# Investigating the Impact of Chatbot Integration on Learning Effectiveness

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## Abstract

As financial instruments become increasingly complex, individuals need stronger financial literacy to mitigate risks—particularly amid growing interest in investment and the rise of scams such as those involving cryptocurrency. Traditional investment education often emphasizes theoretical frameworks while neglecting practical applications and real-world experiences, which can reduce learners' motivation and engagement. Chatbots, powered by natural language processing, offer rich content, instant feedback, interactive dialogue, and personalized learning—fostering engagement, self-efficacy, and learning motivation. These features make chatbots a promising tool for investment education, especially for learners who may feel anxious about complex financial topics or fear making mistakes. However, despite their potential, research on the integration and effectiveness of chatbots in investment education remains limited, highlighting a need for further exploration. This study investigates the impact of integrating chatbot technology into investment education, focusing on learning performance, self-efficacy, cognitive load, and overall learning experience. A total of 23 university students participated in the experiment. The preliminary results indicate that students demonstrated improved learning performance and self-efficacy, experienced a relatively low level of cognitive load, and expressed a willingness to use chatbots in future learning. Students' learning experiences will be further analyzed and discussed. These findings contribute to a deeper understanding of how chatbot technologies can be effectively incorporated into instructional design, guiding future pedagogical innovations.

*Keywords:* chatbot, learning effectiveness

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## Introduction

Investment studies constitute a core and foundational discipline within the field of finance (Bodie et al., 2024). Its theoretical frameworks and logical reasoning not only serve as the basis for professional practice but are also essential for a wide range of financial occupations, including securities analysts, financial planners, senior executives in securities firms, investment-linked insurance agents, and candidates for national financial and insurance examinations. Investment studies encompass not only fundamental concepts of return and risk but also a broad spectrum of financial markets, such as money markets, capital markets, foreign exchange markets, and derivative markets (Hull, 2023). Professionals engaged in investment-related fields are therefore required to develop a comprehensive understanding of these concepts and their practical applications to manage investment portfolios effectively and communicate financial information accurately.

However, current investment education is predominantly delivered through one-way instructional approaches, which in turn leads to suboptimal learning outcomes and low learning motivation (García-Santillán et al., 2025; Oberrauch & Kaiser, 2024). In recent years, increasing attention has been paid to the effectiveness of chatbot applications in educational contexts (Thongsri et al., 2025). By simulating human-like conversations, chatbots are able to provide rich learning resources (Bai et al., 2025) and facilitate interactive question-and-answer processes (Cain & Rajan, 2024). Through interaction and the provision of immediate feedback, chatbots have the potential to enhance students' familiarity with instructional content and thereby improve learning effectiveness in investment education.

The purpose of this study is to construct an investment education learning environment supported by a chatbot, and the research questions are listed below:
1. To investigate whether the students in the chatbot-based learning system (CLS) demonstrate differences in investment education learning performance.
2. To examine whether the students in the chatbot-based learning system (CLS) show differences in self-efficacy toward investment education.
3. To determine students' level of cognitive load in investment education within the chatbot-based learning system (CLS).
4. To explore the learning experiences of the students using the chatbot-based learning system (CLS).

## Methodology

The participants were 23 first-year university students from a university in Taipei City. A total of 43% of them were male, and 57% were female. They engaged in a 30-minute learning session using the chatbot-based investment education learning environment. In the study, quantitative data consisted of questionnaires, pre-test, and post-test scores, and qualitative data came from semi-structured interviews. The face-to-face interview was conducted after the experiment and 7 students participated. After the treatment, they were asked to take a post-test, and questionnaires and in-depth interviews were conducted. The instructional materials were developed through consultation with two experienced investment instructors and were aligned with the examination items of the Financial Planning License Competency Test administered by the Taiwan Academy of Banking and Finance to ensure content validity. The cognitive load scale was modified from the instrument developed by Hwang et al. (2013) to assess learners' cognitive load during investment education learning, using a seven-point Likert scale. The Cronbach's alpha is .81. The self-efficacy scale was modified from the instrument developed

by Pintrich et al. (1991) to assess learners' level of self-confidence toward investment education learning, using a five-point Likert scale. The Cronbach's alpha is .78.

## Results

A paired-samples t-test was conducted to address the first research question: "Do students using the chatbot-based learning system (CLS) demonstrate significant differences in investment education learning performance?" To answer this question, students completed both a pre-test and a post-test at the conclusion of the intervention. The results revealed a statistically significant difference between pre-test and post-test scores, $t(22) = -22.33$, $p < .01$. Specifically, the post-test scores (M = 76.96, SD = 2.98) were significantly higher than the pre-test scores (M = 47.17, SD = 2.98).

A paired-samples t-test was conducted to address the second research question: "Do students using the chatbot-based learning system (CLS) demonstrate significant differences in self-efficacy toward investment education?" The results indicated a statistically significant increase in students' self-efficacy following the intervention, $t(22) = -7.17$, $p < .01$. Specifically, the mean self-efficacy score after the intervention (M = 3.74, SD = 0.62) was significantly higher than the mean score before the intervention (M = 2.13, SD = 0.81).

To address the third research question, which examined students' cognitive load in investment education within the chatbot-based learning system (CLS), descriptive statistical analysis was conducted. The results showed that the mean cognitive load score was 2.43 (SD = 0.61), which is below the midpoint value of 3, indicating that students experienced a relatively low level of cognitive load during the learning process.

To address the final research question, which explored students' learning experiences when using the chatbot-based learning system (CLS), qualitative analysis of the interview data was conducted. The findings indicated that most students perceived the chatbot as providing immediate feedback that supported and enhanced their learning. In addition, several students reported that the chatbot-supported learning environment increased interactivity, which in turn enhanced their learning motivation and reduced perceived learning pressure.

## Conclusions

The purpose of this study was to examine the effects of a chatbot-based learning system on investment education. The findings indicate that learners in this environment demonstrated significant improvements in their investment knowledge, showing that the system effectively supported the learning process. In addition, students exhibited enhanced self-efficacy in learning investment concepts and reported experiencing a relatively low cognitive load while using the system. The interactivity and immediate feedback provided by the chatbot were found to facilitate learning and increase learner satisfaction (Ngo et al., 2024). Moreover, the ease of use of the chatbot guided students in understanding investment concepts more clearly and consistently, while also fostering their self-efficacy and maintaining their motivation to learn throughout the instructional process (Tanveer et al., 2024). The real-time question-and-answer function offered by the chatbot provided a higher level of interactivity compared with traditional instructional methods. Engaging in dialogue and inquiry with the chatbot also helped reduce students' learning pressure, contributing to a more supportive and effective learning experience (Yin et al., 2024).

For future research, it is recommended that the application of chatbot-supported learning be extended to different subjects and age groups, include control groups for comparative analysis, and involve longer intervention periods so that more learners can fully benefit from the advantages provided by these innovative technologies.

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## Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author confirms that Grammarly, an AI-assisted writing tool, was used solely for proofreading and improving the clarity and accuracy of language in the manuscript, including the correction of grammatical and spelling errors and rephrasing of sentences. No other AI or AI-assisted technologies were employed to generate content. All ideas, research design, procedures, findings, analyses, and discussions presented in this manuscript are the original work of the author and were developed through careful and systematic research.

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