Designing a GenAI Chatbot-Enhanced Blended Synchronous Learning Environment to Improve Online Learners' Emotional Engagement

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Abstract: *Blended synchronous learning (BSL) combines in-person and online instruction in real-time, enabling remote learners to join classroom activities. While BSL offers flexibility and merges the benefits of both modalities, online learners often lack emotional engagement due to limited social interaction and personalized support. To address this, this study proposes designing a GenAI chatbot using ChatGPT to enhance online learners' emotional engagement by providing social interaction and personalized support. This proposed research will follow the educational design research approach, and progress through 3-4 iterative rounds of design, implementation, and formative evaluation to gradually optimize the design of the chatbot. This study aims to fill gaps in research on generative AI for emotional engagement in BSL.*
Keywords: Blended Synchronous Learning, Engagement, Interaction, GenAI Chatbot

1. Introduction

Blended synchronous learning (BSL) is an instructional approach that integrates classroom instruction and online learning in real time, allowing remote learners to join classes via interactive technologies like video conferencing (Garrison & Vaughan, 2007). BSL offers flexible, accessible, and simultaneous learning opportunities, especially for adult learners balancing work and study (Wang & Quek, 2016). Therefore, BSL is a highly practical approach for learners, especially adult learners.

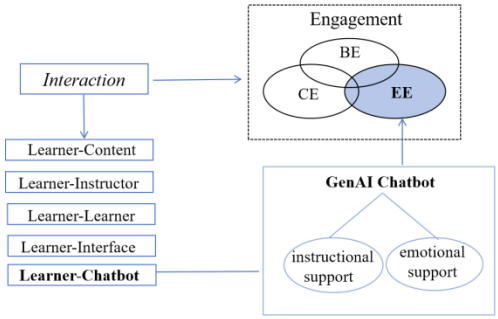
However, BSL still faces some issues, particularly low engagement among online learners, which impacts academic performance, satisfaction, and dropout rates (Fredricks et al., 2004; Wang et al., 2017). Emotional engagement, a critical factor relatively overlooked in existing research, is often hindered by isolation, lack of social interaction, and insufficient personalized support (Wang & Huang, 2023). Nevertheless, emotional engagement is less studied and remains an area needing further exploration.

This study proposes to design a GenAI-powered chatbot to enhance emotional engagement in BSL by offering real-time interaction and personalized support. Specifically, the study seeks to answer three research questions:

1) What characteristics should an interactive GenAI chatbot have for the purpose of emotionally engaging online students in the BSL environment?
2) To what extent does this GenAI chatbot enhance the emotional engagement of online learners?
3) What are learners' perceptions of the use of GenAI chatbot to emotionally engage their learning in the BSL environment?

2. Conceptual Framework

Figure 1 shows the conceptual framework that guides the design of the study. In this section, the key concepts involved in the framework and relevant research studies are reviewed.



**Note*.*BE= behavioral engagement CE= cognitive engagement EE= emotional engagement

Figure 1. The conceptual framework

2.1. Engagement and Emotional Engagement

Engagement is a multifaceted construct described as "the holy grail of learning" (Sinatra et al., 2015), as it is closely related to academic achievement and satisfaction. In online learning, engagement is often defined as cognitive, affective, and behavioral energy learners exert when interacting with others, learning materials, and activities (Martin & Borup, 2022). Although online learning offers flexibility, it often lacks the immediacy of in-person interactions, leading to high isolation and dropout risks. Engagement is commonly categorized into three dimensions: behavioral, cognitive, and emotional (Fredricks et al., 2004). Behavioral engagement includes the learner's attention, concentration, and curiosity to a learning task and other observable actions, and cognitive engagement emphasizes learners' mental endeavor in learning (Fredricks et al., 2004). Emotional engagement, which this study emphasizes, refers to learners' affective states during learning (Skinner & Belmont, 1993). The relationship among these dimensions is dynamic, overlapping, and interdependent. For instance, behavioral engagement is often seen as the physical representation of cognitive and affective engagement, while cognitive engagement predicts behavioral and emotional engagement (Martin and Borup, 2022).

Measuring emotional engagement requires monitoring learners' learning-related emotions and their dynamic changes. Traditional methods, such as self-reports, surveys, and interviews, could effectively capture emotional engagement but are retrospective and subjective, often failing to track real-time emotional changes (Schall, 2014). This study explores facial expression analysis as a non-intrusive, objective method to supplement traditional tools, enabling the real-time monitoring of emotional engagement (Schall, 2014).

Emotional engagement is categorized into two dimensions: positive (POS) and negative (NEG) (Wang et al., 2015). POS, which involves positive emotions like joy and confidence, has a positive correlation with academic performance. In contrast, NEG involves emotions like boredom, frustration, and anxiety, which are common in technology-mediated learning and often hinder learning outcomes. Providing social support and interaction often helps in decreasing the NEG and fostering the POS. Therefore, this study will design and implement a GenAI chatbot to provide real-time instructional and emotional support for online learners in a BSLE, aiming to enhance learners' POS.

2.2. Interaction

Moore (1989) identifies three forms of interaction in distance learning: learner-content, learner-instructor, and learner-learner. Hillman et al. (1994) expand Moore's framework by adding learner-interface interaction, which addresses how learners interact with technology during the learning process. More recently, the emergence of AI technology has introduced an additional form: learner-chatbot interaction. Empirical studies have demonstrated the potential of educational chatbots to enhance learning accessibility and engagement (Okonkwo & Ade-Ibijola, 2021). Kuhail (2022) conducted a systematic review highlighting chatbots' ability to improve learner engagement, analyzing their roles and interaction styles. However, the potential of generative AI (GenAI)-based chatbots, like ChatGPT, remains unexplored in online or blended learning environments (Kuhail, 2022). This study seeks to fill the gap by designing a GenAI chatbot to enhance existing interaction types in a blended synchronous learning (BSL) setting, providing online learners with timely responses and emotional support to improve learner emotional engagement.

2.3. GenAI in BSL and Engagement Studies

GenAI can generate meaningful content such as text, images, and audio based on training data (Feuerriegel et al., 2024). ChatGPT, a representative GenAI chatbot, was launched by OpenAI in November 2022 (Rahman & Watanobe, 2023). Unlike non-GenAI chatbots, ChatGPT recalls previous conversation parts, enabling coherent dialogue. A key feature of ChatGPT is its ability to process natural language queries, enabling learners to interact with it as they would with instructors (Rahman & Watanobe, 2023). Educational chatbots are designed specifically for teaching and learning. Advances in Large Language Models (LLMs) have enabled intelligent chatbots to offer personalized, interactive, and affordable guidance, and these tools could answer students' questions, provide feedback, and facilitate collaboration between learners and the instructors. In blended learning studies, Alshahrani (2023) identifies their ability of GenAI chatbots to provide personalized feedback and enhance sustainable blended learning environments, while also calling for empirical research on their impact on motivation and engagement. Furthermore, in a systematic review, Lo et al. (2024) analyze 72 studies on ChatGPT's impact, noting that emotional engagement remains underexplored. In this proposed study, the chatbot will play the teaching agent and motivational agent (Kuhail,2022). There are two interaction mechanisms between the chatbot and the learner:1) The learner actively initiates a conversation by asking the chatbot instructional questions related to the lecture. The chatbot responds with relevant explanations and provides emotional support; 2) When the system detects that the learner is experiencing a low level of emotional engagement, it proactively activates the chatbot. The chatbot then initiates a simple inquiry to prompt the learner to ask questions or offers emotional encouragement.

3. Research Design

3.1. Context and Participants

This study will be conducted with adult learners, who are taking higher degree courses at a Singaporean university. In each course, the number of participants is around 20. There will be 13 weeks of teaching sessions per semester, and each session is about 2-3 hours. 6-8 weeks of sessions will be conducted in the BSL mode.

3.2. Method (Educational Design Research)

This study will follow the educational design research approach. It is a systematic method that addresses complex educational problems and achieves deeper theoretical and practical knowledge by designing, developing, and implementing innovative educational interventions in authentic contexts (Plomp, 2013). This method fits this study well because integrating a GenAI chatbot in a BSL setting is a relatively new attempt, and little experience is available in existing studies. Therefore, this study will go through several iterations based on formative evaluation and reflection before an optimal solution is reached. More specifically, this study will involve preliminary research, prototyping, and assessment stages (Wang et al., 2017), as shown in Figure 2.

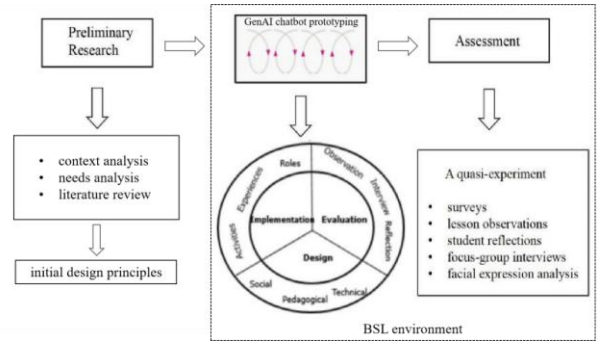


Figure 2. The process of designing and assessing the GenAI chatbot in the BSL environment

In the preliminary research stage, initial design principles will be proposed after context analysis, needs analysis, and literature review. The actual design, implementation, and formative evaluation of a GenAI chatbot in an authentic BSL environment will occur in the prototyping stage. The specific design of the chatbot will focus on pedagogical, social, and technical design perspectives (Wang et al., 2017). The design will be tested and improved in 3-4 rounds of iterations and end up with an assessment stage.

4. Assessment

During the assessment stage, a class using the GenAI chatbot will serve as an experimental group, and the other class with the same student profiles will be selected as the control group. The same instructor will teach the two classes on different days. It is going to be a quasi-experiment. The assessment will examine 1) if integrating a GenAI chatbot can enhance online learners' emotional engagement in the BSLE, and 2) what characteristics an interactive GenAI chatbot should have for emotionally engaging students, and 3) the students' attitudes and perceptions towards the design. Multimodal data, including facial expressions, lesson observations, surveys, interviews, and student observations, will be collected and analyzed during the prototyping and assessment stage.

5. Concluding Remarks

This paper presents our thoughts about utilizing a GenAI chatbot to emotionally engage online students in BSL. The study is currently at the proposal stage and detailed design and implementation has not yet been undertaken. The purpose of this paper is to share our current idea and collect feedback from other researchers and practitioners. We hope this proposal will inspire rigorous research and discussion, offering fresh perspectives and innovative suggestions to improve learner emotional engagement in BSL.

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