

Ask ChatGPT first! Transforming learning experiences in the age of artificial intelligence

ABSTRACT

Chatbots have transformed educational practices, and ChatGPT represents a significant development in this domain. However, more research is needed to determine how user perceptions influence the overall user experience with ChatGPT. To address this gap, this study investigates the role of ChatGPT, a revolutionary artificial intelligence –(AI)-powered chatbot, in educational settings by investigating its impact on user experience from the perspective of students. It focuses on key perceptions, including human-like personality, human-like empathy, and ChatGPT efforts, and their influence on the user experience. It also explores how ChatGPT's efforts and usage depth affect user credibility, which in turn shapes the overall user experience. Data from 516 students who have used ChatGPT for academic assignments are collected through a questionnaire, and seemingly unrelated regression (SUR) is employed for analysis. The findings contribute to the literature on AI chatbots and user experience in three ways: by offering empirical insights into ChatGPT's role in education, by identifying key perceptions and their impact on user experience, and by capturing multiple dimensions of user experience for the design and implementation of ChatGPT as an educational tool. By shedding light on the interplay between user perceptions and user experience, this study provides valuable guidance for educators and developers aiming to optimize the use of ChatGPT in educational contexts and to ensure its effectiveness as a trustworthy and supportive learning tool.

KEYWORDS: ChatGPT; artificial intelligence; generative AI; user experience; credibility; academic assignments

1. Introduction

Over the last decade, there has been an unprecedented and exponential growth of technology and artificial intelligence (AI) in our society which is challenging current educational and working practices (Lincoln and Kearney 2019; Moscardini, Strachan, and Vlasova 2022). Within AI, generative AI has garnered considerable attention given the recent emergence of models such as ChatGPT (Bozkurt et al. 2023). Generative AI is a type of AI used to create new content (e.g. text, image, audio, or other forms of data) and a subset of unsupervised learning within machine learning techniques (Open AI 2016). Generative AI solutions have enormous potential, since they allow processes to be automated (Google Cloud 2023) and are increasingly prevalent within companies and in society more broadly. In addition to ChatGPT, a wide range of other generative AI tools have also emerged recently (e.g. Jasper, DALL·E 2, and Bing Chat) or have been integrated into existing platforms (e.g. Google Cloud) (Davenport and Mittal 2022; Google Cloud 2023).

In particular, ChatGPT is recognized as a pioneering technology, representing one facet of the broader spectrum of generative AI tools, and is the latest development in the

chatbot group (Dwivedi et al. 2023; Taecharungroj 2023). Chatbots powered by AI are radically altering the educational arena (Lee and Yeo 2022; Wang et al. 2023). They are intelligent virtual assistants developed using either rule-based or self-learning AI methods to simulate human conversations through audio and/or text (Hoyer et al. 2020; Ryan, French, and Kennedy 2021), and they stand out as a promising and disruptive tool for transforming the way students perceive their educational experience (Iku-Silan, Hwang, and Chen 2023; Ryan, French, and Kennedy 2021). Since its first release by OpenAI in November 2022, ChatGPT has woken up the world to the transformative potential of AI, capturing global attention and sparking a wave of creativity rarely seen before (Forbes 2023). As emphasized by Statista (2023), ChatGPT has already become increasingly popular, with more than 40% of adults in the United States being aware of the program. More specifically, according to recent research conducted by Accenture (2022), nearly six in ten organizations plan to use ChatGPT for learning purposes and over half are planning pilot cases in 2023.

ChatGPT uses a combination of unsupervised pre-training and supervised fine-tuning to generate human-like responses to queries and provide responses to topics that resemble those of a human expert. Accordingly, many argue that ChatGPT represents a true revolution in the use of the potential of AI (Mathew 2023). Given its ease of use and the complexity of the tasks it carries out, it has been applied across a wide range of contexts, including education, services, engineering, health, and tourism (Dwivedi et al. 2023).

Among the various fields where ChatGPT is applied, education has emerged as a prominent area where apprehension is prevalent. ChatGPT has the potential to provide personalized and responsive support (Tlili et al. 2023), better assist students, and, ultimately, enhance the overall educational experience (Ryan, French, and Kennedy 2021; Wang et al. 2023). Nonetheless, scholars and educators worldwide, irrespective of the level at which they teach, have raised alarms about students exploiting the tool for tasks such as essay writing and more complex assignments. Some have argued that the technology, if used unethically, could diminish students' learning process and objectives (Harvard Business Publishing 2023). In New York, to address concerns about potential adverse effects on learning and about the reliability of generated content, access to ChatGPT has been restricted on devices connected to public school networks (CNN 2023). Meanwhile, recent news reports highlight how Australian universities have modified their examination and assessment methods due to the increasing use of AI in evaluations (The Guardian 2023). It is in this context that OpenAI, the company behind this chatbot, has expressed its commitment to collaborating with educators in order to assist them and students in incorporating AI effectively into teaching practices (CNN 2023). As the use of generative AI tools such as ChatGPT becomes increasingly prevalent in educational settings, specialized guides are emerging to support educators and professors as they navigate the interaction with these technologies (e.g. Atlas 2023).

The accumulated anecdotal evidence has prompted a discussion about what role ChatGPT plays in students' user experience. Current research on ChatGPT in the context of education consists primarily of commentary pieces and exploratory studies (see Appendix). These studies shed light on relevant aspects of ChatGPT use such as personalization (Lee 2023; Lo 2023), interactivity (Lo 2023; Rospigliosi 2023), human-like responses (Cooper 2023; Tlili et al. 2023), and user experience (Lee 2023; Tlili et al. 2023). However, there is a remarkable lack of empirical evidence on how user perceptions influence user experience with ChatGPT. While exploratory studies and commentary provide valuable insights and discussion on the topic, they fall short in providing concrete evidence to support claims about ChatGPT in educational settings.

More empirical evidence is needed to provide a more comprehensive understanding of how students perceive and interact with ChatGPT, and to establish how their perceptions shape the user experience.

Accordingly, in this study we empirically analyze an integrated conceptual framework in an educational context where we examine the relationships across perceptions toward ChatGPT, namely human-like personality, human-like empathy, and user experience. In doing so, we study human-like personality and determine whether the user experience is enhanced when interacting with a chatbot that exhibits relatable qualities (Cooper 2023). Human-like empathy also plays a crucial role in creating supportive learning environments (Pelau, Dabija, and Ene 2021), and users may feel understood and encouraged, which can improve their interaction with ChatGPT. Thus, this study aims to gain valuable insights on how empathy can influence the user experience. Furthermore, we study how ChatGPT efforts and usage depth affect ChatGPT's level of credibility with users, which, in turn, may have a positive influence on user experience. ChatGPT efforts encompass aspects such as interaction, information, accessibility, entertainment, and customization (Cheng and Jiang 2022; Zarouali et al. 2018). Examining these efforts allows us to grasp how they can contribute to building credibility for ChatGPT. Analyzing usage depth determines whether frequent interactions foster higher levels of credibility. Understanding this relationship provides more insights into how ChatGPT can deliver reliable responses, as credibility allows a foundation of trust to be established in the relationship with ChatGPT. By studying the relationship with user experience, we can determine whether, if users perceive ChatGPT as a trustworthy tool, engaging with it enhances the overall experience, which can present further consequences in terms of usage and learning outcomes.

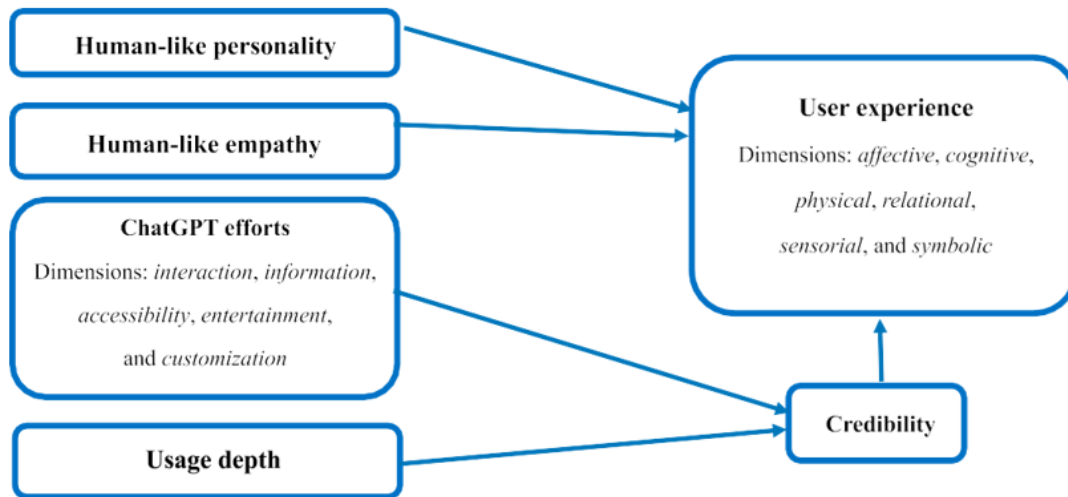
As a result, this study contributes to the emerging literature on ChatGPT, AI chatbots, and user experience in three ways. First, it addresses from an empirical perspective the research gap in relation to the current role of ChatGPT in the educational context (Dwivedi et al. 2023; Peres et al. 2023). To assess the proposed conceptual framework empirically, we collect a dataset consisting of 516 students who have used ChatGPT for academic assignments, to which we apply a seemingly unrelated regression (SUR) approach. This assessment contributes to the broader field of research on ChatGPT, AI chatbots, and user experience by offering insights into how students may perceive and use ChatGPT in an educational context. Second and more specifically, by drawing from the existing literature on AI chatbots (Jiang et al. 2022; Liu-Thompkins, Okazaki, and Li 2022; Shumanov and Johnson 2021), we identify a set of key perceptions related to ChatGPT (e.g. human-like personality, human-like empathy, and ChatGPT efforts) and assess their impacts on user experience in educational settings. This allows us to provide valuable insights into how different perceptions of ChatGPT can ultimately enhance the overall user experience for students. Third and lastly, in our analysis, the user experience obtained from using ChatGPT is captured through its multiple dimensions. This enables us to provide a more complete picture for designing and implementing ChatGPT as an educational tool to generate a satisfactory user experience.

2. Conceptual framework and hypothesis development

We present an integrated conceptual framework in an educational context. First, we aim to investigate relationships across perceptions of ChatGPT, namely human-like personality, human-like empathy, and user experience. Second, we analyze how ChatGPT efforts and usage depth impact its level of credibility for users. Finally, we seek to determine whether perceived credibility has a positive influence on user experience.

Figure 1 represents the proposed model graphically, and Subsections 2.1–2.3 explain each of the hypotheses in detail.

Figure 1. Conceptual framework.



2.1. User experience

The extensive literature on user experience consistently recognizes its pivotal role in shaping inter- actions and long-lasting relationships between users and companies (Becker and Jaakkola 2020). The term ‘user experience’ is applied specifically to experience with a technological offering (Moizer et al. 2019). In the marketing and service literature, the concept of user experience is often referred to as customer experience and has received substantial attention over the years. Recently, the study of user experience has expanded to include emerging technologies (e.g. Liu and Hung 2022). This expansion reflects the increasing interest and focus on user experience, particularly in comprehending the dynamics of interactions with cutting-edge technological advancements such as ChatGPT.

User experience refers to subjective responses of a multidimensional nature during interactions with an experience partner (Gahler, Klein, and Paul 2023). In this connection, Becker and Jaakkola (2020) relate experiences to involuntary reactions to stimuli. Literature on marketing highlights the comprehensive nature of user experience, emphasizing its affective, cognitive, physical, relational, sensorial, and symbolic dimensions (Gahler, Klein, and Paul 2023). The subjective nature of user experience is also emphasized, revealing that individual perceptions play a decisive role in shaping the overall experience. Additionally, literature acknowledges that experiences are dynamic in nature, as they evolve and are influenced by various factors (Becker and Jaakkola 2020). Prior research confirms that developing a positive user experience yields several substantial consequences for businesses, extending beyond immediate financial gains and contributing to the overall success of the business in the long term (Cambra-Fierro et al. 2021).

Recent studies reveal that users expect chatbots to provide a personalized experience that caters to their unique needs and preferences (Rizomyliotis et al. 2022; Ryan, French,

and Kennedy 2021). In the case of ChatGPT, the chatbot can, with the support of AI technology, obtain and analyze user data in order to provide individualized recommendations and solutions. This is of key importance, as many users doubt the effectiveness of chatbots or hesitate to use them due to concerns about their ability to understand specific needs (Ryan, French, and Kennedy 2021; Silva et al. 2023). From an education perspective, students may have certain expectations as regards the performance of ChatGPT, such as intuitive interfaces, responsiveness, and the ability to understand their distinctive learning needs (Huang, Foon Hew, and Fryer 2022). AI technology enables ChatGPT to provide personalized feedback, recommendations, and support (Cooper 2023; Tlili et al. 2023). As a result, a positive user experience with ChatGPT can enhance the learning experience, increase student engagement, and lead to better academic outcomes (Liu et al. 2022). A positive experience with ChatGPT can also reduce cognitive load, allowing students to focus better on their learning process (Iku-Silan, Hwang, and Chen 2023).

In contrast, a negative user experience with ChatGPT can lead to frustration and decreased academic performance. Students might encounter difficulties when interacting with ChatGPT if it fails to understand their queries or if the feedback it provides is irrelevant (Tlili et al. 2023). Therefore, it becomes necessary to prioritize user experience in an education context so that students can have positive experiences while interacting with ChatGPT, which will increase their willingness to embrace and continue to use the technology. An emphasis on user experience can also highlight the advantages of ChatGPT in education, as it has the potential to enhance the overall educational experience and improve learning outcomes.

Given the relatively recent release of ChatGPT, research has not yet fully determined what influences ChatGPT user experience. However, drawing insights from chatbot literature, we can assume that, when interacting with ChatGPT, users may value certain aspects that significantly influence their experience. The functionality of ChatGPT, such as customization options (Rizomyliotis et al. 2022), relevant information (Trivedi 2019), and interactive capabilities (Jiménez-Barreto, Rubio, and Molinillo 2021), plays a vital role in user experience evaluations. Additionally, users have expectations of human-like conversations (Araujo 2018; Rizomyliotis et al. 2022; Shin, Bunosso, and Levine 2023) and empathy (Orden-Mejía and Huertas 2022), which also positively impact their experience and satisfaction.

2.2. Human characteristics

One of the most analyzed variables in AI literature is anthropomorphism, the process of assigning human characteristics to non-human entities such that they are perceived as human (Epley, Waytz, and Cacioppo 2007). One important issue is that anthropomorphism not only refers to assigning human physical characteristics (e.g. appearance and expressions) to non-human agents, but also to assigning human mental abilities, including consciousness, awareness, engaging in reasoning, making moral judgments, forming intentions, and experiencing emotions such as pride or shame (Epley, Waytz, and Cacioppo 2007; Pelau, Dabija, and Ene 2021). Hence, anthropomorphism encompasses the attribution of human characteristics, motivations, intentions, and emotions to non-human agents/entities, assuming that non-human objects will have thoughts, feelings and motivations (Epley, Waytz, and Cacioppo 2007). Most research models currently distinguish between high and low levels of anthropomorphism but lack specific details on whether different types of anthropomorphism (e.g. physical, personality, or emotional) can maximize these outcomes (Alabed, Javornik, and Gregory-Smith 2022).

In contrast to robot anthropomorphism, where there is an important physical presence, anthropomorphism in relation to chatbots tries to compensate for the lack of human contact through a more accomplished conversational style in interactions, focusing on personality and emotional issues. Go and Sundar (2019) acknowledge that the anthropomorphism of chatbots could be understood through different cues (e.g. conversational cues, identity cues, and visual cues). Specifically, one key way to enhance the humanness of chatbots is the use of human language. Because of the complexity of human language, even the most advanced language modeling algorithms cannot communicate fully as humans do; nevertheless, they are extensively trained using deep learning methods to achieve something that resembles natural human language. In this connection, researchers have noted that users perceive the human-like characteristics of chatbots through social cues such as voice, image, name, and human-like personality (Chen et al. 2022).

In our study, we focus on one specific type of chatbot, namely ChatGPT. Due to its intrinsic characteristics (absence of gender, human name, or avatar) and its lack of physical presence, we will focus on its human-conversational capabilities. Thus, in what follows, we analyze human-like personality and human-like empathy.

2.2.1. Human-like personality and user experience

Personality is often used to describe individual differences associated with attitudes, needs, feelings, and behaviors (Barrick, Stewart, and Piotrowski 2002; Moon 2002; Shumanov and Johnson 2021). To analyze personality, the most widely adopted model is the five-factor model, also known as the Big Five (McCrae and Costa 1987), which incorporates five critical components of personality: agreeableness, conscientiousness, extraversion, neuroticism, and openness. Although this is the classic way to contemplate personality, some authors (Ahn, Kim, and Sung 2022) focus on different personality traits such as competence or warmth (Cuddy, Fiske, and Glick 2008). Competence is related to perceived ability, including intelligence, skill, and efficacy, and warmth is related to perceived intent, including friendliness, helpfulness, and sincerity (Ahn, Kim, and Sung 2022).

Some important studies have highlighted the relevance of analyzing perceived personality of human-like chatbots. For interactions involving social gain, Shumanov and Johnson (2021) indicate that matching consumer personality with congruent chatbot personality has a positive impact on consumer engagement with chatbots and purchasing outcomes. Personality traits in AI are frequently incorporated in business models to persuade consumers. We therefore aim to measure whether the perceived human-like personality traits of ChatGPT positively influence user experience using ChatGPT, and accordingly we formulate the following hypothesis:

H1: The perceived human-like personality of ChatGPT positively influences ChatGPT user experience.

2.2.2. Human-like empathy and user experience

Empathy is the ability to understand and share the feelings of another (Hall and Schwartz 2019). It can be defined as a combination of emotional reactions and cognitive understanding of other peoples' experiences and feelings (Pelau, Dabija, and Ene 2021). In general, the literature on marketing has reached a consensus about both the emotional and cognitive components of empathy: 'The emotional component refers to feelings of concern and care for others, and all the emotional experiences derived from this process, and the cognitive component includes the ability of an individual to

understand the feelings and thoughts of others, and to act accordingly' (Pelau, Dabija, and Ene 2021).

Artificial empathy represents the ability of AI agents to detect and adapt to humans' cognitive needs and emotional state (Asada 2015). Liu-Thompkins, Okazaki, and Li (2022) argue that 'artificial empathy is key to bridging the human–AI gap on affective and social customer experience' (1199). In this respect, empathetic AI will have the ability to focus on the needs and desires of specific users, understanding their individual thoughts and feelings. An empathic chatbot can also ask about a user's feelings and generally responds in an empathic, supportive manner. If ChatGPT were perceived as empathetic, its users would feel that they are cared for, valued, receive individualized attention, have a feeling of warmth, and that the chatbot puts their interests first (Chen et al. 2022). However, another important research line has highlighted that 'being like a human is important, but no machines actually reflect humanity, as they lack the essential human quality of empathy. Currently, machines only mimic the human style of interactions' (Esmaeilzadeh and Vaezi 2022, 557). Thus, users may sense that the care and warmth they attribute to service AI agents are not authentic. We therefore aim to shed light on this aspect by measuring whether the perceived human-like empathy of ChatGPT positively influences user experience, and accordingly we formulate the following hypothesis:

H2: The perceived human-like empathy of ChatGPT positively influences ChatGPT user experience.

2.3. Credibility

Credibility is defined as the degree of trustworthiness and reliability of a source (Rogers and Bhowmik 1970). When the source shows a high degree of objectivity and sincerity, the receiver has no reason to question the validity of the information provided (Huang and Chen 2006), resulting in a higher probability that the receiver finds this type of information influential and credible (Chung et al. 2020). In the specific context of chatbots, Cheng and Jiang (2022, 254) define credibility as the believability of chatbots. To ensure believability, users must perceive chatbot agents as trustworthy when listening to their concerns, analyzing their situations, and providing them with the necessary information (Edwards et al. 2014; Liu, Xu, and Yao 2023). These assumptions can be easily translated to the specific case of ChatGPT, as an example of a chatbot. In doing so, the quality of ChatGPT communication is key, as it can significantly determine the bot users' trust (Cheng and Jiang 2022; Edwards et al. 2014; Kumar et al. 2016; Liu, Xu, and Yao 2023). The question of trust is extremely relevant, as there are also malicious programs (e.g. spambots and bimbots) that can affect interactions with users (Edwards et al. 2014).

One of the key issues in defining credibility is the level of knowledge, experience, and expertise that the receiver (the user) gives to the transmitter (in this case, ChatGPT) (Bansal and Voyer 2000; Luo et al. 2015). In this sense, the user considers a source as credible when the information from it can be trusted, which reduces uncertainty (Ismagilova et al. 2020; Sokolova and Kefi 2020). In terms of ChatGPT, users may assume that ChatGPT has substantial and useful information, and the knowledge or ability to fulfill its claims, which can improve their perception of ChatGPT's credibility.

2.3.1. ChatGPT efforts and credibility

Drawing on the generalist literature (e.g. Kim and Ko 2012), we can define ChatGPT efforts as communications via digital applications, platforms, and media that facilitate

interaction, collaboration, and content sharing between ChatGPT and users. The work of Cheng and Jiang (2022) presents a synthesis of recent literature on chatbots' efforts, identifying key components such as interaction, entertainment, customization, word-of-mouth, trendiness, accessibility, immediacy, and information sharing. However, Cheng and Jiang (2022) themselves, along with authors including Zarouali et al. (2018) and Cheng, Liang, and Leung (2015), suggest considering five dimensions in terms of applicability: interaction, information, accessibility, entertainment, and customization. The objective is to build more personal connections with users (Kelly, Kerr, and Drennan 2010); that is, in our context, with chatbots and users (Godey et al. 2016). As our research is focused on ChatGPT, in defining this set of dimensions we adapt their meaning to the specificities of that context.

Interaction refers to communication between users and ChatGPT, and it enables information exchange, discussion, distribution of comments, and connection with the audience (Godey et al. 2016). Interactions based on active and open discussion, courtesy, helpfulness, and trustworthiness can help to build and strengthen links between ChatGPT and users (Chung et al. 2020; Manthiou, Chiang, and Tang 2013). Providing complete, valid, useful, and timely information to users is a fundamental effort of ChatGPT (Brill, Laura Munoz, and Miller 2019). ChatGPT can also gather enormous amounts of data on the basis of which personalized solutions can be offered (Kumar et al. 2016). Accessibility is defined as the way of assessing and responding to customer information in a timely and instant manner, allowing access to services from anywhere, at any time (Cheng and Jiang 2022). It creates value in terms of flexibility, real-time access, and portability (Smutny and Schreiberova 2020). Entertainment is related to hedonic ways of introducing valid and useful information that increase the user's perception of value (Cheng and Jiang 2022). As ChatGPT can offer entertainment and provide an enjoyable experience, users' hedonic needs are more likely to determine further positive perceptions of ChatGPT (Lin and Wu 2023). Real-life evidence recognizes the heterogeneity of users (Kumar et al. 2016), and adaptation to specific user characteristics seems to be central to understanding the benefits of using ChatGPT. In this sense, customization may be understood as the extent to which chatbots are able to offer users personalized assistance to satisfy their needs (Godey et al. 2016). ChatGPT allows services to be modified, personalized, and tailored to meet the preferences, needs, and demands of individual users (Chung et al. 2020).

In the respects discussed above, as AI technologies continue to advance, their capability to analyze and interpret information, learn from user data, and make accurate inferences improves consistently. This continuous advancement enables ChatGPT to enhance its understanding of users' need and preferences. As a result, ChatGPT provides increasingly relevant and tailored responses, which ultimately increases its perceived credibility. On the basis of these considerations, we propose the following hypothesis:

H3: The perceived ChatGPT efforts positively influence the credibility of ChatGPT.

2.3.2. Usage depth and credibility

Usage depth represents the intensity to which an individual uses a specific service or product (Shankar, Smith, and Rangaswamy 2003). Prior research (e.g. Metzger et al. 2003) suggests that frequent use of a new technology may give ample opportunities to users to witness its functions and experiment with it. In the context of ChatGPT, hands-on knowledge gained from frequent use allows students to explore the capabilities and limitations of the tool, and thus gain a deeper understanding of its functionality. As they become more proficient in using ChatGPT, their confidence in its ability to provide

accurate and relevant information increases. This increased familiarity and experimentation can lead to a stronger sense of credibility in the minds of the users (Yang, Jun, and Peterson 2004). Accordingly, students who have a deeper usage level of ChatGPT recognize its value and reliability as a tool for obtaining information and engaging in meaningful conversations. More importantly, through frequent use, they are more capable of interpreting the nuances of its outputs, distinguishing between reliable information and potential biases or inaccuracies (Wangenheim, Wunderlich, and Schumann 2017). This heightened discernment enhances the credibility of ChatGPT, as students can assess its responses from a more informed and critical perspective, ultimately reinforcing their trust in the tool's capabilities. Therefore, we propose the following hypothesis:

H4: The usage depth of ChatGPT positively influences the credibility of ChatGPT.

2.3.3. Credibility and user experience

Credibility reflects the knowledge and experience that somebody (or something) has in a given domain, showing the capacity to provide the correct information (Liu, Xu, and Yao 2023; Sokolova and Kefi 2020). In this sense, one can consider credibility to be the degree of the recipient's trust in the message given by the information communicator when that message is judged as valid and to the point (Brill, Laura Munoz, and Miller 2019; Levy and Gvili 2015; Lim and Van Der Heide 2015), believable, honest, honorable, and in line with what the audience cares about (Kumar and Polonsky 2019). Based on ideas from Filieri (2015), in this sense users will perceive ChatGPT to be technically capable and competent of delivering on its promises and claims. Under these conditions, the information exchanged will be doubted less and considered more useful by the receivers. Therefore, if the source is considered credible (i.e. trustworthy, attractive, and perceived as an expert), it can influence the perception and attitude of the audience (Ismagilova et al. 2020), including user experience.

Adapting general ideas of Newell and Goldsmith (2001), users believe whether ChatGPT has the knowledge or ability to fulfill their claims and whether it can be trusted. AI will consequently be well prepared to solve users' individual problems and inquiries and implement user-focused strategies that add value for the audience (Kumar et al. 2016), thereby creating positive experiences during interactions. Based on all these ideas and arguments, we propose our fifth and final hypothesis:

H5: The perceived credibility of ChatGPT positively influences the user experience.

3. Empirical study

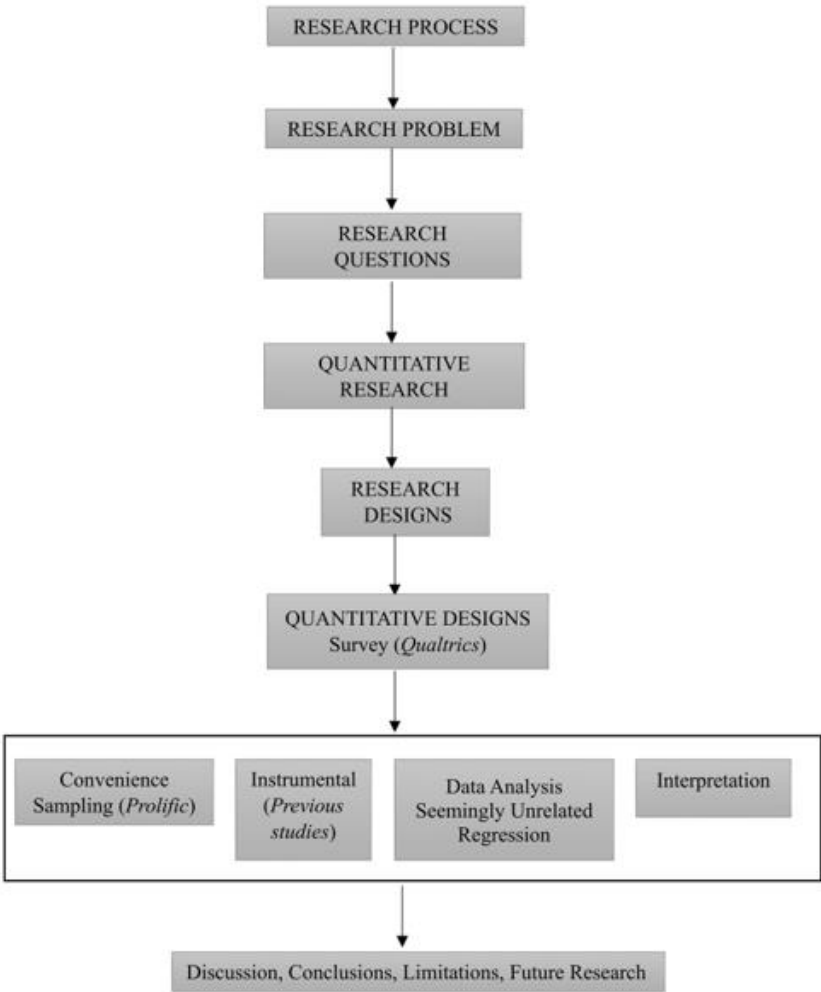
To test the proposed conceptual framework and the associated hypotheses, following the schema proposed by Creswell (2004) we applied a quantitative research design (see Figure 2). In what follows, we detail our data collection approach, sampling method, and data analysis methodology step by step.

3.1. Data and sample

The data were collected in May 2023 via a survey administered through Prolific, an online academic research panel that connects researchers with participants (Suher and Hoyer 2020). Prior research (Douglas, Ewell, and Brauer 2023) has shown that the quality of data obtained from Prolific is superior to that from other platforms (e.g. Amazon Mechanical Turk). Prolific predominantly uses a convenience sampling method, which is

appropriate for our study, since the survey questions are relevant to the actual consumers and no manipulation variables are required (Nikbin et al. 2015). Overall, 530 university students (mean age = 28.39 years, SD = 9.79) from the United States who have used ChatGPT for academic assignments were recruited to complete our questionnaire in exchange for monetary compensation. After removing 14 respondents who did not answer all the questions contained in the survey and/or who took more than 15 minutes to complete the survey, we had 516 participants.

Figure 2. Research process.



Note: Adapted from Creswell (2004).

We used items adapted from previous studies to measure the key variables of our proposed research model in terms of user experience, human-like personality, empathy, credibility, and ChatGPT effort (see Table 1) on a 7-point Likert scale (1 = ‘strongly disagree’, 7 = ‘strongly agree’). Previous studies have examined and confirmed the reliability and validity of the items. The rationale for utilizing them in adapted form was to ensure that the content was appropriate for the research context. The decision to employ a 7-point rating scale was made because longer scales yield more accurate and dependable measurements, even though respondents tend to prefer shorter scales (Preston and Colman 2000).

We performed an exploratory factor analysis, where all the items loaded on their respective scales. To assess reliability, we used Cronbach's alpha. As Table 1 shows, all the scales exhibit high internal consistency, with the minimum alpha value of 0.822 surpassing the critical threshold of 0.7 (Taber 2018). Given the multidimensional nature of customer experience and ChatGPT efforts, we applied the multidimensional reliability coefficient by incorporating all scale factors into a single measure of reliability (Widhiarso and Ravand 2014). The high values of Cronbach's alpha (0.909 for customer experience and 0.876 for ChatGPT efforts) confirmed that it was appropriate to group the multiple dimensions together. Table 1 provides the descriptive statistics for the items and the scales used in the survey, together with the mean values at item level, dimension level, and construct level.

3.2. Methodology

In line with the data analysis in the schema proposed by Creswell (2004), with the dataset collected via a survey and using variables based on previous studies, we applied a two-equation SUR model to empirically assess the proposed conceptual framework and the associated hypotheses. As indicated by Zellner (1962), the SUR model is a collection of linear equations wherein the errors are correlated across equations for each individual. This model comprises $j=1 \dots m$ linear regression equations for $I=1 \dots N$ individuals. This approach has been widely used in previous marketing research (e.g. Elberse 2010; Luo and Homburg 2007; Umashankar, Bahadir, and Bharadwaj 2022) for two main reasons. First, as Autry and Golicic (2010) state, since certain variables serve as both dependent and independent variables in different regressions, this technique helps mitigate endogeneity issues that may exist in the data. Consequently, given the recursive nature of the proposed framework, conducting joint estimation of the equations using the SUR approach is generally the optimal procedure, aligning with other studies that investigate recursive processes such as the service-profit chain (Bowman and Narayandas 2004). Second, the approach enhances estimation efficiency by combining information from different equations. Estimating a system of multiple equations becomes more efficient when the error terms of the regressions are allowed to correlate. Inconsistencies and biases can arise in the results when failing to account for the joint relationship between disturbances across a system of j equations (Ogundari 2014).

Our model consists of $j = 2$ linear regressions, one for the impacts of human-like personality, empathy, and credibility on user experience, and another for the linkages across usage depth, ChatGPT effort, and credibility. For the two regressions, a number of additional variables (age, gender, and education) were taken into account to control for potential heterogeneity. The linear regression models were specified as follows:

$$UX_i = \beta_0 + \beta_1 Personality_i + \beta_2 Empathy_i + \beta_3 Credibility_i + \beta_4 Control_i + \omega_i \quad (1)$$

$$Credibility_i = \alpha_0 + \alpha_1 Usage_i + \alpha_2 ChatGPTEffort_i + \alpha_3 Control_i + \varepsilon_i \quad (2)$$

Regarding Equation (1), UX_i indicates the perceived user experience from the use of ChatGPT. $Personality_i$ and $Empathy_i$ are, respectively, the perceived human-like personality and human-like empathy from the use of such a tool. In Equation (2), $Credibility_i$ represents the perceived credibility of ChatGPT, while $Usage_i$ and $ChatGPTEffort_i$ refer to the usage level of ChatGPT and the perceived effort during its use. Finally, in both Equations (1) and (2), $Control_i$ represents a vector of control variables, namely the age, gender, and education of the participants.

Table 1. Measurement items and validity assessment.

	Cronbach's <i>alpha</i> , Dimension level	Cronbach's <i>alpha</i> , Construct level	Mean, Item level	Mean, Dimension level	Mean, Construct level	SD
USER EXPERIENCE (adapted from Gahler, Klein, and Paul 2023)					4.393	1.186
<i>Affective</i>		0.909				
The interaction with ChatGPT for academic assignments induced good emotions.	0.925		4.634	4.693		
I had positive feelings during the interaction with ChatGPT for my academic assignments.			4.760			
The interaction with ChatGPT for my academic assignments put me in a good mood.			4.684			
<i>Cognitive</i>						
The interaction with ChatGPT for my academic assignments piqued my curiosity.	0.877		5.149	5.245		
I learned something beneficial during the interaction with ChatGPT for my academic assignments.			5.312			
I got positive insights during the interaction with ChatGPT for my academic assignments.			5.273			
<i>Physical</i>						
My physical responses during the interaction with ChatGPT for my academic assignments were pleasant.	0.907		4.678	4.536		
During the interaction with ChatGPT for my academic assignments, I actively moved in a way I liked.			4.415			
During the interaction with ChatGPT for my academic assignments, I was active in a way I liked.			4.514			
<i>Relational</i>						
I established a personal relationship with ChatGPT when dealing with my academic assignments.	0.916		3.174	3.432		
I felt positively connected with ChatGPT when dealing with my academic assignments.			3.866			
The interaction with ChatGPT for my academic assignments made me feel like I belonged to a community.			3.256			
<i>Sensorial</i>						
The interaction with ChatGPT for my academic assignments had a positive sensory appeal.			4.266	4.224		
The interaction with ChatGPT for my academic assignments had a positive impact on my senses.	0.945		4.246			
The interaction with ChatGPT for my academic assignments positively engaged my senses in a variety of ways.			4.159			
<i>Symbolic</i>						
The interaction with ChatGPT for my academic assignments was in line with my personal values.	0.903		4.333	4.233		
My personal beliefs were confirmed during the interaction with ChatGPT for my academic assignments.			4.190			

(Continued)

Table 1. Continued.

	Cronbach's alpha, Dimension level	Cronbach's alpha, Construct level	Mean, Item level	Mean, Dimension level	Mean, Construct level	SD
The interaction with ChatGPT for my academic assignments was in line with my self-image.			4.174			
HUMAN-LIKE PERSONALITY (adapted from Chen et al. 2022)						
ChatGPT has similar personality characteristics to humans.			3.488	3.581	3.581	1.388
I feel that ChatGPT has its own personality.	0.858	0.858	3.324			
The personality of ChatGPT is similar to that of a human being.			3.252			
ChatGPT's speaking style is similar to that of a human being.			4.260			
HUMAN-LIKE EMPATHY (adapted from Chen et al. 2022)						
ChatGPT gives me personalized attention.			4.165	3.949	3.949	1.307
I feel that ChatGPT puts my interests first.	0.853	0.853	4.110			
I feel that ChatGPT serves me attentively.			4.855			
ChatGPT makes me feel concerned.			3.812			
ChatGPT makes me feel that it cares about my needs.			3.564			
ChatGPT makes me feel warm.			3.186			
CREDIBILITY (Chung et al. 2020)						
ChatGPT is honest for academic assignments.	0.896		3.915	4.105	4.105	1.489
ChatGPT is trustworthy for academic assignments.		0.896	4.264			
ChatGPT is credible for academic assignments.			4.138			
USAGE DEPTH						
Measured through the perceived use frequency of ChatGPT (daily, monthly, or occasionally).	—		2.606	2.606	2.606	1.093
CHATGPT EFFORTS (adapted from Cheng, Liang, and Leung 2015; Chung et al. 2020; Godey et al. 2016)						
Interaction					5.002	1.022
ChatGPT is sensitive to users' needs related to academic assignments.	0.822	0.876	4.407	4.801		
ChatGPT has the knowledge to answer users' questions related to academic assignments.			5.180			
ChatGPT gives users individual attention related to academic assignments.			4.816			
Information						
ChatGPT helps to understand issues related to academic assignments.	0.886		5.136	5.265		
ChatGPT provides recommendations related to academic assignments.			5.215			
ChatGPT provides information that helps dealing with academic assignments.			5.444			
Accessibility						
ChatGPT gives a timely response when dealing with academic assignments.			5.922	5.725		
ChatGPT is convenient and efficient for academic assignments.	0.897		5.643			

(Continued)

Table 1. Continued.

	Cronbach's alpha, Dimension level	Cronbach's alpha, Construct level	Mean, Item level	Mean, Dimension level	Mean, Construct level	SD
ChatGPT can deliver efficient online assistance or information for academic assignments.			5.614			
ChatGPT can offer immediate answers related to academic assignments anytime and anywhere.			5.719			
<i>Entertainment</i>						
It is fun and enjoyable to share a conversation with ChatGPT about academic assignments.	0.920		4.672	4.355		
I was absorbed in the conversation with ChatGPT about academic assignments.			4.134			
The conversation with ChatGPT about academic assignments was exciting.			4.184			
I enjoy interacting with ChatGPT for academic assignments rather than completing them alone.			4.428			
<i>Customization</i>						
I feel that using this chatbot and transacting with it meets my personal needs.	0.851		4.847	4.865		
When a customer has a problem, the chatbot shows a sincere interest in solving it.			4.448			
The chatbot is able to handle customer complaints directly and immediately.			5.194			
I have confidence that the chatbot has the ability to get the job done.			4.977			

3.3. Projected user experience by simulation

As emphasized by prior research (De Haan et al. 2018; Verhoef, Kooge, and Walk 2016), it is important that the effects be not only statistically significant but also practically substantive. In pursuit of this objective, we used a dual approach consisting of sensitivity analysis and graphical representation (De Haan et al. 2018), and we conducted a simulation in two steps. In the first step, we generated a simulated dataset. Following previous studies (De Haan et al. 2018; Gao et al. 2023), the imputation of the key independent variables was aligned with the measurement scales, while the rest of the variables took their mean values. In this way, we were able to infer the extent to which a change of one unit in one key independent variable would affect the dependent variable. Accordingly, the values for human-like personality, human-like empathy, and credibility were imputed on a scale from 1 to 7, whereas usage depth, ChatGPT effort, age, gender, and education were taken at their mean values. The imputation aligned well with the 7-point Likert scale we used for the measurement of the key independent variables (human-like personality, human-like empathy, and credibility).

In the second step, we used the estimated parameters reported in Table 2 together with the simulated dataset to project user experience alongside the evolution of human-like personality, human-like empathy, and credibility. On the basis of the simulation results, we elaborated Figure 3 to show the effectiveness of human-like personality, human-like empathy, and credibility in improving user experience. The patterns are represented in linear form, since the relationships examined in the SUR model were linear. This decision

is also supported by prior research (e.g. Ismagilova et al. 2020; Liu- Thompkins, Okazaki, and Li 2022; Shumanov and Johnson 2021), which predominantly assumes the linearity of the variables under study. We know that human-like personality, human-like empathy, and credibility all contribute significantly to the improvement of user experience. However, as Figure 3 shows, the increase in user experience is sharper with each point of increase in credibility and human-like personality. The incline for credibility is slightly sharper than that for human-like personality. However, the impact of human-like empathy reveals a much flatter incline which suggests that credibility and human-like personality are more effective than human-like empathy in delivering better user experience, and that credibility is marginally more efficient than human-like personality.

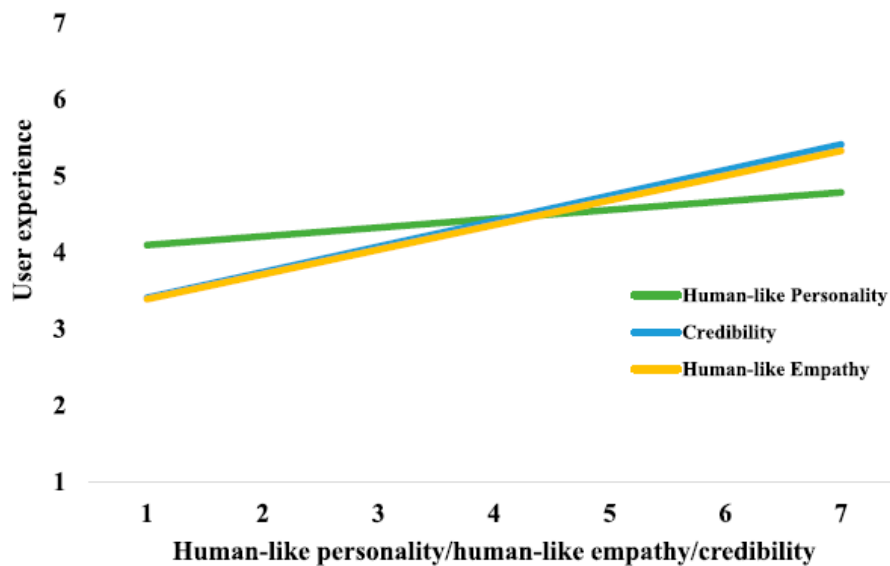
Table 2. Empirical results.

	M0		M1		M2		M3	
Dependent variable = User experience (EQ1)	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Human-like personality			0.115***	0.000			0.091***	0.003
Human-like empathy			0.334***	0.000			0.276***	0.000
Credibility			0.323***	0.000	0.680***	0.000	0.478***	0.000
Age	0.206***	0.000	0.004	0.336	0.002	0.570	0.001	0.787
Gender	-0.277***	0.003	-0.093	0.142	0.023	0.759	-0.032	0.606
Education	0.043	0.539	-0.009	0.853	-0.003	0.960	-0.013	0.773
Intercept	4.142***	0.000	1.387***	0.000	1.502***	0.000	1.059***	0.000
R ²	0.0504	0.575	0.355	0.547				
Dependent variable = Credibility (EQ2)	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Usage depth					0.189***	0.000	0.184***	0.001
ChatGPT effort					1.021***	0.000	0.994***	0.000
Age					0.009*	0.099	0.011**	0.028
Gender					-0.250***	0.004	-0.284***	0.001
Education					0.587	0.371	0.081	0.217
Intercept					-1.429***	0.000	-1.113***	0.000
R ²					0.463	0.463		

Note: *p < .1 **p < .05 ***p < .01. Sample size = 516.

Figure 3. Projected user experience by simulation.

Impact of human-like personality/human-like empathy/credibility on user experience



4. Empirical findings

In total, four models were estimated (Models 0–3). Model 0 is the base model that examines the impact of the control variables. Model 1 adds the main effects of human-like personality and human-like personality on user experience. Model 2 includes the impacts of usage depth and ChatGPT efforts on credibility, and the effects of credibility on user experience. Finally, Model 3 is the full model that includes all key variables. The results of the regression models are presented as a series of nested models. An overall F test shows that adding each set of variables improves the model fit significantly. The estimated results are reported in Table 2, including the estimated coefficients along the p -values.

We expect that users mainly have a positive user experience with ChatGPT when human-like personality traits of ChatGPT are perceived. In line with our expectation, the results reveal that a perceived human-like personality in the use of ChatGPT positively and significantly affects user experience ($\beta_1 = .091$, $p < .01$). Hypothesis 1 is therefore supported. Regarding the linkage between empathy and user experience, when a higher level of empathy is perceived from the use of ChatGPT, the user experience is more positive ($\beta_2 = .276$, $p < .01$). We thus find support for Hypothesis 2. This suggests that human-like empathy of ChatGPT may lead users to sense care and warmth during their use of ChatGPT, thus triggering a positive user experience.

In our framework, we also hypothesized that ChatGPT tends to have a high level of credibility for frequent users, and the results do indeed show such a pattern ($\alpha_1 = .184$, $p < .01$). This finding indicates that greater usage depth in ChatGPT allows users to be more capable of understanding the nuances of its outputs, which increases their trust in ChatGPT. We thus find support for Hypothesis 3. Meanwhile, consistent with our expectation, we find that ChatGPT efforts positively and significantly affect perceived credibility, which supports Hypothesis 4 ($\alpha_2 = .994$, $p < .01$). Finally, for the impact of credibility on user experience, we find that when stimulated by a high level of credibility, the perceived user experience tends to be more positive ($\beta_3 = .478$, $p < .01$), which supports Hypothesis 5. Therefore, when ChatGPT shows the capacity to provide the correct information, students are more likely to perceive a positive user experience during its use.

5. Discussion

5.1. Main conclusions

We believe that this study makes potentially valuable contributions in various fields by integrating elements from the literature streams on education, AI, and chatbots with a specific focus on ChatGPT. The findings provide deeper insight into the impact of novel variables in the context of the use of ChatGPT for educational purposes, namely the central role of user experience and of students' perceptions of human-like personality, human-like empathy, credibility, ChatGPT efforts, and usage depth.

In general, it could be argued that user experience, given its multidimensional nature, is one of the key concepts associated with adoption of new technologies (Gahler, Klein, and Paul 2023; Moizer et al. 2019). The concept also holds significant importance in the context of education, since positive experiences can contribute to enhancing engagement and motivation (Moizer et al. 2019; Schott and Marshall 2021). These considerations highlight the relevance of prioritizing the user experience for educational

tools and technologies, and how this could empower students and enable them to improve their learning process (Crompton, Bernacki, and Greene 2020; Ryan, French, and Kennedy 2021). As a result, it seems that the current study represents a pioneering research endeavor in the field of education, where more research was needed to examine the ChatGPT user experience from the student perspective. Prior to this study, the topic had been explored theoretically and speculatively through exploratory studies and commentary pieces (Cooper 2023; Lee 2023), which failed to provide concrete evidence, leaving a gap in the literature. It appears that the present study makes important contributions to the academic literature in the areas of AI research, education, and ChatGPT interaction, and it is to be hoped that it will enable scholars to achieve a deeper understanding of ChatGPT in educational contexts.

Moreover, this study specifically examines the antecedents of user experience by identifying to what extent they shape students' experiences. In the context of ChatGPT, authors have suggested, in line with prior research on service robots and chatbots, that some human-like characteristics of interaction with the chatbot may be relevant (Cooper 2023; Tili et al. 2023). Anthropomorphic features have played a pivotal role in explaining user attitudes as regards embracing human-robot interactions and engaging with chatbots (Blut et al. 2021; Liu et al. 2022). Consequently, the present study has implications for understanding which human aspects shape the user experience with ChatGPT and how they can be enhanced. The findings could be used to advance the field by determining to what extent human-like personality and human-like empathy exert an influence on user experience. Another central topic of discussion has revolved around the accuracy and reliability of ChatGPT's responses (Fergus, Botha, and Ostovar 2023; Lo 2023). Building on this, our findings support the inference that credibility represents a key determinant of the user experience, thereby clarifying the influence of perceived credibility.

We also studied how credibility can be enhanced, focusing on ChatGPT efforts in terms of inter- action, information, accessibility, entertainment, and customization. Our findings indicate that these efforts can help to address concerns about credibility, since there is evidence to suggest that as users interact more with ChatGPT over time, their perceived credibility can be enhanced. This is especially relevant because as users gain more competence in interacting with ChatGPT, they tend to formulate more precise and relevant inquiries (Lee 2023). At the same time, ChatGPT gains a larger volume of user data, which can be employed to improve its accuracy (Tili et al. 2023). The implications of this finding are profound, since as users become more familiar with the tool, their reliance on its responses can increase along with its credibility, leading ultimately to an improved user experience. The reciprocal nature of the perceived benefits suggests that user experiences can evolve positively over time, as more data lead to a better understanding of users, more relevant responses, and enhanced experiences. Through such an increase in credibility, students in higher education can further develop their critical thinking skills (Lincoln and Kearney 2019).

A potentially significant contribution of this study derives from it being developed specifically for the higher education context. By examining the use of ChatGPT among university students, it addresses a unique area of inquiry that has received considerable scholarly attention, yet for which there is virtually no empirical evidence (Lee 2023). With the emergence of ChatGPT, universities have been among the first institutions to raise concerns surrounding its implementation and general use (Anders 2023). Academics and professors have urged higher education institutions to adapt to this new reality, recognizing the enormous potential of ChatGPT alongside the need for empirical study

of its use (Lee 2023). Despite the growing discussion about ChatGPT in higher education, the lack of empirical evidence is notable. It could be argued that this study addresses this need and provides valuable insights and empirical findings related to the use of ChatGPT in the higher education context.

Last but not least, the academic literature has also faced challenges in regard to effectively measuring and capturing the complexity of user experience (Becker and Jaakkola 2020). To address this, our study employs the innovative measurement framework proposed by Gahler, Klein, and Paul (2023). Although the framework improves on previous approaches in acknowledging the multidimensional nature of user experience, empirical research was needed to establish its validity and reliability. By applying the framework, this study contributes to some extent to its empirical corroboration and to determining how it can be adapted to the ChatGPT context.

5.2. Recommendations for practice

The presence of ChatGPT in higher education is a current reality, and its relevance will continue to increase in the near future. In this sense, from a practical point of view, it is necessary to take into account the elements that could contribute to improving the user experience. Our data reveal the relevance of human-like personality, empathy, and credibility to improving user experience, with potential implications for providers, practitioners of educational technology, and higher education institutions.

Our findings demonstrate a relationship between personality, empathy, and a superior ChatGPT user experience, highlighting the importance of human-like characteristics in shaping experiences (Tili et al. 2023). The results indicate that users respond positively to a human-like personality, as it may encourage familiarity and closeness; therefore, improving ChatGPT's human characteristics is a key element in improving students' experiences of ChatGPT. For this reason, practitioners could consider to what extent they might employ machine learning to adapt the chatbot's personality to individual users. Empathy is also important, as our study confirms that empathetic responses have a positive effect on user experience. There is evidence to suggest that practitioners should focus on integrating appropriate responses that show understanding and emotional support during interaction with ChatGPT. This approach could enable the chatbot to recognize the emotional states of users more accurately, which could enhance user experience by fostering a sense of companionship and support during the learning process.

The results of our testing of Hypotheses 3 and 4 suggest positive relationships between ChatGPT efforts (i.e. interaction, information, accessibility, entertainment, and customization) and usage depth with credibility. Accordingly, ChatGPT could develop tools for providing a very friendly interface, collecting users' comments, respecting privacy issues, and/or always including sources for any response. Simple and flexible interfaces may also be valued highly by users, as may alternative and flexible entry options (e.g. keyboard or voice) and adaptations for disabled users in terms of accessibility. One could also infer from the results of this study that entertainment suggestions and allowing users to adjust the style or personality of ChatGPT not only have the potential to enhance engagement and personalization in interactions but could also underscore the tool's commitment to continuous efforts to enhance usability.

Our study confirms the relevance of credibility when engaging with ChatGPT. Credibility is influenced by ChatGPT efforts and usage depth; it is also critical for shaping positive user experiences in educational contexts. The findings have practical implications for

providers, practitioners, and educational institutions. ChatGPT efforts, in the form of interaction, information, accessibility, entertainment, and customization, are highly relevant for developing the chatbot's credibility, and providers should focus resources on enhancing these features. Given the impact of usage depth, we highlight that regular use fosters familiarity with a tool through which users can increase their proficiency in employing it; over time, students become more used to interacting with ChatGPT and, as a result, they become more skilled in engaging with it (Cooper 2023). This consideration is particularly important because ChatGPT collects all input and queries, which are then employed to improve its responses, and the improvements foster its continued use. For these reasons, we believe that practitioners and providers of this type of technology could benefit from encouraging sustained use of ChatGPT, as students are then more likely to perceive it as a dynamic and reliable learning companion.

In the same vein, higher education institutions could assist students in using this new technology properly. This study has indicated how improving features of ChatGPT and increasing the depth of its usage could lead to better perceptions of credibility and enhanced user experience. Our findings suggest that students are becoming aware of ChatGPT's role as an educational tool. Therefore, institutions could develop guidelines on the appropriate use of ChatGPT and provide students with orientation on its capabilities and limitations. This would encourage students to analyze its outputs critically, thereby developing a better understanding of the topic under study and potentially identifying inaccuracies. A more constructive interaction with ChatGPT would benefit students and their learning outcomes, an important result for educators and educational institutions.

Finally, our research demonstrates that credibility is a key issue in creating a positive ChatGPT user experience. To increase credibility, providing clear, honest and trustworthy responses while avoiding ambiguity is vital; for example, when a request is not completely clear, the user could be asked to provide clarification. In the same vein, in order to avoid misunderstandings and improve the accuracy of the output, ChatGPT might prompt the user to indicate their level of satisfaction or dissatisfaction with the response obtained. It could be argued that interactive feedback of this type would increase ChatGPT's knowledge of user needs. We believe that this kind of interaction, as an additional example of ChatGPT efforts, would contribute to increasing the level of customization. Another action that would be relatively straightforward to implement is requesting general data (e.g. demographics, psychographics, and professional data) from the user at the time of registration, as well as the purpose of each query. This approach would allow the tool to be more precise both in the style of the language it uses and in the depth of its responses. Requesting this information as part of each individual interaction could disrupt the overall experience, which is why an occasional pop-up could be used to stimulate the user to provide the information while perceiving the obvious benefits of doing so. The underlying idea is to collect the amount of information that is appropriate to the context of the interaction, enabling ChatGPT to deliver more precise and personalized responses, encouraging a continuous improvement process, and demonstrating ChatGPT efforts, as well as showing more empathy toward the user in a virtuous circle.

This study demonstrates how specific aspects of ChatGPT, namely credibility and human-like characteristics, are vital to developing a superior experience for students during their learning process. As shown in the practical implications discussed so far, we believe that these actions are part of an interconnected system that would collectively

contribute to enhancing user experience with ChatGPT in the context of higher education.

5.3. Limitations and future research

Although this study presents valuable contributions and implications, it is important to acknowledge that no research is free from limitations. Nevertheless, the ChatGPT research field is still in its infancy, and the main limitations of the current study indicate promising avenues for future research.

One significant limitation is the use of cross-sectional data collected from a limited sample. Although the data we collected are valuable, we acknowledge that they do not make it possible to observe trends over time. Nonetheless, given the novelty of ChatGPT and the pioneering nature of this study, obtaining longitudinal data was not feasible. In light of this, future research could adopt a longitudinal approach and develop a dynamic analysis of interactions with ChatGPT. Studying evolving patterns and trends can provide deeper insight into the long-term effects of ChatGPT.

Second, this study has focused exclusively on the user experience of students. However, the use of ChatGPT in educational contexts and, thus, the user experience more broadly may also be determined by the willingness of professors to integrate the tool into their subjects. Some exploratory and commentary pieces have touched on this aspect, but there is a need for more research (Fergus, Botha, and Ostovar 2023). In this context, future studies could incorporate the professors' perspective and determine whether their willingness to adopt ChatGPT can reinforce the positive relationship we have found between user perception and user experience.

Finally, although the context of our study is education, it is important to recognize that numerous other domains can benefit from using ChatGPT, such as marketing (Paul, Ueno, and Dennis 2023), healthcare (Cascella et al. 2023), and software development (Yilmaz and Karaoglan Yilmaz 2023). We therefore hope that future studies of other uses of ChatGPT can be used to complement the results obtained here, as some outcomes may differ across contexts.

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