

## **A Complex Dynamic Systems Theory Perspective on Underprivileged Students' Agency in Technology-Enabled English Supplementary Tutoring**

In many non-English-speaking contexts, English has the highest demand in supplementary tutoring since it is usually the most challenging subject, particularly among underprivileged students (i.e., those in poverty) who lack English learning resources. As paid supplementary tutoring continues to widen achievement gaps and exacerbate educational inequalities, more non-governmental organisations (NGOs) worldwide have offered fee-free one-on-one supplementary tutoring for underprivileged students to support their out-of-school English learning. However, challenges in recruiting and retaining volunteer tutors persist, resulting in some students frequently losing their tutors, and many waiting to be allocated one. To address this issue, some NGOs in Hong Kong have provided free technology-enabled English supplementary tutoring (TEST) powered by artificial intelligence (AI) (e.g., avatar tutors, AI-generated exam questions) for underprivileged students' self-learning as they lack access to human tutors. Whether TEST can facilitate underprivileged students' English learning and ultimately serve as an equaliser for educational opportunities largely depends on students' agency. This study aims to understand underprivileged students' experience in TEST and identify elements that afford and constrain their exercise of agency in the complex English learning process. Recognising the multifaceted, emergent, and context-dependent nature of learner agency, this study will adopt Complex Dynamic Systems Theory as the theoretical framework. It will employ a narrative inquiry approach, involving 24 Hong Kong underprivileged secondary school students participating in TEST provided by three NGOs. Data collection will span one year and include three rounds of in-depth interviews, reflective journals, informal conversations, system interaction logs, field observations, and interviews with parents and tutors. The collection of multiple data allows for an in-depth exploration of students' experiences to identify and capture their dynamic agency development over time. Aligned with narrative inquiry principles, data analysis will follow an iterative, emergent, and interpretative process, attending to temporality, sociality, and place. The findings will inform the design and implementation of technology-enabled educational interventions that facilitate language learning. By providing insights into how underprivileged students navigate and utilise TEST, this study can guide educators, policymakers, and EdTech developers in creating more inclusive and empowering learning environments. Furthermore, the focus on learner agency in this context represents a novel effort to understand how language learning can mediate individuals' growth as human beings who claim control over and ownership of language learning in complex, dynamic and technology-enhanced environments. Ultimately, this research aims to contribute to promoting equal educational opportunities for all in the increasingly digital and technology-driven educational landscape.