Generative AI as Personal Tutor? Designing a Study Planner Bot to Facilitate Online Creative Computing Education

1. Introduction

As online education gains increasing popularity among higher education institutions, scholars and educators become more interested in exploring methods to enhance the study experience for online learners (Dumford and Miller, 2018). Recent studies have examined the use of chatbot technologies in supporting online learning sessions and discovered the effectiveness and perceived ease to use to utilise chatbot to provide engaging learning environments and sustain students' motivation and interest throughout the academic term (Singh, Joesph and Jabbar, 2019; Du, Huang and Hew, 2021; Khalil and Rambech, 2022). Building upon prior studies on designing chatbots for self-regulated learning (SRL) (Du, Huang and Hew, 2021; Hew *et al.*, 2023), this study aims to investigate the integration of the latest generative machine learning models into the chatbot's data infrastructure. Additionally, it seeks to examine the deployment of such technology through social applications. By surveying user experiences, this research will assess user satisfaction of personalized study planning recommendations provided through the ubiquitous chatbot interactions on social platforms. The ultimate goal is to utilize these findings to inform future design of AI-powered personal tutor chatbots in SRL related research.

2. Research Background

Self-regulated Learning (SLR) in Online Education

Online or remote education has empowered students to partake in the learning process without constraints of time and location (Dumford and Miller, 2018). For this type of education, researchers highlight the role of self-regulation in shaping academic behaviours, as it can significantly influence students' engagement in learning, their academic performance, and overall success (Hartley and Bendixen, 2001; Dumford and Miller, 2018; Wong *et al.*, 2021). Zimmerman (2013, p. 142) identified three phases of self-regulation including forethought, performance, and self-reflection that cycle continuously. According to his theory, the forethought phase encompasses two subprocesses: task analysis and self-motivation beliefs/values, which is crucial for students to prepare effectively for a new learning journey (Zimmerman, 2013). Schwarzenberg and Navón (2020) further expanded upon this theory, observing that goal setting is a pivotal element within the forethought stage of self-regulation.

They posited that students intuitively assess all available information, such as their prior background and learning objectives, to determine an anticipated learning outcome and adjust study efforts. Additionally, their research demonstrated that providing clear goal-setting options can enhance students' self-regulation, ultimately promoting more effective study progression that is aligned with students' learning goals (Schwarzenberg and Navón, 2020).

Recent studies such as Wong et al. (2021) suggest that many online students lack adequate self-regulation skills, particularly in goal setting and planning. In these studies, researchers experimented with various technology-mediated methods, such as integrating prompts into lecture videos. These prompts aim to encourage students to consider their learning outcomes and guide them in formulating actionable goals (Wong et al., 2021). However, other researchers, such as Hew et al. (2023), have noted that the vagueness and immeasurability of such prompts limit their effectiveness. They propose the adoption of the SMART framework to develop more specific, actionable study goal questions (Hew et al., 2023).

Originally introduced by Doran (1981), SMART framework consists of five objectives for goal development: specific, measurable, assignable, realistic, and time-related (SMART). This framework has been employed in physical and medical education to encourage more executable steps (Aghera *et al.*, 2018). In this study, participants will interact with a study planner bot based on SMART criteria to receive their customized study plan.

Chatbot Technology for Online Education

Chatbot technologies, designed to interact with users through natural language, have been widely utilized in service-oriented fields including areas such as marketing, social media, and, more recently, educational programs (Adamopoulou and Moussiades, 2020; Følstad *et al.*, 2021). Based on a systematic review on chatbot use in education, Deng and Yu (2023) concluded three main roles for educational bots: teaching assistants, learning partners, and personal tutors. According to them (p. 3), chatbots acting as teaching assistants are responsible for "providing knowledge and feedback" as well as "scaffolding online learning". Chatbots as learning partners focus on "chatting and interacting with students", while those playing the role of personal tutors are tasked with "offering questions and answers", "guiding learning", and "giving quizzes". That said, the review shows that these roles often overlap to effectively support students' learning journey (Deng and Yu, 2023).

This proposed study emphasizes the role of educational bots in guided learning tasks for online education. Earlier studies such as Song and Kim (2021) developed a chatbot agent that encourages students to reflect on their learning plans and strategies, as well as assess their performance cyclically. Their research demonstrated that student interaction with the chatbot significantly improved self-regulated learning (SRL) levels. Similarly, Du, Huang and Hew (2021)

designed a rule-based chatbot to guide students in formulating and evaluating the feasibility of their learning goals during the SRL process. This approach was shown to increase students' awareness during goal setting and motivate them to establish specific goals. The research findings are also supported in their subsequent research (Hew et al., 2023).

Despite the substantial amount of research conducted on chatbots in an educational context, studies related to SLR still remain limited. From a technical perspective, prior studies such as Du, Huang and Hew (2021) are restricted to their chatbot usage on learning management systems (LMS) and did not provide students with a personalised study support. This study seeks to broaden the application of educational chatbots to social platforms and assess students' experience through more pervasive interactions.

3. Research Aims and Questions

As previously mentioned, this study is set within the "new normal" of online higher education, with the aim to explore technological interventions that could enhance students' online education experiences. Specifically, the study focuses on how to improve student study planning skills in their online learning processes through the use of a goal-setting bot. This research seeks to further investigate how to design an engaging and customised chatbot interaction for study planning. The goal is to create an intelligent user experience that positively influences student engagement, thereby leading to successful completion of their online education. Therefore, to guide the design of the chatbot and the subsequent research, the study proposes the following central research questions: **(1) How can a study planner chatbot be designed to facilitate self-regulated learning in online higher education? (2) How do students experience and perceive a conversational agent for study goal planning integrated within social applications?** By addressing these questions, the research aims to enhance current chatbot design methodologies by comprehending user needs, such as ease of use, within educational contexts. Furthermore, it seeks to explore the potential of actualizing such products to maximize their usefulness as technological interventions. This investigation will ultimately contribute to a better understanding of how to leverage technology to support and enhance the learning process in online higher education.

4. Methodology and Data

Designing Study Bot

This study applies the Discord API[1] and the OpenAI API[2] to develop a prototype bot for research purposes (see figure 01). The programming language is Python[3].

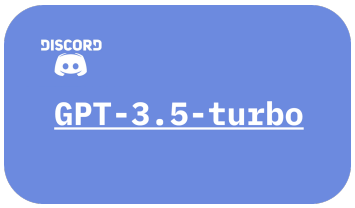

Fig.01 Study Bot Ideation

Defining Participants

The study is targeted at students aged 18 or above who have experience with online studies or are currently enrolled in a distance learning program in the field of creative technologies. Considering the specificity of the audience, the scope of the research, and the timeline, participant recruitment will begin through the researcher's personal contacts, then leverage the snowball sampling method to expand the participant pool. To ensure sample diversity, Kirchherr and Charles (2018) highlight the crucial role of diverse sample seeds. Therefore, the researcher will take into account the initial participants' demographics, educational backgrounds, and experiences with study planner applications. This approach will promote diversity within the initial sample seed and influence the diversity of future participants in the study.

Experimental Process

Upon giving their consent, each participant will be asked to interact with the chatbot for a minimum of 10 minutes for data analysis. Additionally, participants will be asked to complete a brief chatbot evaluation survey. This survey is designed to collect user feedback on the usability testing of the study bot including the recommendation algorithms and the acceptability of the deployed technology, as informed by the Technology Acceptance Model (TAM).

Measuring User Experiences

Several studies (e.g., Jadeja and Varia, 2017; Jain *et al.*, 2018; Casas *et al.*, 2020; Borsci *et al.*, 2022) have performed systematic review to investigate the design trends and research methodologies employed in designing for human-chatbot interaction. Focused on user

[1] https://discord.com/developers/applicationsfull
[2] https://openai.com/blog/openai-api
[3] https://www.python.org/

perceptions of AI study bot facilitated by social applications, the study will use five-point Likert-type questionnaire to measure **user satisfaction** (pragmatic and hedonic) by looking into attributes such as **interaction engagement**, **usefulness, ease to use,** and **sense of trust**. However, the study acknowledges the limitations of using subjective reports to inspect the study planner bot's usability. To counteract these limitations, the study will also use **open-ended questions** to gather user feedback on their chatbot experience.

5. Ethical Considerations

Data Transparency and Confidentiality

The research acknowledges participants' concerns about the usage and storage of personal data such as educational background enquired by the chatbot interaction and their feedback gathered from the user experience questionnaire. To ensure user privacy and data protection, all feedback from participants, including survey responses and conversation transcripts, will be collected anonymously stored securely on UAL's cloud service. Participants will be thoroughly informed about the data protection measures in place. This includes the use of Adobe Photoshop to meticulously erase any identifiable information inadvertently captured during user interactions. In addition, the consent form will clearly outline potential uses of participant data, such as for report writing. Lastly, the study will explicitly detail OpenAI's latest policy regarding data submitted through its API before initiating each experiment. All these measures combined will ensure the highest level of transparency and respect for the participants' privacy.

Design Biases and Human Cognition

The study also recognizes ethical considerations inherent in the design of user experience (UX) and language model-powered recommendation systems. For a more inclusive UX, the researcher employs strategies suggested by earlier studies, such as those by Feine *et al.* (2020) and Borau *et al.* (2021), to mitigate gender bias in the creation of the chatbot persona. For instance, careful consideration is given to stereotypes that might be inadvertently perpetuated through features like the chatbot's name and communication style. The chatbot is purposefully designed with a non-gendered, mechanical tone to avoid reinforcing gender roles typically associated with assistant-type chatbot designs. Furthermore, the researcher will add functions that can manage the reciprocation of negative language inputs. This approach is intended to provide a safe digital environment for participants to use.

Throughout user engagement, there's a potential that participants could develop certain cognitive biases towards personalized study recommendations. Latest research suggests that ChatGPT might not always excel in sequential and direct recommendation tasks (Liu *et al.*,

2023). To counteract this and minimize the persuasiveness of AI algorithms, this study will incorporate a warning message as the starting point of the chatbot interactions and encourage participants to experiment multiple times. By doing so, the study can highlight the inherent limitations of AI recommender systems and promote transparency when designing the UX of AI. These approaches can also help manage user expectations concerning the system's performance.

6. Reference List

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