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The Effect of Chatbots and AI on The Self-Efficacy, Self-Esteem, Problem-Solving and Critical Thinking of Students

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A B S T R A C T

This article delves into the multifaceted impacts of chatbots and AI in educational settings. It explores how these technologies, increasingly integrated into learning environments, influence key psychological aspects and cognitive skills among students. The review highlights the potential of chatbots in enhancing academic processes, offering personalized learning experiences, and serving as bridges to educational resources. However, it also raises concerns about the ethical use of such technologies. Focusing on psychological aspects, the article reviews literature suggesting that frequent and satisfying interactions with chatbots can enhance students' self-efficacy and engagement. Studies indicate that chatbots might improve self-efficacy in experimental settings and have indirect effects on health-related self-efficacy. In terms of self-esteem and self-confidence, the research presents mixed findings. While chatbots can positively affect body image and self-esteem among certain demographics, over-reliance on these technologies for social interaction or validation might negatively impact real human connections and individual confidence. The article also examines the impact of chatbots on problem-solving skills. Some studies suggest that AI chatbots can enhance problem-solving abilities, especially when integrated into educational systems. However, there is a risk that reliance on chatbots could limit users' exploration of alternative problem-solving strategies. Critical thinking is another area reviewed, with studies presenting diverse results. While some research indicates a positive influence of chatbots on critical thinking, others suggest limitations or context-dependent effects. The article concludes that while AI and chatbots offer transformative potential for enhancing student learning and engagement, their impact is complex and multifaceted. Future advancements in chatbot technology should aim to enhance their positive impact on users' psychological well-being and cognitive development, balancing the need for independent thinking and adaptability to complex problems.

Keywords: *AI, chatbots, self-efficacy, self-esteem, critical thinking, problem-solving*

1. Introduction

Chatbots are increasingly being integrated into educational settings, offering a range of impacts and potential benefits. Chatbots have many applications for education. Concerning higher education students, AI applications like personalized learning experiences, adaptive testing, predictive analytics, and chatbots for learning and

research are increasingly being used by college and university students and also teenagers (1-3). However, many studies conducted on the impact of chatbot on education.

Chatbots can serve as a bridge between students and educational resources, providing timely information on courses, academic results, and other educational queries. Many chatbots are designed to enhance students' comprehension, retention, and application of acquiring knowledge in real-time. The interactive nature of these chatbots allows for a more personalized learning experience, catering to individual student needs and learning styles (4). Research suggests that it can enhance academic and librarian-related processes. However, it also raises concerns about the ethics of using such technology. Chatbots can potentially enhance academic and librarian-related processes, offering a more efficient and accessible way for students to engage with educational content (5). Students are increasingly using chatbots and AI in various educational contexts, leveraging these technologies for a range of purposes that enhance their learning experience. For example, chatbots provide round-the-clock assistance, allowing students to get answers to their academic queries anytime. This is especially beneficial for distance learning or online courses where immediate human assistance might not be available.

In the case of education, the current literature provides decent information about the changes in the behavior of students, the role of the teachers, the growth and convenience of self-study by using chatbots and AI. Concerning psychological aspects, the literature provides very small data which mostly focus on the self-related variables like self-esteem and self-confidence, and problem-solving and critical thinking which are believed that can be influenced by the exploiting chatbots.

2. Literature review

2.1. Psychological aspects

2.1.1. Self-efficacy

In the case of self-efficacy, research investigates how the use of chatbots influences self-efficacy in visual design. One suggests that frequent and satisfying interactions with chatbots can enhance self-efficacy, engagement, and learner autonomy in students (6). Zhang et al. (2022) discusses an AI-based educational chatbot paradigm that aims to improve learners' emotional confidence and self-efficacy through dialogue templates and emotional connections (3).

examines a chatbot designed to deliver stress management techniques. The findings suggest that using the chatbot leads to significant improvements in well-being and stress, which can be indirectly related to self-efficacy (7).

Some studies look into how self-efficacy influences the assessment of user experience in chatbot interactions which provide insights into how self-efficacy affects perceptions and satisfaction with chatbot interactions (8). On the other hand, research discusses the role of virtual experimental platforms, which can include chatbot-like interfaces, in enhancing students' self-efficacy in experimental settings (9).

Additionally, Sakane et al. (2023) discusses a mobile health AI impact on self-efficacy related to health behaviors. While not directly about chatbots, this study is relevant for understanding how digital tools can influence self-efficacy in health-related domains (10). Notably, Ammen et al. (2022) investigates the relationship between stress and the use of ChatGPT in Thailand, providing insights into how chatbot interactions might affect stress levels and indirectly influence self-efficacy (11). One also investigates the relationship between stress and the use of ChatGPT in Thailand, providing insights into how chatbot interactions might decrease stress levels and indirectly improve self-efficacy (9). Finally, some studies discusse how a chatbot improved patient satisfaction and knowledge, which can be linked to increased self-efficacy in managing health conditions (12, 13)

2.1.2. Self-esteem and Self-confidence

Many studies indicated, directly or indirectly, the effect of AI and chatbots on self-esteem and self-confidence. Fore example, Leavitt (2022) explores the impact of chatbot tutors on confidence levels among students in an introductory programming course. The study finds that the effect of a chatbot tutor is stronger for women than for men, indicating a potential role in bridging the gender confidence gap in certain academic fields. In educational settings, chatbots that provide personalized learning and positive feedback can enhance a student's sense of self-worth by acknowledging their progress and achievements (14). Ameen et al. (2022) also investigates how the use of augmented reality, AI-enabled chatbots, and social media affects body image, self-esteem, and purchase behavior among Generation Z women. The study found that these technologies, including chatbots, positively affect body image and self-esteem. Moreover, Chatbots can help

Health Nexus
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students feel more confident in their learning process by offering support and assistance, reducing feelings of frustration or helplessness when tackling challenging subjects (11). Studies indicate that o(15)ver-reliance on chatbots for social interaction or validation can lead to a reduction in real human connections, potentially negatively impacting self-esteem. Excessive dependence on chatbots for decision-making or problem-solving might undermine an individual's confidence in their own judgment and abilities (13). Chatbots may lack the nuanced understanding of human emotions and complexities, leading to responses that can be perceived as insensitive or inappropriate, affecting an individual's self-esteem. Failure to receive adequate or empathetic responses from chatbots during crucial conversations can lead to decreased self-confidence, especially in emotionally vulnerable individuals (16).

2.1.3. Problem-solving

The use of chatbots and their impact on problem-solving skills has been explored in some scholarly studies. One explores how AI chatbots can be used to make online assessments more authentic and meaningful, thereby potentially enhancing problem-solving skills (17). Other discusses the development of a Learning Management System integrated with an AI assistant like ChatGPT which indicates how AI and chatbots can expedite the learning journey and improve problem-solving skills (18). Peng (2021) believes that intelligent agents, including chatbots, can assist in high-level thinking and problem-solving tasks (19). Others found that students who received robotics-assisted programming education had higher problem-solving skills. This is relevant for understanding how AI and chatbots, often integral to robotics education, can impact problem-solving abilities (20).

2.1.4. Critical thinking

There are many studies regarding the effect of AI and chatbots on critical thinking with diverse results. For example, Deng and Yu (2023) investigated the effect of chatbot-assisted learning on various components, including critical thinking. The study reviewed 32 empirical studies and found that chatbot technology had a medium-to-high effect on overall learning outcomes. However, they noted negative findings in critical thinking, suggesting that the impact of chatbots on this aspect might be limited or context-dependent (12). Bailey and Almusharraf (2021) explored how different types of chatbot-delivered questions influenced student participation and critical thinking. It found that while some types of questions facilitated recall and content assessment, they required low levels of critical thinking (21).

Additionally, one concluded that ChatGPT can potentially enhance academic processes, which may include aspects of critical thinking (5). Musi (2023) presents chatbots designed to inoculate against misinformation, which could indirectly enhance critical thinking skills (22). Haspari & Wu (2022) believe how AI chatbots can foster critical thinking in the context of language learning (23). Gonzalez-Cacho and Abbas (2022) found that interactivity and collaborative learning positively influence critical thinking, which may be relevant in chatbot-assisted learning environments (8). Finally, Adhikari (2023) mentions visualizations can help in the process-aware teaching of writing or computer programming, potentially enhancing critical thinking (24).

3. Discussion

While the benefits of AI and chatbots in education are evident, there are also challenges and ethical considerations to be addressed. Issues such as data privacy, the potential for bias in AI algorithms, and the need for human oversight in educational settings are critical concerns that need to be addressed as these technologies continue to evolve and become more integrated into the educational landscape. In an era where digital interactions are increasingly commonplace, understanding the impact of technologies like chatbots on psychological constructs such as self-esteem and self-efficacy is crucial (6, 10, 11, 15, 16, 25, 26).

Moreover, the studies collectively suggest that chatbots and AI-assisted tools can positively influence problem-solving skills, especially when integrated into educational systems and learning management platforms. The effectiveness of these tools in enhancing problem-solving skills appears to be influenced by the design of the chatbot, the context of its use, and the specific educational or training program (20). So, future advancements in chatbot technology should aim to address these challenges, ensuring that these digital tools contribute positively to users' psychological well-being. Chatbots, with their increasing sophistication and prevalence in various sectors, have the potential to significantly influence users' problem-solving skills. This impact can be either positive or negative, and is multifaceted, depending on the design, usage context, and the user's interaction with the chatbot (23). However, the

Health Nexus
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author believes that users might encounter limitations when dealing with complex issues that are beyond the chatbot's programmed knowledge base or reasoning capabilities, potentially leading to frustration and a false perception of their own problem-solving abilities. Moreover, the convenience of chatbot assistance might discourage users from exploring alternative problem-solving strategies or thinking outside the box. On the other hand, Interactive learning experiences facilitated by chatbots can stimulate cognitive processes essential for effective problem-solving, such as logical reasoning, hypothesis testing, and decision-making.

Finally, studies suggest that while chatbots and AI-assisted tools have the potential to influence various learning outcomes, their impact on critical thinking is complex and may depend on the design of the chatbot, the context of its use, and the specific educational or training program. Some studies indicate a positive influence, while others suggest limitations or context-dependent effects. It can be said that particularly in educational, professional, and informational contexts (8, 22). Critical thinking, a crucial skill involving the objective analysis and evaluation of an issue to form a judgment, can be significantly impacted by the use of chatbots. This effect can be both positive and negative, depending on various factors such as the design of the chatbot and the context of its use.

4. Conclusion

The use of AI and chatbots in education presents a transformative opportunity for enhancing student learning and engagement. These technologies offer personalized, efficient, and interactive learning experiences, although their implementation must be carefully managed to address potential challenges and ethical concerns. As AI and chatbot technology continue to advance, their role in education is likely to become more prominent, necessitating ongoing research and evaluation to maximize their positive impact on student learning and educational outcomes.

Chatbots hold the potential to positively influence self-efficacy by providing immediate feedback, personalized support, and fostering a sense of achievement and competence. However, challenges such as over-reliance and frustration with the limitations of chatbots can have adverse effects. Continued research is vital to fully understand and optimize the use of chatbots for enhancing self-efficacy in various domains. Moreover, chatbots can positively influence problem-solving skills by providing educational support, structured guidance, and interactive problem-solving scenarios. However, it's crucial to balance this with the need for independent thinking and adaptability to complex problems. Future developments in chatbot technology should aim to enhance these aspects, providing a more nuanced and effective approach to cultivating problem-solving skills in users.

Additionally, while chatbots have the potential to positively influence self-esteem and self-confidence through supportive and reinforcing interactions, there are challenges related to over-reliance and emotional comprehension limitations. Future advancements in chatbot technology should aim to address these challenges, ensuring that these digital tools contribute positively to users' psychological well-being. Finally, Chatbots have the potential to both positively and negatively influence critical thinking. While they can offer new ways of engaging with information and encourage analytical thinking, there is also a risk of promoting passive acceptance of information. Future developments in chatbot technology and design should focus on enhancing their ability to stimulate critical thinking, ensuring these digital tools contribute constructively to users' cognitive development.

This study also has faced some limitations as follows: The study may have limitations in the selection of literature, potentially focusing on studies that support the positive impacts of chatbots and AI while overlooking research that presents contradictory or negative findings. The review relies on published studies, which might not represent the full spectrum of current knowledge, including unpublished or ongoing research. The diverse designs and functionalities of chatbots across different studies make it challenging to generalize findings. Different chatbots may have varying impacts on psychological and cognitive aspects. Moreover, the study may not fully account for cultural and contextual factors that influence how students interact with chatbots, affecting the applicability of findings across different educational settings. Therefore, Future research should aim to address these limitations by incorporating diverse methodologies, empirical data, and a more nuanced understanding of the interplay between technology, psychology, and education. Overall, this study suggests the followings for future research and application:

1) Ensuring chatbots are designed and implemented ethically, with a focus on enhancing rather than replacing human interaction, can mitigate negative impacts on self-esteem and self-confidence.

Health Nexus
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2) Programming chatbots to be more inclusive and empathetic, understanding a wide range of emotional expressions, can enhance their positive impact on users' self-esteem and self-confidence.

3) Combining chatbot interactions with human support, especially in contexts like therapy, education, or customer service, can provide a balanced approach that benefits self-esteem and self-confidence.

4) Incorporating advanced AI and machine learning techniques can enhance chatbots' ability to handle complex problem-solving scenarios, making them more effective tools for learning and development.

5) AI-enhanced chatbots can adapt to the user's skill level, offering tailored challenges that promote the development of problem-solving skills.

6) Hybrid models that combine chatbot assistance with human expertise can offer a more comprehensive approach to problem-solving, especially in complex scenarios. Such models can ensure users benefit from the efficiency and accessibility of chatbots while still developing critical thinking and problem-solving skills through human interaction.

Transparency Statement

The author is willing to share their data, analytics methods, and study materials with other researchers. The material will be available upon reasonable request.

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Declaration of Interest

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Ethics Considerations

None.

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Health Nexus
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