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City University of Hong Kong

Peer-Based Learning in Engineering Education Through Integrating CityU GPT Chatbot and Surprisingly Popular Algorithm

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Principal Investigator: Prof. Rui LUO

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Abstract:

Research has consistently demonstrated the significant positive impact of peer-based learning methodologies on student outcomes (Polkowski et al., 2020). Yet, the integration of AI technologies, particularly generative AI such as ChatGPT, poses new challenges. Concerns over privacy, including potential leaks of students' learning history and personal data (Khan et al., 2021), as well as algorithmic biases influencing AI outputs (Bakhshandeh et al., 2021), could potentially undermine the efficacy of peer-based learning (Huang and Marechal, 2023; Nadeem et al., 2023).

The primary objective of this proposal is to adapt the CityU GPT Chatbot (CityU GPT) for peer-based learning, aiming to foster an autonomous, collaborative, and AI-enhanced learning environment for science and engineering students at CityU. This proposal intends to utilize the Surprisingly Popular (SP) algorithm and integrate it with ChatGPT. Developed by researchers at MIT and Princeton, the SP algorithm (Prelec et al., 2017) has proven effective in group decision-making regarding factual propositions (Rutchick et al., 2022), making it suitable for undergraduate teaching where the content is predominantly factual and established.

The proposed project will break down each lecture into segments, each one focusing on a specific key concept. For each segment, CityU GPT generates two statements about the concept, one of which is deliberately embedded with a factual error, to stimulate student assessment using the SP algorithm. The diversity of student academic backgrounds and the difficulty of the concept will be revealed via the outcome of the SP algorithm, and peer-based learning will be conducted accordingly. Students will engage in group-based activities, adopting roles as both leaders and listeners to bolster their learning experience. Student feedback is sought to improve the quality of the CityU GPT-generated statements, thereby helping to optimize the AI-generated content to better meet the students' learning needs. Student learning outcome will be evaluated in a three-level framework. This framework will assess student learning outcomes at differing scales: the individual segment level, the overall lecture level, and the comprehensive course level.

The proposed project will be launched primarily in "Engineering Statistics and Experimentation" (ADSE2100) and "Industrial Data and Manufacturing Analytics" (ADSE4005), with approximately 35 students mostly majoring in Intelligent Manufacturing Engineering (ITME) but also welcoming students from other science and engineering disciplines. The proposed methodology is scalable and can be



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adapted to various other courses within the College of Engineering. The overarching goal is to harness the potential of CityU GPT to enhance student learning outcomes. Additionally, the project seeks to boost students' proficiency and familiarity with CityU GPT, thereby enriching their educational journey. This project aligns with the University's effort to embrace the generative AI technology into teaching and learning activities.