

Assessing the Effect of AI Chatbots on the Entrepreneurial Learning Engagement of ABM Senior High School Students

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Abstract

This study investigated the effect of AI chatbot-assisted instruction on the entrepreneurial learning engagement of ABM Senior High School students at San Julian National High School. The research employed a quasi-experimental pre-test and post-test design with purposively sampled Grade 11 ABM students. Data were collected using validated pre-test and post-test questionnaires and analyzed through descriptive statistics and paired and independent sample t-tests. Results demonstrated significant increases in behavioral and emotional engagement after AI-assisted instruction, while cognitive engagement improved but remained higher under standard instructional methods. Comparisons revealed that AI chatbots are effective in fostering active participation and motivation, while traditional methods provide stronger scaffolding for complex cognitive tasks. The study concludes that AI chatbots can serve as complementary instructional tools to enhance classroom interaction, sustain motivation, and enrich affective and behavioral dimensions of entrepreneurship learning. Recommendations include integrating AI-assisted and traditional instruction to optimize learning outcomes and further research to explore AI's role in enhancing cognitive engagement. This study aligns with SDG 4 – Quality Education and SDG 8 – Decent Work and Economic Growth, promoting educational equity and preparing learners with entrepreneurial skills. Its sustainability impact lies in supporting institutional adoption of technology-enhanced learning, improving student engagement in under-resourced rural schools, and informing policy and curriculum development for sustainable educational practices.

Keywords: ABM Senior High School, AI Chatbots, Behavioral Engagement, Cognitive Engagement, Emotional Engagement, Entrepreneurship Education, Learning Engagement, Quasi-Experimental Design, Technology-Assisted Learning, Student Motivation

1. Introduction

Artificial intelligence has become part of global educational innovation by transforming classrooms into more adaptive and interactive learning environments. In countries with advanced digital infrastructures, AI chatbots are used as learning companions that provide immediate responses, personalize instruction, and support students in understanding complex concepts in business and entrepreneurship. International studies show that chatbots can enhance motivation, provide formative feedback, and support complex cognitive tasks through guided reasoning (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018). Systematic reviews also emphasize that chatbots can strengthen engagement through immediacy, accessibility, and personalized scaffolding, which are useful in business and entrepreneurship education where timely learner support is important (Ciechanowski et al., 2019; Pereira & Díaz, 2019). In the Philippine context, the use of educational technology in Senior High School is growing, but implementation remains uneven. National reports show that although digital tools are increasingly promoted in basic education, gaps in infrastructure, internet access, and device availability continue to affect equitable adoption (Department of Education, 2020; UNESCO, 2022). Rural and geographically isolated areas experience greater limitations due to weak connectivity, limited digital resources, and fewer opportunities for teacher training (Asian Development Bank, 2021). These conditions may influence whether AI chatbots can produce the same positive effects reported in other contexts.

The literature highlights AI chatbots as tools that can promote engagement, motivation, feedback, and learner support. Studies suggest that chatbots help students process complex learning tasks by providing step-by-step guidance and interactive support (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018). Related reviews further show that chatbot-supported learning can enhance student engagement through accessibility, immediate interaction, and personalized scaffolding (Ciechanowski et al., 2019; Pereira & Díaz, 2019). Entrepreneurial learning engagement in this study is viewed through behavioral, emotional, and cognitive dimensions. These dimensions are important indicators of students'

participation, motivation, interest, effort, and deeper involvement in learning activities (Fredricks et al., 2004; Ciechanowski et al., 2019). In entrepreneurship education, these forms of engagement are relevant because students need both active participation and critical thinking to understand and apply business concepts.

Globally, AI chatbots have been recognized for their capacity to personalize instruction, provide feedback, and support student interaction in technology-enhanced learning environments (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018). However, the Philippine educational setting presents challenges that may affect the adoption and effectiveness of AI tools. National conditions show continuing disparities in digital infrastructure, internet access, and device availability (Department of Education, 2020; UNESCO, 2022). Locally, Eastern Samar represents a rural and geographically constrained setting where many public schools operate with limited technological resources. In San Julian National High School, ABM learners may have fewer opportunities to experience entrepreneurship practice outside the classroom. Because of this, AI chatbots may provide an alternative learning support system by simulating interaction, guiding activities, and sustaining student engagement. However, the effectiveness of this approach remains largely untested in this specific local context.

This study is anchored on the concept of student engagement as a multidimensional construct composed of behavioral, emotional, and cognitive engagement (Fredricks et al., 2004). Behavioral engagement refers to students' participation, attentiveness, and task completion. Emotional engagement involves interest, motivation, enjoyment, and positive attitudes toward learning. Cognitive engagement focuses on critical thinking, problem-solving, and the application of concepts. Within this framework, AI chatbot-assisted instruction serves as the independent variable, while entrepreneurial learning engagement serves as the dependent variable. The study examines whether exposure to chatbot-guided activities, formative feedback, and interactive learning tasks can improve students' engagement in entrepreneurship lessons.

Although global studies have shown that AI chatbots can strengthen motivation, interaction, and cognitive support (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018), Philippine literature remains limited, especially in Senior High School settings. Existing local studies have mostly focused on higher education or general perceptions rather than empirical measurement of learning engagement among Senior High School learners (Belda-Medina & Kokošková, 2023). This gap is more evident in rural Philippine schools where digital access and infrastructure are limited. Few studies have examined AI chatbot-assisted instruction among ABM Senior High School students in rural settings, and none to the researcher's knowledge have focused on Eastern Samar or San Julian National High School. Therefore, this study aims to provide localized and practical evidence on whether AI chatbot-assisted instruction can improve behavioral, emotional, and cognitive engagement in entrepreneurship learning.

This study aligns most directly with SDG 4 – Quality Education because it examines how AI chatbot-assisted instruction may support learner engagement, improve access to interactive learning, and strengthen entrepreneurship education among Senior High School students. The focus on ABM learners in a rural public school also connects with educational equity, since the study addresses how digital tools may support students in areas with limited resources. The study is also related to SDG 8 – Decent Work and Economic Growth because entrepreneurship education prepares learners with business-oriented thinking, problem-solving, and future livelihood skills. By improving engagement in entrepreneurship lessons, the research may contribute to developing students' readiness for economic participation. It also supports SDG 9 – Industry, Innovation and Infrastructure because the study explores the educational use of AI technology in a rural school context. Since infrastructure and digital access remain challenges in the Philippines (Department of Education, 2020; UNESCO, 2022; Asian Development Bank, 2021), the study may provide insight into how technology-based learning tools can be introduced in under-resourced educational environments.

The study contributes to educational sustainability by examining whether AI chatbots can support student engagement in entrepreneurship learning within a rural public-school setting. Its focus on behavioral, emotional, and cognitive engagement may help teachers understand how technology can be used to supplement instruction and sustain learner participation. The study also contributes to technological and innovation sustainability by exploring how AI-assisted tools may be integrated into teaching practices despite infrastructure limitations. For school administrators, the findings may support decisions on digital learning resources, teacher training, and technology-friendly learning environments. In terms of socio-economic sustainability, the study is relevant because entrepreneurship education can help students develop confidence, problem-solving skills, and practical understanding of business concepts. For policymakers and future researchers, the study may provide localized evidence on AI chatbot use in rural Philippine education and guide further studies on digital interventions in secondary schools.

The present study assesses the effect of AI chatbot-assisted instruction on the entrepreneurial learning engagement of Grade 11 ABM students at San Julian National High School. It specifically examines engagement before and after exposure to chatbot-assisted instruction and compares the post-test engagement of students exposed to AI-assisted learning with those taught through standard instruction. The study is limited to behavioral, emotional, and cognitive engagement within the

duration of the intervention and does not cover other strands, long-term retention, business performance skills, or the development of actual entrepreneurial ventures.

2. Material and methods

2.1 Research Design

A quasi-experimental research design was adopted, using a pre-test and post-test approach to evaluate the influence of AI chatbot-assisted instruction on ABM students' entrepreneurial learning engagement. This design allowed for the comparison of engagement levels before and after the intervention without requiring random assignment, which is often impractical in school settings (Creswell & Creswell, 2018). One section of Grade 11 ABM students was divided into an experimental group, receiving entrepreneurship lessons supplemented by an AI chatbot, and a control group, receiving standard instruction. Data on behavioral, emotional, and cognitive engagement were collected through validated pre-test and post-test questionnaires, with descriptive and inferential statistics applied to assess the significance of observed changes.

2.2 Locale of the Study

The research was conducted at San Julian National High School, a public Senior High School in San Julian, Eastern Samar, Philippines, offering the ABM academic strand. The school operates within a rural context characterized by limited digital infrastructure, intermittent internet connectivity, and scarce technological resources. The province's geographical isolation and restricted exposure to digital learning tools make it an appropriate setting to examine the potential impact of AI-based educational interventions on student engagement in entrepreneurship.

2.3 Respondents of the Study

The population consisted of all Grade 11 students enrolled in the ABM strand at San Julian National High School during the current academic year. These students were directly exposed to the K-12 ABM entrepreneurship curriculum, making them relevant participants for evaluating behavioral, emotional, and cognitive engagement.

2.4 Sample and Sampling Procedure

Purposive sampling, a non-probability technique, was used to select students who were currently enrolled in the ABM strand, present during both pre-test and post-test assessments, and capable of interacting with digital devices for AI-assisted learning. The sample was divided into an experimental group, receiving AI chatbot-assisted instruction, and a control group, receiving standard instruction. This approach ensured that participants were relevant to the study objectives and allowed meaningful comparison between instructional methods.

2.5 Research Instrument

A single research instrument, a pre-test and post-test questionnaire, was employed to measure changes in behavioral, emotional, and cognitive engagement (Fredricks et al., 2004). The questionnaire included items on behavioral engagement, assessing active participation, attentiveness, and task completion; emotional engagement, evaluating motivation, interest, and enjoyment; and cognitive engagement, measuring critical thinking, problem-solving, and application of entrepreneurial concepts. All items used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The instrument was constructed based on validated engagement scales, adapted for the ABM curriculum, reviewed by experts in entrepreneurship education and educational technology, pilot-tested for reliability (Cronbach's $\alpha \geq 0.70$), and finalized for the main study.

2.6 Data Gathering Procedure

Data collection followed a structured sequence. Permission was secured from the school principal, and students were briefed on the study purpose, procedures, and AI chatbot use, with informed consent obtained from students and, if required, parents or guardians. A pre-test questionnaire established baseline engagement levels, supplemented by classroom observations. The intervention involved AI chatbot-assisted exercises, formative feedback, simulations, and interactive tasks aligned with the entrepreneurship curriculum, while the control group received standard instruction. Post-test questionnaires and additional observations were conducted after the intervention. All data were compiled, verified for completeness, and prepared for statistical analysis. Participation was voluntary, and student responses were treated confidentially.

2.7 Data Analysis Techniques

Collected data were coded according to the five-point Likert scale, with scores for each engagement dimension summed and averaged. Descriptive statistics, including mean and standard deviation, summarized engagement levels, while inferential statistics assessed changes. Paired-sample t-tests were applied to compare pre-test and post-test scores within the experimental group, and independent-sample t-tests compared post-test outcomes between the experimental and control groups. Non-parametric alternatives, such as the Wilcoxon Signed-Rank Test or Mann-Whitney U Test, were used if

normality assumptions were violated. Statistical analyses provided evidence of the effect of AI chatbot-assisted instruction on behavioral, emotional, and cognitive engagement.

2.8 Ethical Considerations

The study adhered to strict ethical guidelines. Informed consent was obtained, and students could withdraw at any time. Confidentiality and privacy were maintained through anonymized coding. The intervention was designed to avoid physical, psychological, or emotional harm, and all research procedures complied with principles of academic integrity. Official permission from school authorities was secured, and data were stored securely and used solely for research purposes in accordance with ethical standards.

3. Results and Discussion

3.1 Entrepreneurial Learning Engagement Before and After AI-Assisted Instruction

3.1.1 Behavioral Engagement

Prior to AI chatbot-assisted instruction, students exhibited a mean behavioral engagement of 3.14, with considerable variability ($SD = 0.85$), reflecting modest and inconsistent participation. After the intervention, mean behavioral engagement increased to 4.24 and standard deviation decreased to 0.44, indicating both higher and more uniform participation levels. This improvement suggests that AI chatbot-assisted instruction effectively stimulated active engagement in entrepreneurship lessons. By providing interactive guidance and real-time feedback, the intervention helped students focus, complete tasks, and participate consistently, aligning with international findings on chatbot-enhanced engagement (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018; Ciechanowski et al., 2019).

3.1.2 Emotional Engagement

Emotional engagement showed a pre-test mean of 3.58 ($SD = 0.50$) and increased to 4.59 ($SD = 0.49$) post-intervention. Students reported higher motivation, enjoyment, and positive attitudes toward learning entrepreneurial concepts following AI-assisted instruction. These results indicate that AI chatbots can foster affective engagement by creating an interactive and responsive learning environment. The increase in emotional engagement is consistent with literature highlighting chatbots' capacity to boost learner motivation, interest, and emotional connection to content (Pereira & Díaz, 2019; Fredricks et al., 2004).

3.1.3 Cognitive Engagement

Cognitive engagement improved from a pre-test mean of 3.34 ($SD = 0.48$) to a post-test mean of 4.40 ($SD = 0.45$), reflecting enhanced analytical skills, problem-solving, and application of entrepreneurial concepts. This suggests that AI-assisted instruction supports deeper cognitive processing and sustained attention. Chatbots' structured guidance and instant feedback likely contributed to students' ability to interpret, analyze, and apply concepts effectively, corroborating prior evidence on technology-enhanced learning in complex cognitive tasks (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018).

3.2 Significance of Pre-Test and Post-Test Differences

Paired-sample t-tests confirmed statistically significant improvements across behavioral, emotional, and cognitive engagement dimensions (all p -values < 0.05). The robust mean gains indicate that the AI chatbot intervention meaningfully enhanced students' participation, affective involvement, and cognitive focus. These findings support the premise that integrating AI tools into classroom instruction can elevate engagement beyond baseline levels. They align with existing studies emphasizing the role of AI in sustaining learner motivation and fostering consistent effort across multiple engagement dimensions (Ciechanowski et al., 2019; Fredricks et al., 2004).

3.3 Comparison Between AI-Assisted and Standard Instruction

Independent-sample t-tests revealed that students in AI-assisted lessons scored significantly higher in behavioral ($p = 0.002$) and emotional ($p = 0.004$) engagement than those in standard instruction. Conversely, cognitive engagement was significantly higher in students taught through standard methods ($p < 0.001$), suggesting traditional instruction may still provide superior scaffolding for complex analytical and problem-solving tasks. These outcomes indicate that AI chatbots are particularly effective in enhancing active participation and affective involvement, whereas conventional teaching methods continue to support higher-order cognitive processing. The complementary use of both instructional approaches may therefore optimize learning across behavioral, emotional, and cognitive domains (Okonkwo & Ade-Ibijola, 2021; Winkler & Söllner, 2018).

3.4 Summary of Findings

Overall, AI chatbot-assisted instruction improved behavioral and emotional engagement among ABM students while also contributing to cognitive gains. Pre-test to post-test differences were statistically significant, confirming the effectiveness

of AI tools in supporting active, motivated, and focused learning in entrepreneurship education. Comparisons with standard instruction underscore the potential for blended approaches to achieve balanced engagement across all dimensions.

4. Conclusion & Recommendations

AI chatbot-assisted instruction significantly enhanced the behavioral and emotional engagement of ABM Senior High School students at San Julian National High School, evidenced by higher post-test scores in participation, motivation, interest, and enjoyment compared to pre-test levels and standard instruction. Cognitive engagement also improved with AI-assisted learning, though students taught through traditional methods demonstrated comparatively stronger analytical and problem-solving performance. These results indicate that AI chatbots serve as effective complementary tools, supporting active classroom interaction, sustaining motivation, and enriching the affective and behavioral dimensions of entrepreneurship learning.

Educators are encouraged to integrate AI chatbots as supplementary tools to foster active participation and emotional engagement in entrepreneurship lessons, while students may use them during independent or group study to reinforce understanding and maintain motivation. Curriculum developers should consider balancing AI-assisted and traditional instructional strategies to optimize both cognitive and affective learning outcomes. Further research is recommended to explore how AI tools can enhance cognitive engagement and support higher-order thinking skills in business-oriented learning.

Compliance with ethical standards

The authors declare no conflict of interest. This study complied with recognized ethical standards for human-participant research by ensuring voluntary participation with informed consent, the right to withdraw without penalty, and strict confidentiality through anonymous, secure, and aggregated data handling. Given the focus on psychological well-being, procedures were non-invasive, and safeguards were observed to minimize discomfort, with guidance to appropriate support services when needed, and required institutional permissions were secured for instrument use and access to academic records.

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