RESEARCH-ARTICLE

Human-AI Interactions in Teacher Education: Examining Social Presence and Friendship

HUIWEN HUANG, Shaoguan University, Shaoguan, Guangdong, China

JESSICA (CHIEH YU) CHANG, Texas Woman's University, Denton, TX, United States

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Hui-Wen Huang
School of Education
Shaoguan University
Shaoguan city, Guangdong, China
huiwen422@163.com

Jessica (Chieh-Yu) Chang
Business School
Texas Woman's University
Denton, TX, USA
chernandez95@twu.edu

Abstract

This study examines the potential of AI chatbots, such as ChatGPT, to establish meaningful human-AI friendships with college students enrolled in teacher education programs. Fifty-nine junior-level elementary education majors participated in a three-week intervention study. Using the framework of social presence theory, this research explores whether generative AI technologies can replicate key qualities of friendship, such as empathy, social support, and trust. The findings reveal that while AI chatbots provide practical benefits and reliable assistance, they fall short in fostering the deep emotional and empathetic connections that are fundamental to human relationships. Notably, some participants expressed trust in AI chatbots, citing their ability to keep users' secrets private. The results suggest that enhancing social presence may improve emotional engagement and trust in human-AI interactions. This study contributes to the understanding of AI's role in offering social and emotional support, particularly in explaining student teachers' behaviors with AI technologies within educational settings.

CCS Concepts

• **Applied Computing**; • **Human-computer interaction (HCI)**;
• **Natural language generation**;

Keywords

Generative AI, human-AI Interaction, social presence theory, emotional support, virtual friends

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1 INTRODUCTION

The rapid advancement of generative artificial intelligence (AI) technologies, particularly chatbots, has fundamentally changed human-computer interaction, offering new possibilities for social and emotional engagement. One intriguing yet underexplored question is whether these AI-driven systems can serve as genuine virtual friends, especially for younger generations. Previous research indicates that younger generations are more open-minded about using AI technologies than older people (De Cicco et al., 2020 [1]; Gillespie et al., 2021 [2]). This study investigates the potential of generative AI chatbots, such as ChatGPT, to establish meaningful human-AI friendships with college students majoring in teacher education. As future educators, these students represent a critical demographic: they are digital natives who have grown up in technology-rich environments and are uniquely positioned to shape the future integration of technology in classrooms (Huang et al., 2024 [3]). Understanding their interactions with AI chatbots can provide critical insights into the evolving role of AI as a social actor, extending beyond mere informational or instructional tools to companions capable of fostering emotional and social connections.

Grounded in social presence theory, this study explores whether AI chatbots can simulate the qualities necessary for friendship, such as empathy, social support, and trust. Social presence theory is central to understanding human-AI friendships, as it emphasizes the importance of perceived presence and immediacy in forming connections that resemble human interaction (Gunawardena, 1995 [4]). This theory suggests that, for any relationship—whether human-human or human-AI—interactions must create a sense of "being there" to foster emotional closeness in mediated communication (Lowenthal, 2010 [5]). The theory's application to AI chatbots is particularly relevant, as the AI systems are designed to simulate human-like conversations through real-time responses and personalized interactions, which may lead users to perceive them as more socially present. This concept provides a foundation for investigating how AI chatbots might replicate the elements of friendship, thereby deepening our understanding of their potential role in supporting social and emotional connections in various contexts.

Although face-to-face interactions are traditionally considered the primary component of social presence (Oh et al., 2018 [6]), building strong connections with real human friends can be challenging due to busy schedules and physical distance. In contrast, AI chatbots offer unique benefits, such as constant accessibility, providing users with instant social gratification through 24/7 availability and social support (Park et al., 2022 [7]; (Pentina et al., 2023 [8]). The availability of social chatbots may signify the growing importance of immediate feedback and emotional support without the limitations of time or physical proximity, suggesting a new avenue for building human-AI friendships (Araujo, 2018 [9]; Ho et al., 2018 [10]). Virtual friends in the form of AI chatbots can provide companionship and reduce loneliness, while also serving

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as valuable social partners for students. This dynamic is especially relevant in digital learning environments, where human interaction opportunities may be limited (Ho et al., 2018 [10]). In the context of teacher education, understanding these dynamics is crucial, as future educators will navigate the complexities of employing AI technologies not merely for instructional purposes, but also as tools for fostering socially enriching learning environments.

Hence, this paper focuses on the capabilities of generative AI chatbots for human-AI interactions among teacher education students in China. It will contribute empirical findings on the application of social chatbots in exploring student teachers' perceptions of human-AI interactions. The paper will address the potential opportunities and challenges, outline the theoretical framework of social presence in employing this AI technology, and expand the discussion by focusing on students' emotions while using chatbots to understand the affective implications of generative AI. Finally, the paper will synthesize the study's findings and highlight areas for future research, aiming to significantly advance the use of AI chatbots in the social and emotional support domain.

2 LITERATURE REVIEW

2.1 Social presence theory

In technology-mediated contexts, *social presence* is defined as a user's psychological connection to the technology (Park et al., 2022[7]; Yoo & Alavi, 2001 [11]). According to social response theory, Nass and Moon (Nass & Moon, 2000 [12]) proposed the concept of 'computers as social actors' (CASA) to describe users' social reactions to computers during human-machine interactions, even though they perceive computers as lacking "any feelings, intentions, or motivations like humans" (Ki et al., 2020 [13]). Human-like interactive conversations between users and computers lead individuals to perceive reciprocity, a concept originally developed for human-human interactions, thereby enhancing the sense of social presence (Chattaraman et al., 2019 [14]) and fostering relationships with computers (Ki et al., 2020 [13]).

Previous studies have found that social presence plays an important role in facilitating users' emotional attachment to chatbots (Merrill et al., 2022 [15]; Zhang & Rau, 2023 [16]) and promoting trust and enjoyment among millennials (De Cicco et al., 2020 [1]). Social chatbots are designed with human-like features to help users perceive them as more interactive and "socially present" in human-AI interactions (Park et al., 2022 [7]; Pentina et al., 2023 [8]). Unlike humans, who may not always be available, chatbots offer consistent and synchronous interactions at any time. This constant availability makes it easier to develop human–AI friendships compared to human–human friendships because the latter requires greater social independence to manage their own time and availability to maintain such relationships (De Cicco et al., 2020[1]; Merrill et al., 2022 [15]). While the social dimension of human–AI friendships does not necessarily replicate the experiences users have with family and friends, it provides a convenient channel where a personalized AI friend is always available, potentially complementing or substituting traditional friendships (Croes & Antheunis, 2021 [17]). Therefore, the use of social chatbots and personalization does not inherently lead to individual isolation (Croes et al., 2022 [18]); rather, it points to a promising future where AI chatbots can enhance our social experiences.

2.2 The significance of this study

Previous studies have indicated that friendship-oriented and mental health-related social chatbots, such as Replika and Woebot, can help users develop connections with AI or reduce symptoms of depression and anxiety through human-AI interactions (Park et al., 2022 [7]; Chattaraman et al., 2019 [14]; Croes & Antheunis, 2021 [17]). However, these chatbots are not based on generative AI technologies. Currently, only a few studies discuss AI friendships for social or emotional support (Croes & Antheunis, 2021 [17]; Marriott & Pitardi, 2024 [19]; Ta et al., 2020 [20]), but the chatbots used in these studies were not based on generative AI technologies either. Furthermore, while previous research has explored the potential of human-AI relationships (Pentina et al., 2023[8]; Croes et al., 2022 [18]), there is still a scarcity of research comparing human-human relationships with human-AI relationships from the perspective of college students. As a result, there is a need for empirical data to understand how users perceive generative AI chatbots in terms of friendship establishment. Hence, this study aims to address this gap. By reviewing the literature on social presence with AI chatbots and human-AI relationships (Ki et al., 2020 [13]; Chattaraman et al., 2019 [14]; Croes & Antheunis, 2021 [17]), this study proposes the following research question: How do students compare their relationship with an AI chatbot, such as Sider, to that of a human?

3 RESEARCH METHOD

To address the research question, we first employed a qualitative survey to collect participants' online written responses. We then conducted a content analysis to identify patterns in the responses and categorize them.

3.1 Participants

This study used convenience sampling to recruit participants. Fifty-nine junior students majoring in primary education at a public four-year university in southern China participated. The sample included 3 males and 56 females, aged 20 to 22 years. The students were enrolled in a required AI-supported learning class titled Western Cultures, which met for 100 minutes per week during the fall semester of 2023. None of the students had previously interacted with generative AI chatbots regarding friendships. They were part of a cohort program that focused on integrating AI technologies into course design.

3.2 Research Design

The study was conducted in a natural classroom setting, led by an experienced professor who had taught in higher education for nearly 20 years. The focus was on exploring student perceptions of whether generative AI chatbots could serve as virtual friends for teacher education students in China. One unit of the Western Cultures course included an introduction to movies. Disney's Ralph Breaks the Internet was selected as the learning material.

We chose Sider (https://sider.ai/) as the representative AI chatbot for this study for two reasons. First, it is accessible in Mainland

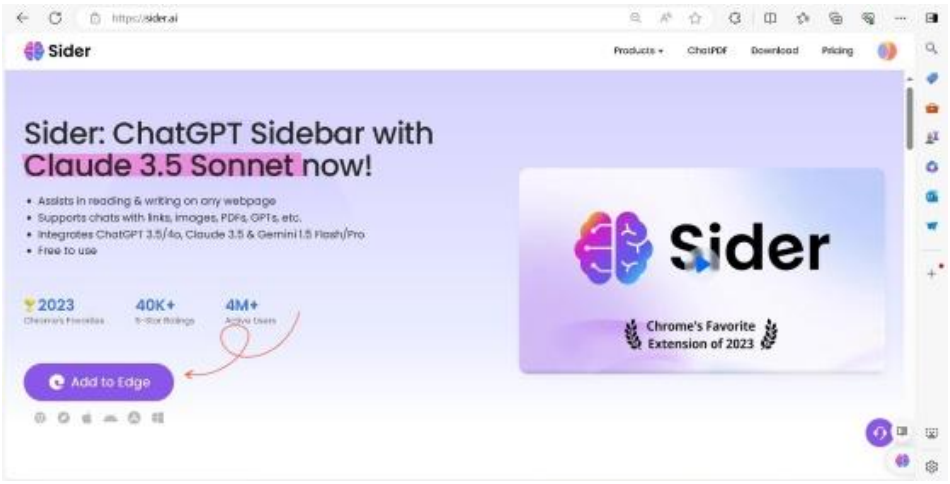

Figure 1: Sider homepage interface

China, where OpenAI's ChatGPT is restricted. Sider is a browser extension (https://microsoftedge.microsoft.com/addons/detail/sider-chatgpt-sidebar-/dhoenijjpgpeimemopealfcbiecgceod?hl$=$en-US&gl$=$US) and supports 52 languages as of June 2024. Second, it is free for students to use as long as they have an Internet connection and access to the Microsoft Edge browser. Figure 1 presents screenshots of the Sider interface.

3.3 Teaching Procedures and Data Collection

This study collected data from students' final reflections on human-AI interactions over three-weeks. At the end of the intervention, students self-selected two open-ended questions on the Canvas platform (https://www.instructure.com/canvas) to answer, reflecting on the concept of friendship depicted in the movie.

W1:

Students watched Ralph Breaks the Internet, a Disney movie released in 2018, and participated in class discussions about the concept of friendship between Ralph and Vanellope in the film.

W2:

Step 1: Students engaged in deeper group discussions about friendship by addressing the following questions. Each group chose two of the following questions to discuss and shared their results with the class.

1) What qualities does Ralph exhibit regarding friendship? What about Vanellope?

2) Do best friends have to do everything together to be considered best friends?

3) How does Vanellope's friendship with Ralph contribute to her character development? What does Ralph learn about himself through his friendship with Vanellope?

4) Can you relate any experiences of Ralph and Vanellope's journey to your own life?

5) What distinguishes good friends from toxic friends?

Step 2: Students interacted with Sider in class by asking questions about friendship (see Figure 2). They participated in a role-play game in which students acted as interviewers and Sider played the role of either Ralph or Vanellope, responding to their questions.

Assignment: Students completed an online assignment announced on the Canvas platform.

The assignment included two open-ended questions: "After interacting with Sider and discussing the friendship themes in Ralph Breaks the Internet, how has your understanding of friendship changed or deepened?" and "How does interacting with Sider compare to interacting with a human friend? How does human-AI interaction affect your understanding of building connections with both AI and people?" The assignment also included screenshots of human-AI interactions for discussion about virtual friends between users and Sider, although these screenshots were not analyzed in the present study.

W3: Students shared their human-AI interaction results in class, and the teacher summarized the findings to close the learning unit.

3.4 Data Analysis

Content analysis was employed to categorize and analyze students' reflections. The participants' responses to the second open-ended question were analyzed using ChatGPT-4. The rationale for using ChatGPT-4 was its advanced natural language processing capabilities. ChatGPT can understand and generate human-like text, making it a powerful tool for identifying patterns and themes within large volumes of qualitative data (Leas et al., 2024 [21]; OpenAI, 2023 [22]). Its ability to quickly process and summarize information facilitates an efficient analysis process, especially with extensive datasets (MIT, n.d., [23]; OpenAI, 2024[24]; Rathje et al., 2023 [25]).

Two methodological steps were undertaken to ensure the reliability and validity of the content analysis conducted with ChatGPT-4:

Multiple rounds of analysis were performed to cross-check the consistency of identified themes.

The results generated by ChatGPT-4 were cross-validated with human coders to ensure accuracy and coherence.

These procedures ensured effective human-AI collaboration in content analysis (Guetterman et al., 2018 [26]) (See Figure 3).

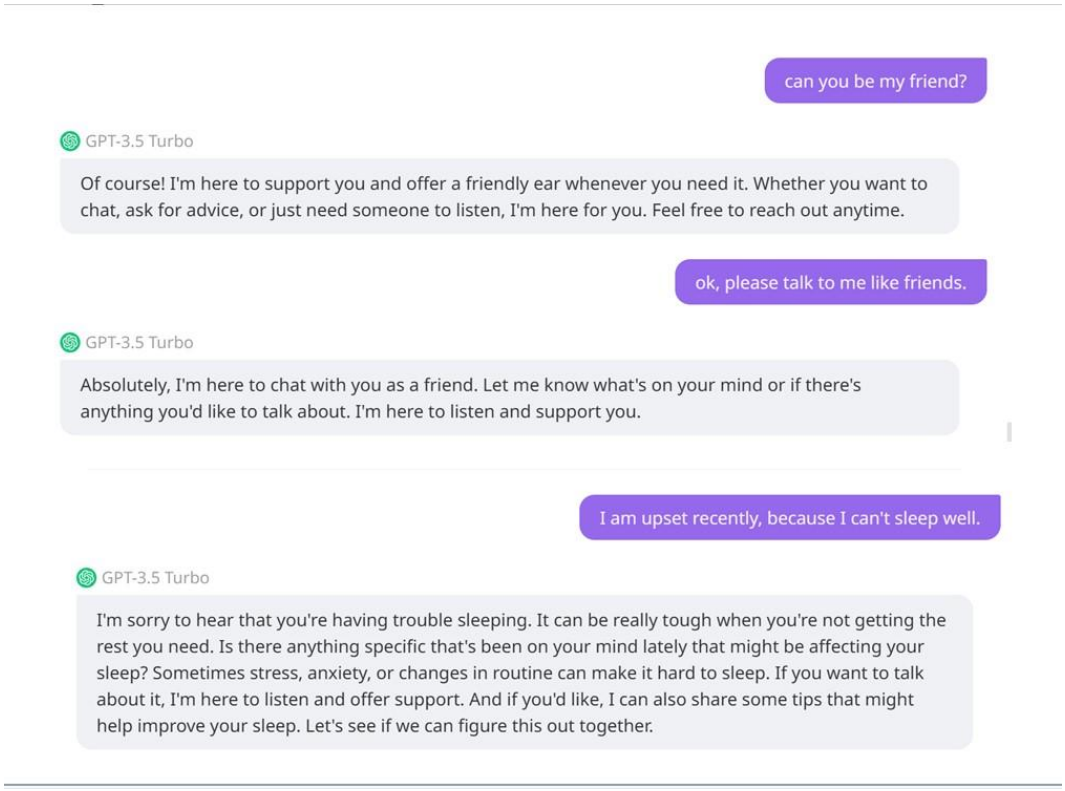

Figure 2: Selected human-AI interactions about friendship

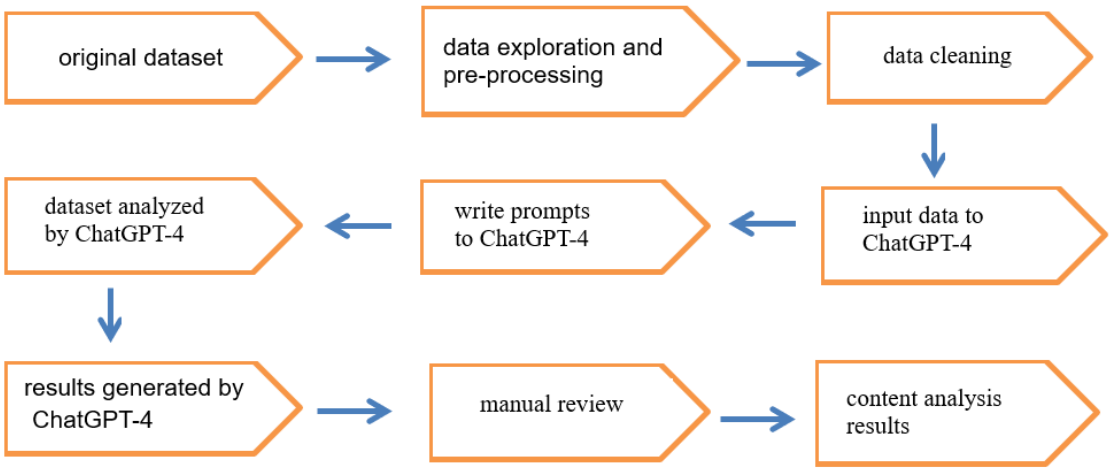

Figure 3: Procedures of data analysis in ChatGPT-4

4 RESULTS

Below are the themes from students' reflections on comparing human-AI interactions to human-human interactions.

4.1 AI as a Practical Tool vs. Human Emotional Connection

A recurring theme in the analysis is the distinction students make between AI as a practical tool and the emotional depth provided by human relationships. While AI is recognized for its efficiency and intellectual support, many students express that it cannot replace

the emotional connection they share with humans. For instance, one student remarked, "AI is like a useful assistant to me... But AI cannot accompany me. Humans share my sadness when I feel it and share happiness with me" (Student 11). This viewpoint is echoed by others who emphasize the lack of emotional understanding in AI, stating, "AI can only intellectually provide us with theoretical solutions to problems. Our relationship with humans is complex and can be intimate or nasty" (Student 13) and "AI is just a machine. It doesn't have any feelings and it can't really sympathize with us" (Student 32).

The distinction between AI's intellectual problem-solving abilities and the emotional fulfillment derived from human relationships is a key point of comparison. As one student explained, "AI has helped me more on an intellectual level, while my friendships with people have been more emotional" (Student 35). Similarly, another student stated, "I always turn to AI when there is a problem that needs to be solved... I share a deep emotional connection with human beings" (Student 58). These responses demonstrate that students understand AI excels in practical, intellectual tasks, but human relationships offer the emotional connection that AI lacks.

4.2 Lack of Empathy in AI

A second recurring theme is the perceived inability of AI to empathize with human emotions and experiences. This lack of empathy is seen as a significant limitation, with students emphasizing the irreplaceable nature of human empathy. "AI doesn't empathize with you. It doesn't detect your mood changes. But people can empathize with you and detect the changes in your mood" (Student 33). This finding underscores the importance of emotional intelligence in meaningful relationships, a domain where AI currently lags behind humans.

Several students pointed out that AI cannot empathize with their feelings or situations, which is a significant drawback compared to human relationships. For example, Student 45 stated, "When I share some joys and sorrows with the AI, the AI will not give me adequate feedback... But if I share it with a human friend, she will laugh with me or comfort me."

4.3 Memory and Trust

The analysis also revealed concerns regarding trust and memory. Students highlighted that while AI is reliable in maintaining confidentiality, it lacks the ability to remember past interactions over time, which is crucial for building trust over time. One student observed, "When I share something with a human friend, she will always remember... but if I talk to the AI, it won't remember" (Student 45). This aspect of memory and continuity is critical for fostering deep, trusting relationships.

A few students also indicated that, despite its reliability and consistency, AI lacks the personal touch of human relationships. They believe that AI can keep their secrets, suggesting that AI is perceived as more secure and trustworthy in terms of safeguarding private information. Additionally, students contrasted AI's unchanging nature with human relationships, implying that AI will always be present and dependable, unlike human friends who might leave or betray them over time. For instance, Student 57 expressed, "AI will protect my secret. It will always be my friend and will not leave me, but human beings will."

5 DISCUSSION

The findings from the analysis of the 59 students' feedback on human-AI interactions provide nuanced insights into the nature of these relationships, highlighting several key themes. This discussion interprets these findings through the lens of social presence theory, offering a deeper understanding of how social presence can enhance human-AI interactions.

5.1 Emotional Value and Empathy

A dominant theme in the students' feedback was the lack of emotional value and empathy in interactions with AI compared to human relationships. Many students emphasized that AI, despite its utility, cannot provide the emotional support and understanding that human friends offer. According to social presence theory, the perception of being understood and emotionally connected is crucial for meaningful interactions (Short et at., 1976 [27]). Future AI development should focus on advanced emotional recognition algorithms and empathetic response systems to bridge this gap, potentially incorporating affective computing techniques that enable AI to detect and respond to human emotions more naturally (Picard, 1997 [28]).

5.2 Trust and Confidentiality

Another significant theme was trust and confidentiality. Several students highlighted the reliability and confidentiality of AI interactions, contrasting this with potential trust issues in human relationships. This aligns with social presence theory, which posits that trust is a key component of social presence (Gunawardena, 1995 [4]). By ensuring data privacy and providing consistent, accurate responses, AI can build trust with users, offering a sense of reassurance and security. Moreover, trust-building can be augmented by designing AI systems that offer clear explanations for their actions and decisions, thereby increasing perceived reliability and accountability (Lowenthal, 2010 [5]).

5.3 Practical Tool and Reliability

Students also valued the practical utility and reliability of AI, particularly in providing information and solutions. This practical utility enhances social presence by positioning AI as a knowledgeable and dependable source of support. To truly enhance social presence, AI should also be able to provide contextually relevant information and meet users' specific needs. This can be achieved through personalized interactions and adaptive learning algorithms that tailor responses to individual user profiles (Park et al., 2022 [7]).

Overall, students view AI primarily as a functional tool that supports intellectual tasks, contrasting it with human relationships that offer emotional support and empathy. The findings reflect the broader understanding that while AI serves as a valuable assistant, it does not fulfill the emotional role in human-AI interactions. Students indicate the distinct roles that AI and human relationships play, with AI being viewed primarily as a helpful tool and humans being essential for emotional connection and support in daily lives.

6 CONCLUSION

The findings of this study highlight that while AI chatbots offer practical advantages and reliable assistance, they currently lack the capacity to provide the emotional and empathetic connections that define human relationships. Social presence theory offers a pathway to addressing some of these deficiencies by enhancing the emotional engagement, trustworthiness, and resonance of AI interactions. Nevertheless, this study has limitations. Although insightful, the sample of 59 students may not fully represent broader cultural and social contexts, which can influence diverse perceptions of human-AI relationships. Additionally, the reflections gathered were based on short-term interactions with AI chatbots, limiting the depth of insights into more sustained AI relationships.

To address these limitations, future research should aim to include a more diverse range of participants across different age groups, professional backgrounds, and cultural settings. Longitudinal studies could provide a deeper understanding of how human-AI relationships evolve over time, particularly whether emotional connections with AI can develop or deepen. Further investigation is also needed into how AI can better stimulate social presence, enhancing both the quality and depth of human-AI relationships in various contexts.

Introducing generative AI chatbots into social presence theory represents a significant advancement, presenting both opportunities and challenges, including ethical considerations. Striking a balance between utilizing the unique capabilities of AI and acknowledging its limitations will enable researchers to navigate the complexities of human-AI interactions more effectively. Moreover, this research has broader implications for teacher education programs, highlighting AI's role in fostering intellectual and emotional support within learning environments. Ultimately, this study contributes to the growing discourse on AI's role in human relationships and provides valuable insights for future research.

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