited improved learning outcomes. This suggests that ChatGPT might enhance learning outcomes among undergraduate and postgraduate students in China.

Another aspect of interest in the literature is chatbots' potential to foster student engagement and motivation. Følstad et al. [44] discovered that chatbots could encourage engagement by providing personalized feedback and support, as well as promoting social presence in online learning environments. This theme may be particularly relevant to the current study, as ChatGPT may also facilitate engagement and motivation in higher education settings.

Researchers have also examined the barriers to chatbot adoption and usability concerns in higher education. Følstad et al. [44] identified issues such as limited chatbot functionality, privacy concerns, and a lack of personalization as potential barriers to adoption. These findings imply that addressing such barriers in the development and implementation of ChatGPT may be vital for its successful adoption in higher education.

Lastly, research has centered on understanding factors influencing students' acceptance and adoption of chatbots in higher education. Dwivedi et al. [88] determined that perceived usefulness, ease of use, and social influence were significant factors affecting students' intentions to use chatbots. These factors may also be relevant to learners' perceptions of ChatGPT and should be considered in the context of the current study.

As can be seen from the literature review, the existing research provides valuable insights into the application and perceptions of ChatGPT in higher education. However, there is a need for further investigation to explore the long-term effects of integrating ChatGPT into the learning process and develop strategies to mitigate the identified limitations and ethical concerns. Additionally, the prevailing literature predominantly concentrates on the applications and constraints of the technology, with a minimal exploration of learners' conceptualizations of ChatGPT. Delving into learners' perceptions and experiences with ChatGPT can yield crucial insights into potential challenges, advantages, and avenues for enhancement.

5. Theoretical framework

The Technology Acceptance Model (TAM), initially formulated by Davis in 1989, builds on [45] Theory of Reasoned Action (TRA). TAM, a prominent model in information systems research, suggests that an individual's use of information systems is mainly influenced

by two variables: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), with the latter also impacting the former. This model extends TRA's principle that behavior is a result of behavioral intentions, which are in turn influenced by attitudes and subjective norms.

TAM has been widely recognized for its succinct yet effective approach to understanding technology adoption, as evidenced by its application in numerous studies. It has been used to evaluate user acceptance across various technologies, including word processors [46], email [47], and diverse contexts, reflecting its robustness and relevance in the field. Notably, foundational TAM research by Davis [48] and Davis et al. [46] had garnered significant citations by the early 2000s, as pointed out by Lucas and Spitler [49] and Venkatesh and Davis [50].

In TAM, perceived usefulness refers to the belief in the technology's ability to improve work performance, and perceived ease of use indicates the degree of effortlessness associated with using the technology. These factors collectively influence the user's attitude towards technology use and their intention to use it.

Using the Technology Acceptance Model (TAM), this study delves into undergraduates' and postgraduates' perceptions of ChatGPT, guided by specific interview questions. The study assesses Perceived Usefulness by exploring their motivations for using ChatGPT, its effectiveness in solving daily problems, and the benefits they derive, such as its accuracy and reliability. Additionally, it evaluates Perceived Ease of Use by examining their experiences with ChatGPT's user interface, the reliability of its responses, and any challenges faced. Questions about privacy and security provide insights into their comfort level with ChatGPT and desired improvements.

6. Method

This study employed the peer interview method, which is a qualitative research approach that utilizes peer-to-peer interactions to explore participants' experiences, perceptions, and understandings of a specific phenomenon. By engaging participants in a semi-structured, in-depth dialogue, this method creates an environment of trust and openness, enabling more profound and nuanced insights into the research topic [51]. In a peer interview, participants serve as both interviewer and interviewee, allowing for a multidimensional exploration of the subject matter [52]. This approach is particularly advantageous in higher education research, as it empowers participants to directly engage with their peers, leading to a better understanding of their shared experiences with new technologies or educational practices [53].

The peer interview method typically utilizes a semi-structured interview guide, consisting of open-ended questions that facilitate the exploration of various aspects of the phenomenon under study [54]. Researchers may offer guidance and training to participants in conducting interviews, ensuring they are equipped to elicit comprehensive and meaningful data from their peers [55]. Upon completion of the interviews, researchers analyze the collected data using thematic analysis or other qualitative data analysis techniques to uncover emergent themes and patterns that illuminate the participants' perceptions and experiences [56].

In this study, the researchers, who also served as English teachers for the undergraduate and postgraduate participants, employed a peer interview methodology. Prior to the peer interviews, the researchers provided comprehensive training to the participants to ensure their ability to effectively elicit meaningful data from their peers. This training encompassed addressing common challenges and offering strategies to overcome them, as well as providing illustrative examples.

A semi-structured interview guide, comprising open-ended questions related to ChatGPT, was distributed and comprehensively explained to all participants. The participants were then allowed to form pairs autonomously. During the interview process, each session was audio-recorded, and the interviewers were instructed to take detailed notes. Upon completion of each interview, the participants switched roles.

Following the interviews, the audio recordings were transcribed, and all interviewees were asked to review the transcripts to ensure the accuracy of the information. Subsequently, the researchers conducted a thematic analysis of the collected data to uncover emergent patterns and insights pertaining to the participants' experiences with ChatGPT.

6.1. Sample and sampling

The study employed convenience sampling, based on its feasibility and cost-effectiveness [57]. As the participants were students of the researchers, this sampling method allowed for easy access and communication, thus ensuring a more efficient data collection process [58]. Furthermore, convenience sampling is well-suited for exploratory research [57], which aligns with the aim of this study: to explore learners' perceptions of ChatGPT in higher education. Although convenience sampling may limit the generalizability of findings, it can still provide valuable insights into the target population [59].

The study's sample comprised 81 postgraduate students and 106 undergraduate students from various disciplines at a

Table 1
Basic information of Informants.

Students	Number	Average age	Gender		Major	
			female	male	Humanities	Natural Science
undergraduate	106	19.52	52	54	60	46
postgraduate	81	23.56	53	28	41	40

comprehensive university in East China. All participants had used ChatGPT for a period of at least one month before the study.

The variation in age among students of different grades is illustrated in Table 1. The sample, consisting of 187 participants, includes undergraduate and postgraduate students. The youngest undergraduate student is 18 years old, while the youngest postgraduate student is 22 years old. The oldest undergraduate student is 24 years old, and the oldest postgraduate student, a postdoctoral candidate, is 35 years old. The mean age for both undergraduate and postgraduate students is 21.27 years.

As depicted in Fig. 1, the age distribution follows a normal pattern. The majority of undergraduate students are 19 years old, while the largest proportion of postgraduate students are 23 years old.

This study was conducted in compliance with the ethical guidelines and standards set forth by the Academic Board of the School of Foreign Studies at Wenzhou University. Before the initiation of the research, the study received approval from the Institution Review Board of the School of Foreign Studies at Wenzhou University (Approval Number IRB20230201), ensuring that the research design and methodology adhered to the principles of ethical research practices.

To safeguard participants' privacy and confidentiality, all personal information, including names and other identifying details, was anonymized during the data collection and analysis process. Participation in the study was entirely voluntary, and participants were informed about the research objectives, procedures, and potential benefits and risks. Additionally, participants were assured that they could withdraw from the study at any point without facing any adverse consequences.

6.2. Instrument

The instrument used in this study was a questionnaire comprised of 10 open-ended questions designed to explore students' perceptions and experiences with ChatGPT. The selection of the 10 questions was deeply informed by the Technology Acceptance Model (TAM), focusing on ChatGPT's Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) from the student's perspective. Initial questions about how students discovered ChatGPT and the problems it helps them solve assess PU, revealing the tool's relevance and practical benefits in their academic life. Questions on the benefits gained and the reliability of responses explore both PU (effectiveness and content accuracy) and PEOU (ease of obtaining reliable information). The questionnaire also probes into privacy and security concerns, key elements of PEOU, as these factors significantly influence the ease and willingness to adopt new technologies. Feedback on desired improvements provides insights into enhancing both PU and PEOU, reflecting students' expectations and needs. The final set of questions, covering ChatGPT's role, misconceptions, its distinctiveness compared to similar tools, and its potential future impact, collectively assesses how students perceive the tool's usefulness and ease of use in a broader educational and societal context (see Appendix 1).

To ensure the validity and reliability of the questionnaire, several steps were taken during its development and implementation. First, an extensive review of the literature on AI in education was conducted to identify the most pertinent themes and aspects related to students' experiences with ChatGPT. This provided a solid foundation for the development of relevant and focused questions.

Next, the questionnaire was subjected to a pilot study involving a small sample of students who were representative of the target population. Feedback from the pilot study was used to refine the questionnaire, making adjustments to the phrasing, order, and clarity of the questions. This iterative process ensured that the final questionnaire had both face validity and content validity.

6.3. Data analysis

In this study, thematic analysis was utilized to scrutinize the peer interview data. This prevalent qualitative research method enabled the researchers to identify, analyze, and report themes present within the data [56]. The process entailed familiarization with the data, coding salient and relevant phrases or sentences, searching for overarching themes, reviewing and refining these themes, and ultimately defining and naming them. The findings were subsequently reported in a clear and concise manner, with direct quotes from the interview data to support the researchers' interpretations and offer a more profound understanding of learners' perceptions of ChatGPT in higher education.

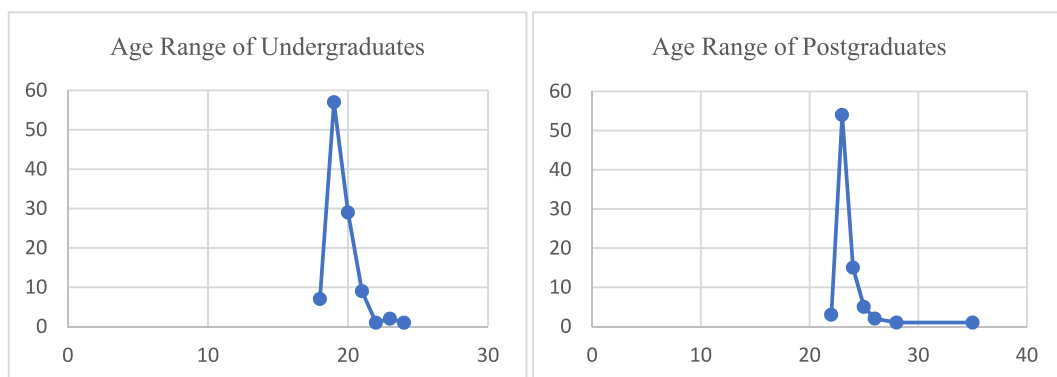


Fig. 1. Comparison of age range between undergraduates and postgraduates.

7. Results

Question 1: What are the different perceptions of ChatGPT among undergraduates and postgraduates?.

Undergraduate and postgraduate students reported discovering ChatGPT through various online platforms, such as Bilibili, WeChat groups, blogs, as well as through offline sources, predominantly from teachers or friends. A total of six primary themes and thirteen subthemes were identified concerning the conceptions of ChatGPT among undergraduate and postgraduate students (see Table 2 below).

Both groups of participants tended to have distinctively opposite opinions on themes like way to know, practical use, reliability, safety, and attitudes as shown in Fig. 2.

Fig. 2 indicates a noticeable difference in perceptions between undergraduates and postgraduates. Undergraduates demonstrated a wider range of opinions regarding their ways of knowing ChatGPT, while postgraduates showed greater diversity in their views on the reliability of ChatGPT. In terms of other themes, both student groups exhibited similar levels of varied perspectives. Detailed insights into these differences are explored in the subsequent sections, focusing on aspects such as the approaches to understanding ChatGPT, its practical application, reliability, safety concerns, potential enhancements, its role in daily life, and overall attitudes.

8. Way to know

Students acquired knowledge about ChatGPT through two distinct channels: online and offline. Frequently, teachers of specific courses or disciplines served as the primary offline sources for introducing ChatGPT. Additionally, both in-class and out-of-class interactions with classmates or friends were reported as effective means for learning about ChatGPT.

“I came to know ChatGPT from my tutor. My tutor views ChatGPT as intelligent and bright, which can play a significant role in helping to bring ideas and spark inspirations in project research.” (S-Wu)

Various online platforms were utilized for discovering ChatGPT, including Bilibili, blogger, TikTok, and others. These digital channels facilitated the dissemination of information about ChatGPT among students.

“I know it through open social media.” (S-Zhou) “I learned about it from uploaders’ recommendation on TikTok or Bilibili.” (S-Yang & Guo)

9. Practical use

Students reported that ChatGPT played a supportive role in their academic pursuits by providing suggestions, offering clues, and guiding their writing, among other functions. They emphasized the practical utility of ChatGPT in facilitating their studies and research activities.

“I first used it to assist me in writing my final paper on dialectical materialism, and all of my questions could be answered on ChatGPT.” (S-Huang) “It can supplement what’s learned in class, and it can help me further my understanding or dispel my misunderstanding with abundant examples.” (S-Chu) “The reason why I used it is that it is convenient and intelligent, especially in searching related references.” (S-Chen)

Some students expressed curiosity about ChatGPT and questioned whether it lived up to its recommendations or how it functioned. Some claimed they were using ChatGPT to pass the time or merely for entertainment purposes. In this regard, the primary motivation for students to use ChatGPT seemed to stem from curiosity. They aimed to gain a deeper understanding of ChatGPT and its capabilities.

Table 2
Themes and sub-themes extracted from the opinions of the participants.

Themes	Subthemes	definition
Way to know	Learning online	Students learn about ChatGPT from websites or online channels
	Learning offline	Students get to know ChatGPT from in-class or off-class interactions with teachers, classmates, or friends
Practical use	Using in study or research	Students find it helpful to offer them clues or suggestions in writing
	Using it out of curiosity	Students want to find out what is ChatGPT or find it interesting or funny
reliability	offering reliable answers most of the time	Students find ChatGPT is competent
	giving incorrect answers sometimes	Students find ChatGPT unable to answer correctly or fabricate answers
safety	Being possible to leak privacy	Students believe it is necessary to take some precautions when using ChatGPT
	Further improvement	Students find it inconvenient to use only texting
Role in life	Being a helper	Students hope ChatGPT offers aid like a teacher, a friend or a housekeeper
	Being a tool	Students find it similar to intelligent tools like Xiaodu,
attitude	Being positive	Students have a strong belief in new technology
	Being negative	Students are concerned about its threats to future employment
	Being neutral	Students are objective when confronting new products



Fig. 2. Graduates and postgraduates' divided opinions on themes.

"After learning about ChatGPT on a short video platform where people chat with computers as friends, I was interested and wanted to know more about it, which made me start using it."(S-Zhu)

10. Reliability

It was widely acknowledged among students that ChatGPT was quick to respond and efficient in providing related information. However, postgraduate students noted that its reliability was conditional, suggesting that the accuracy and relevance of the information generated by ChatGPT might vary depending on the context or complexity of the query.

"ChatGPT's accuracy depends on the quality and complexity of input. It's continuously improved by developers."(S-Zhang) "I think the answer is reliable but inaccurate. It will give me different answers for the same question."

Furthermore, students observed that ChatGPT might be more prone to errors when dealing with different languages, particularly Chinese. This finding underscores the importance of considering language-specific challenges and potential limitations when evaluating the performance of ChatGPT across various linguistic contexts.

"To me, it was much more reliable, but I read online that it would err when confronting questions about entertainment gossip, and make more mistakes in answering Chinese questions." (S-Fu) "It may not be reliable. For example, when I need it to write a Chinese poem in which the first words of each line are connected together to form an independent meaning, it cannot provide accurate answers. I don't think it has a good grasp of localization information, and I am skeptical about whether it's updated in a timely manner." (S-Chen-2)

Both undergraduate and postgraduate students conveyed confidence in ChatGPT's accuracy in most instances; however, they also expressed reservations about its overall reliability. This finding highlights the need for users to approach ChatGPT's output cautiously and cross-verify the information it provides to ensure its correctness and dependability.

11. Safety

Students expressed concerns about the potential for personal information to be leaked during interactions with ChatGPT, given its ability to remember personal preferences and habits and its reliance on massive online data.

"I think the level of privacy and security provided by ChatGPT is very important because people may include some of their own personal information or academic content in the process of asking questions." (S-Rong) "The security of personal information is not guaranteed, and it is easy to leak." (S-Yang)

Hence, they suggested several precautionary measures: 1) refraining from revealing personal information or sharing less information during conversations; 2) deleting conversation content after use; 3) using coded language to discuss private matters.

12. Further improvement

Students expressed their desire for more advanced features in future versions of ChatGPT, including automatic speech recognition, video calls, image recognition, voice playback, and other functions to enhance the chatbot's conversation experience.

"Currently, ChatGPT is only limited to the subtitle conversation feature. It is hoped that it can add a voice feature to free up our hands, and in terms of language learning, it may be a good learning companion to help us speak the authentic language, like an authentic foreign language teacher. It can also add some picture or video features, compared to silent text, which may be better for us to understand and learn, internalize and make it our own." (S-Xiao) "First of all, increase its mail assistance capability to help save time. Secondly, increase the translation ability, which can carry out real-time translation and help the efficiency of human learning and work. Finally, increase the conversion ability, that is, people ask questions in Chinese, and it answers in English." (S-Liu) "allows users to set access preferences, add some more personalized modules, and become a customized answer platform. Insert more easy-to-understand images and tables in the answers to add richness to your answers." (S-Zhu)

Undergraduates of various majors expressed their specific needs for ChatGPT. For instance, English majors desired language conversion functions, mechanics majors requested AI drawing functions, and music majors called for song composing functions. Both undergraduate and postgraduate students hoped for ChatGPT to be more user-friendly, with the addition of functions such as vocal conversation (76 items), image recognition (39 items), or video screen (8 items), and to be customized (28 items), such as functions of housekeepers, storytellers, or advisors.

13. Role in life

The findings of the study indicate that undergraduate and postgraduate students generally viewed ChatGPT as a useful and innovative technology that could assist them in their academic pursuits. As digital natives, they were comfortable with using technology in their daily lives and saw ChatGPT as a tool to improve their learning outcomes. Furthermore, they regarded ChatGPT as a friendly and knowledgeable virtual companion that they could interact with and learn from. These perceptions suggest that ChatGPT holds significant potential for enhancing the educational experiences of students in higher education.

"I mainly use ChatGPT to help me with homework and studying. It's a great tool for answering quick questions or getting a better understanding of a particular topic." (S-Wu) "I think it acts as a tool for learning as well as a pal to have a chat or play together in the leisure time." (S-Luo) "I envision it can be a virtual person that can accompany with people who feel lonely in the future. In my daily life, it will be a problem-solver who gives the ideas to help me handle problems I am confronted with." (S-Zhou)

In contrast, postgraduate students placed a greater emphasis on the instructional and supportive role that ChatGPT could play, and expressed a desire for an assistant or aid to help them achieve success in their academic pursuits.

14. Attitudes

It is worth noting that students' attitudes toward ChatGPT were generally positive or neutral, indicating a high level of acceptance and openness toward new technology among the current generation of technology-savvy students.

"I hope it can enter into the Chinese market." (S-Li) "I believe that the emergence of ChatGPT may replace some of the mechanical and repetitive jobs in society, resulting in a large number of workers being laid off, which will have a significant impact on human employment. However, I am optimistic about the popularity of ChatGPT because of its vast knowledge base that even decades of human learning cannot match. Instead of worrying about it replacing humans, we should use its knowledge to our advantage, as it was created by humans and how we use it depends on us." (S-Xiao)

Students demonstrated a nuanced understanding of the emergence and development of ChatGPT, recognizing that the responsibility for any negative outcomes lies not with the technology itself but with its users.

"Generally speaking, it is beneficial to have ChatGPT. Technology is not good or bad technology itself, but the technology users matter." (S-Xiong)

Relatively, students of higher education had an objective view of the phenomenon and were capable of treating it rationally.

Question 2: How do gender and discipline impact the perceptions of ChatGPT among undergraduates and postgraduates?

The interview content was analyzed and categorized based on the participant's grade, age, gender, and major. The aim was to investigate the impact of these factors on the participants' perceptions of ChatGPT in terms of their ways of acquiring knowledge, practical use, reliability, safety, and attitude. The participants tended to express binary views on these five aspects. The sample consisted of 53 female postgraduates and 52 female undergraduates, with 18 postgraduates majoring in Humanities, 34 in Natural Science, and 45 undergraduates majoring in Humanities and seven in Natural Science. Thematic analysis was used to analyze the interview data, and SPSS was utilized to examine to what extent factors such as grade, age, gender, and major influenced the participants' perceptions of ChatGPT.

According to the results presented in Table 3, it is evident that gender did not have a significant impact on the way undergraduate and postgraduate students learned about ChatGPT, their perceptions of its reliability and safety, or their attitudes towards its

development, as the significance values were all above 0.05. However, among the remaining three factors (grade, age, and major), the significance values of grades were below 0.05 regarding how students learned about ChatGPT, its perceived reliability, concerns about privacy, and their outlook on its future. This indicates that students of different grades held different views on these aspects. Additionally, students' majors were also a factor in shaping their perceptions of ChatGPT's reliability.

15. Discussion

Among the four factors examined in this study, the grade had the greatest impact on students' perceptions of ChatGPT, followed by age and major. Gender had the least influence on their views. The minimal gender differences observed in the study can be contextualized within the nuanced discourse on gender and technology use [60], suggesting subtle influences of gender on technology perception. Specifically, postgraduate students differed from undergraduate students in their perceptions of ChatGPT's reliability. A significant proportion (70.37%) of postgraduates held a negative view of ChatGPT's reliability in responding to their questions, with only 8.64% considering it reliable most of the time.

On the issue of ChatGPT's reliability, there was a clear divide among undergraduates, with only 39.62% considering its responses to be unreliable. This group primarily asked questions related to daily life, such as national or ethical cultural knowledge, entertainment gossip, and history. By contrast, postgraduates tended to be more cautious about ChatGPT's ability to solve academic problems, which was consistent with Van der Westhuizen et al.' (2011) finding that research ability was the most predictive dimension of academic research performance among postgraduates.

The distinction in perceptions of ChatGPT between undergraduates and postgraduates aligns with developmental stage theory, suggesting that cognitive maturity shapes technological interactions. Postgraduates' skepticism about ChatGPT's reliability and their concerns about its academic utility can be interpreted through the lens of Perceived Usefulness. Postgraduates, engaged in more complex and specialized academic work, have higher expectations for the reliability and accuracy of information provided by AI tools like ChatGPT. This expectation is rooted in their advanced academic needs and the critical analytical skills developed through their education. Their perception of ChatGPT's reliability reflects a sophisticated understanding of the tool's capabilities and limitations in meeting specific academic requirements. This echoes Mohammed et al.'s (2023) emphasis on research competence in postgraduate performance, reflecting concerns about AI's limitations in providing accurate, specialized content.

Undergraduates, in contrast, are typically in the earlier stages of their academic careers, where the focus is more on foundational knowledge and general skill development. Their positive perception of ChatGPT aligns with their educational needs, which include accessible information and user-friendly interfaces that facilitate learning [61]. Their interaction with technology is often guided by ease of use, making them more receptive to AI tools that offer a straightforward user experience [62]. Their comfort with digital technologies, as described by Prensky [63] and supported by Yan [64], suggests a readiness to embrace AI tools due to their user-friendly and accessible nature. This demographic's less critical approach and broader range of competencies, including digital literacy as indicated by Tsai et al. [65], point towards a general acceptance of technology influenced by ease of use rather than an in-depth evaluation of its utility.

Furthermore, exposure to and familiarity with technology also play crucial roles in shaping perceptions. Undergraduates, who have grown up in a more digitally integrated environment, may be more accustomed to using technology for various purposes, including education. This familiarity could translate into a more accepting attitude towards AI tools [66]. In contrast, postgraduates might evaluate these tools through the lens of their specific academic and research needs, leading to a more critical assessment of technology's role in their educational pursuits [67].

Meanwhile, undergraduate students were thought to possess a broader range of competencies, such as communication, leadership, accuracy, autonomy, planning and organization, information technology, reflective capacity, teamwork, creativity, and initiative. Tsai et al. [65] indicated that with the development of science and technology, college students have gained more experience in internet use and have become more knowledgeable about online safety precautions. As for safety concerns related to ChatGPT, three out of four postgraduate students were concerned about personal privacy, while one out of two undergraduate students cared about the safety of using ChatGPT. This difference could be attributed to the varying levels of awareness and experience with online platforms between the two groups [68–80,89]. Undergraduate students, typically younger and more integrated into digital environments, may have a comfortable familiarity with online tools but a less developed understanding of online privacy and security. Postgraduate students, with more professional or academic experience, are often more aware of online risks, including data privacy concerns. This heightened

Table 3

Correlations between factors.

		grade	age	gender	major	way to know	Practical use	reliability	safety	attitude
grade	Pearson	1	-.841	.164	-.060	.161	-.014	-.348	-.149	-.275
	Sig.(two-tailed)		.000	.025	.418	.027	.847	.000	.042	.000
age	Pearson	-.841	1	-.197	-.016	-.106	-.021	.239	.125	.233
	Sig.(two-tailed)	.000		.007	.832	.151	.775	.001	.088	.001
gender	Pearson	.164	-.197	1	.482	.002	.022	.056	-.100	-.060
	Sig.(two-tailed)	.025	.007		.000	.974	.765	.447	.172	.411
major	Pearson	-.060	-.016	.482	1	.097	.036	.204	-.063	-.094
	Sig.(two-tailed)	.418	.832	.000		.189	.624	.005	.395	.203

a. N = 187.

awareness influences their cautious approach toward new technologies like ChatGPT, particularly regarding personal information security. This variation in digital literacy and security awareness is crucial for tailoring technology use and education to different student groups.

Utilizing the insights from the Technology Acceptance Model, the study sheds light on the distinct ways undergraduate and postgraduate students perceive ChatGPT. It finds that perceptions are shaped not only by the functionality and ease of using the technology but also by the students' stage of academic development, familiarity with digital tools, and nuanced gender-related factors. This approach subtly draws upon the core principles of TAM, revealing how both utility and usability influence students' acceptance and use of ChatGPT and how these perceptions are further influenced by their educational and digital backgrounds.

16. Conclusion and future research

This study explored the different perceptions of ChatGPT among undergraduate and postgraduate students in terms of the way to know, practical use, reliability, safety, and attitude. Thematic analysis was employed to examine the peer interview data, and SPSS was used to analyze the impact of factors like grade, age, gender, and major on their perceptions of ChatGPT. The findings showed that students learned about ChatGPT from both online and offline sources, with teachers and friends being the primary sources. While both undergraduates and postgraduates found ChatGPT to be practical, they also had concerns about its reliability and safety, especially regarding the potential for personal information leakage.

The findings indicate that both undergraduates and postgraduates recognize the practicality of ChatGPT but hold reservations about its reliability and safety, particularly concerning personal information security. Interestingly, perceptions of ChatGPT's reliability varied with academic level; postgraduates showed more skepticism about its efficacy in solving complex academic problems, while undergraduates displayed greater confidence in its reliability for everyday queries.

Furthermore, this study draws attention to the ethical considerations and limitations linked with ChatGPT's use in educational settings. The responsible and effective incorporation of AI tools in education is vital. However, it's essential to approach this integration with a balanced perspective, acknowledging both the potential benefits and the challenges. This study suggests the need for cautious integration of AI into educational curricula, considering ethical implications and potential limitations. Rather than advocating for outright restriction or embracing AI tools without scrutiny, a nuanced approach is recommended, one that aligns with educational objectives while being adaptable to the evolving nature of AI technology.

The study effectively captures diverse student perspectives on ChatGPT across academic levels using a comprehensive thematic and statistical analysis. However, it is important to note that these findings, while valuable, are context-specific and may not be universally applicable. The study focused on a specific demographic at a single institution, which limits the generalizability of the results. Additionally, its qualitative approach, while detailed, might not fully represent broader quantitative aspects, suggesting the need for further, more expansive research. Moreover, the rapidly evolving nature of AI technologies like ChatGPT means that perceptions and usage patterns can quickly change, necessitating ongoing research in this area.

The research findings have practical implications for educators, policymakers, and researchers in higher education AI integration. Educators can use these insights to adapt AI tools to students' academic levels, focusing on usability for undergraduates and content accuracy for postgraduates. Policymakers should consider policies supporting diverse technological needs, particularly regarding data privacy. For researchers, this study opens avenues for further exploration into the long-term impacts of AI in education, cross-cultural adoption differences, and ethical considerations.

Future research could focus on improving the responsible and effective implementation of AI in education. Further investigation is needed into ChatGPT's long-term impact on student learning experiences and outcomes, along with its applicability in various educational contexts and subjects. As AI technologies advance, continuous research and development are essential to ensure their ethical and beneficial use in educational settings.

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Data availability statement

The data is available within the manuscript.

CRedit authorship contribution statement

Xiaoshu Xu: Writing – review & editing, Writing – original draft, Project administration, Data curation, Conceptualization. **Yujie Su:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis. **Yunfeng Zhang:** Writing – review & editing, Supervision, Methodology. **Yunyang Wu:** Visualization, Validation, Resources. **Xinyu Xu:** Visualization, Software, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1

1. How did you learn about ChatGPT, and why did you decide to use it?
2. What problems do you primarily use ChatGPT to solve in your daily life?
3. How has ChatGPT helped you in your work or personal life, and what benefits have you gained from using it?
4. When using ChatGPT, do you find its responses reliable and accurate? What incorrect answers or issues have you encountered?
5. What are your opinions on the privacy and security levels provided by ChatGPT? What measures do you think should be taken to ensure the safety of user information?
6. Are there any additional features you would like ChatGPT to include to improve its usability or effectiveness?
7. What role do you think ChatGPT plays in your daily life?
8. What common misconceptions do people have about ChatGPT?
9. What do you think sets ChatGPT apart from other similar products or services available in the market?
10. What kind of impact do you think ChatGPT will have on the future of humanity? Are you optimistic and supportive of ChatGPT's widespread adoption, or are you filled with concerns?

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