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Designing for Autonomy in EFL: Implementing an AI–VR Virtual Speaking Partner to Enhance Independent Learning in Suburban Areas

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Abstract

This study addresses a persistent gap in fostering autonomous speaking development among EFL learners in suburban, resource-constrained environments, where access to high-quality interactional practice and sustained self-regulation supports is limited in digitally mediated settings. The research aims to design, implement, and evaluate an AI–VR-enabled Virtual Speaking Partner (VSP) that scaffolds independent speaking practice and self-regulated learning in junior high school EFL programs. Adopting a research-and-development design informed by constructivist and self-regulated learning theories, the study carried out needs analysis, iterative prototyping, usability testing, and school-based implementation. The intervention integrated the VSP into an extracurricular digital platform to deliver simulated, context-rich dialogues with adaptive AI feedback and VR-based situational immersion. Evaluation data consisted of speaking performance assessments, learner autonomy/self-regulation scales, system logs, and qualitative learner feedback, analyzed through mixed-methods approaches. Findings indicated notable gains in speaking fluency, interactional management, and confidence, alongside increased indicators of learner autonomy such as planning, monitoring, and strategic help-seeking. Students and teachers further reported high levels of usability and feasibility. The study demonstrates that coupling AI-driven feedback with VR-mediated communicative scenarios can meaningfully enhance autonomous EFL speaking practice in suburban contexts. Implications include a practical development framework for school-level implementation, guidance for integrating formative analytics into autonomy-oriented pedagogy, and policy relevance for scaling immersive language technologies in under-resourced educational ecosystems.

Keywords: *Learner Autonomy; EFL Speaking; Virtual Speaking Partner; Artificial Intelligence; Virtual Reality.*

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INTRODUCTION

Persistent disparities in access to high-quality language learning opportunities continue to constrain the development of communicative competence especially speaking among EFL learners in suburban and semi-peripheral schooling systems, where limited instructional resources, reduced exposure to authentic interaction, and insufficient teacher support impede progress in oral proficiency within increasingly digital learning ecologies. Addressing these systemic constraints is urgent because speaking proficiency functions as a core dimension of communicative competence and a transferable soft skill for academic progression and employability in multilingual, technology-rich societies (Godwin-Jones, 2021).

While communicative and task-based pedagogies have advanced practice, speaking ability does not emerge passively; it requires sustained, feedback-rich interaction and scaffolded opportunities for planning, practice, and reflection. In suburban environments, however, student talk time and opportunities for authentic, context-sensitive interaction remain constrained, curtailing the development of fluency, interactional management, and confidence. Concurrently, accelerating innovation in educational technology has introduced conversational agents and immersive media, yet the pedagogical integration of Artificial Intelligence (AI) and Virtual Reality (VR) to cultivate autonomous speaking practice in low-resource contexts is still under-specified in applied classroom development literature and in school-level implementation models (Parmaxi, 2023).

Building on autonomy and self-regulated learning perspectives and the importance of social presence for communicative development, this study positions AI-driven feedback and VR-mediated situational immersion as complementary affordances for simulating realistic, low-stakes speaking opportunities outside regular class time. However, much existing work is concentrated in well-resourced, urban settings, leaving a practical gap for scalable, school-embedded solutions in suburban systems. This article addresses that gap by reporting the development and validation of an AI–VR–enabled Virtual Speaking Partner (VSP) designed to scaffold independent speaking practice, adaptive feedback, and reflective self-regulation among junior high school EFL learners in suburban Indonesia.

The study's aim is to design, implement, and formatively evaluate a VSP that enhances autonomous speaking practice in a resource-constrained context. The guiding research question is: How, and to what extent, can an AI–VR–enabled Virtual Speaking Partner support improvements in learners' speaking performance and autonomy-related behaviors in suburban junior high schools? To answer this question, the study adopts a research-and-development (R&D) approach integrating needs analysis, iterative prototyping, usability and feasibility testing, and school-

based piloting within extracurricular digital platforms. The evaluation draws on mixed evidence sources pre/post speaking assessments, learner-reported autonomy indicators, and user experience feedback to examine pedagogical value and implementation feasibility.

The remainder of this article proceeds as follows. First, it situates the study within theoretical and empirical work on learner autonomy, self-regulated learning, and technology-mediated speaking development in EFL. Second, it details the R&D methodology, VSP design rationale, and integration within the suburban school ecology. Third, it presents the formative and outcome evidence from the pilot implementation. Finally, it discusses implications for autonomy-oriented pedagogy, equitable technology integration in under-resourced environments, and directions for scaling and future research.

RESEARCH METHOD

This project followed a research and development (R&D) design to create, refine, and formatively evaluate an AI–VR Virtual Speaking Partner (VSP) for autonomous EFL speaking practice in suburban junior high schools. An iterative cycle needs analysis, prototyping, expert validation, limited field trials, and revision was selected to balance theoretical grounding with classroom feasibility and learner usability, consistent with established development models in educational technology and language education research design (Creswell, 2015).

Setting and participants.

The study was conducted in two public junior high schools in suburban East Java, Indonesia during the 2023–2024 academic year. Participants for the limited field trial were a purposive sample of 30 eighth- and ninth-grade EFL learners (ages 13–15) with comparable curricular exposure. Inclusion criteria were regular attendance in the English program and parent/guardian consent. Data were anonymized and handled according to institutional ethics procedures; school-level approval and written consent/assent were obtained prior to data collection.

Theoretical foundations informing design Design choices were guided by; Communicative competence and interactionist views emphasizing feedback-rich, task-based speaking practice aligned to real-world scenarios (Huang & Liaw, 2018). Self-regulated learning, operationalized as cycles of forethought, performance, and reflection to build autonomy in planning practice, monitoring progress, and strategy use (Kessler, 2018). Social presence and situated context to support confidence and interactional management in simulated communicative episodes (Liu et al., 2024).

MATERIALS, EQUIPMENT, AND SOFTWARE

AI component: a conversational engine to deliver adaptive prompts, turn-taking, recasts, and formative feedback on fluency and appropriateness. VR component: smartphone-compatible 3D scenarios (e.g., school office, public service counter, market) deployable via low-cost

head-mounted displays; assets were optimized for low bandwidth to fit suburban infrastructure constraints.

Delivery platform: a web-mobile interface integrated with the schools' extracurricular digital learning environment, enabling access outside class hours and basic learning analytics (usage time, turns taken, completed tasks).

Procedures and development workflow

1. Needs analysis

Classroom observations, semi structured teacher interviews, and learner questionnaires identified speaking pain points (limited talk time, lack of authentic contexts, low feedback availability) and access constraints (device availability, bandwidth limits, scheduling). Findings informed scenario selection, feedback granularity, and session length.

2. Prototyping and content authoring

Dialogue tasks were specified following task based principles (clear goal, information gap, outcome) and scaffolded across difficulty levels. Prompts and feedback moves were scripted to align with autonomy behaviors (planning, self monitoring, help seeking). Early prototypes were evaluated in hallway usability tests with 8 non sample students to refine navigation, prompt clarity, and time on task.

3. Expert validation

Three educational technology specialists and two EFL methodologists reviewed version 0.9 of the VSP for content validity, pedagogical alignment, linguistic appropriateness, cognitive load, and technical reliability. Reviewers used a structured rubric (4 point scale) and provided open comments; revisions addressed feedback on turn length balance, error tolerance in speech recognition, and clearer visual affordances for help and replay.

4.Limited field trials

Two sessions per school were conducted over two weeks (total four sessions), facilitated by an EFL teacher and a research assistant. Each session included a brief orientation, two VSP tasks (A2–B1 difficulty), and a short reflection. Observations focused on engagement, task completion, spontaneous speech attempts, and help feature use.

5. Data collection

Quantitative: pre/post brief speaking tasks rated with an analytic rubric (fluency, interactional management, appropriateness; 0–5 scale); learner self report scales for confidence and autonomy behaviors (planning, monitoring, strategy use; 5 point Likert); system logs (session count, turns, time on task, help/replay clicks).

Qualitative: short reflective journals after each session; post trial semi structured interviews with a subset of learners (n=12) and the two EFL teachers; field notes documenting usability issues and facilitation demands.

DATA ANALYSIS

Descriptive statistics summarized engagement metrics and rating distributions. Within group pre/post comparisons used paired samples t tests for speaking subscales and self report measures; normality was checked via Shapiro–Wilk and visual

inspections. Effect sizes were reported as Cohen's d with 95% CIs. Inter rater reliability on speaking ratings (two raters) was assessed using weighted Cohen's kappa and ICC(2,k) for absolute agreement.

Table 1. Data Analysis Procedures

No	Analysis Procedure	Technique/ Method	Description
1	Descriptive Statistics	Descriptive statistics	Summarized engagement metrics and rating distributions
2	Pre-Post Compariso n	Paired samples t-tests	Compared within-group pre/post scores on speaking subscales and self-report measures
3	Normality Check	Shapiro–Wilk; visual inspection	Assessed normality using statistical test and visual methods
4	Effect Size	Cohen's d (95% CIs)	Reported magnitude of effects with confidence intervals
5	Inter-rater Reliability	Weighted Cohen's kappa	Assessed agreement between two raters on speaking ratings
6	Inter-rater Reliability	ICC (2,k) absolute agreement	Assessed consistency between two raters

Qualitative data underwent thematic coding combining a priori categories (engagement, confidence, perceived feedback usefulness, barriers) with inductive codes emerging from journals/interviews. Convergence across quantitative trends and qualitative themes was examined for triangulation.

ETHICAL CONSIDERATIONS

Participation was voluntary with no academic penalties or grading implications. Learners could withdraw at any time. Data were de identified; recordings used solely for research and rater training. The VR content was screened for motion comfort; session lengths were capped and opt out was permitted for discomfort. School approval and parental consent/learner assent were secured prior to implementation.

Reproducibility notes to enable replication, the appendix provides: task outlines and prompts by scenario; the speaking rating rubric; the autonomy/self regulation items; the expert validation rubric; and the interview protocol. Platform specifications (minimum device and bandwidth requirements) and session scripts are also described for implementers in similar contexts.

RESULT AND DISCUSSION

The Virtual Speaking Partner (VSP) technology utilizes a systematic process for improving EFL students' speaking skills,

encompassing three stages: orientation, activity, and reflection-evaluation, all facilitated by AI and VR-based digital environments. At each stage, the orientation points system (aim, motive, knowledge, and experience) guides students through the process of independent learning and self-management. These orientation points are vital for enhancing the quality of speaking skills, as they enable students to identify the purpose and motivation of communication, activate existing knowledge, and utilize prior experiences effectively.

The orientation stage serves to introduce students to the significance of improving their speaking skills, outlining the conditions required for enhancing communicative competence. During this stage, students familiarize themselves with the course goals, the specific language tasks at hand, and the evaluation methods used to assess language acquisition. It also covers the various forms of interaction, such as synchronous and asynchronous teacher-student engagement.

The activity stage focuses on fostering students' communicative skills through consistent, purposeful, and active language practice. In this phase, students engage with the VSP technology powered by AI and VR, which simulates real-world language interactions. This allows them to apply language skills in contexts that reflect authentic communication. Here, the feedback and corrections provided by the system help students refine their skills, enabling them to independently navigate language tasks and interactions.

The reflection-evaluation stage focuses on assessing students' progress in improving their speaking skills. It allows for a reflective analysis of their communicative abilities and identifies areas that need further improvement. During this stage, students are encouraged to evaluate their learning experience and engage in self-assessment through activities such as online discussions, project-based tasks, and quizzes, which track their language development over time.

In each stage, priority is given to teaching methods that foster problem-solving, interactive learning, and active student participation in digital environments. By minimizing passive, repetitive learning activities and promoting cognitive and verbal engagement, the VSP technology encourages students to take ownership of their language learning and enhances both real and virtual communication capabilities. As students progress through these stages, they transition from being passive recipients of language knowledge to active participants in communicative tasks.

Over time students move from guided activities to independent, self-sufficient communicative performances signaling their growth into more confident and creative language

users.

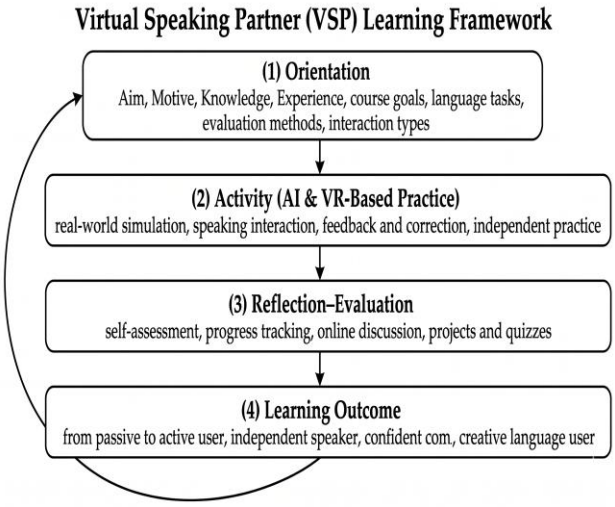

Figure 1: Virtual Speaking Partner (VSP) Learning Framework

In an initial diagnostic study conducted at Muhammadiyah universities in the Bungo and Kerinci districts, it was found that many students experienced significant challenges in speaking English. More than half of the students struggled with rapid word recall due to limited vocabulary, while others expressed concerns about understanding their interlocutors. This lack of confidence often led them to avoid initiating conversations, resulting in a lack of engagement with the learning process. Additionally, a considerable number of students were unable to assess their own speaking abilities.

Despite their active use of digital tools like mobile apps, podcasts, and language practice platforms (e.g., Quizlet and WordWall), students reported that these tools were often not systematic or tailored to their needs. They noted that such resources did not effectively promote dialogue skills, speech etiquette, or the ability to engage with English-language materials (Putra et al., 2023, 2026; Putra & Yanti, 2025). This feedback emphasized the need for a more targeted approach to improving speaking skills, particularly in suburban areas where access to immersive language learning environments is limited.

A pilot group of 30 second-year students from English Education programs participated in an experiment using the VSP technology. This intervention was designed to develop students' speaking skills in a controlled, digital environment. The experiment utilized the VSP prototype, combining AI and VR technologies to facilitate interactive and immersive learning experiences. Throughout the experiment, the students engaged with various digital tools within the VSP platform, such as voice recognition and interactive dialogues, to simulate real-world conversations.

The orientation stage involved introducing students to the features and functions of the VSP technology, demonstrating how the system's orientation points could guide them through the learning process. Students were encouraged to set personal goals for their speaking practice and familiarize themselves with the virtual environments they would interact with. The teacher played a significant role in guiding students through this stage, providing feedback and motivating them to engage with the system's capabilities.

During the activity stage, students used the VSP platform to engage in regular speaking exercises, with AI and VR

supporting the simulation of realistic scenarios. The system tracked students' progress, offering corrective feedback and suggestions for improvement. Interactive elements such as chatbots and VR simulations were used to create a dynamic, context-rich environment where students could practice speaking skills in diverse settings, such as ordering food, attending a meeting, or making small talk.

In the reflection-evaluation stage, students were prompted to reflect on their performance through self-assessment tools and peer evaluations. They also engaged in group discussions via the platform, providing opportunities for collaborative learning and feedback (Radianti et al., 2020). The system collected data on students' speaking accuracy, fluency, and engagement levels, which helped teachers assess overall performance and identify areas for further improvement.

DISCUSSION

The implementation of the Virtual Speaking Partner (VSP) technology in the experimental group demonstrated consistent positive dynamics in the development of EFL students' communicative competence. Observations conducted across the diagnostic, orientation, activity, and reflection stages revealed that the use of AI- and VR-assisted environments provided significant improvements in students' speaking performance, confidence, and overall communicative awareness compared to traditional digital tools. Specifically, students showed notable growth in fluency, accuracy, and the ability to sustain conversations in simulated real-world contexts.

The orientation points system (aim, motive, knowledge, and experience) proved to be a critical factor shaping students' learning trajectories. At the orientation stage, students who previously struggled with motivation and goal-setting reported clearer awareness of their communicative objectives (Yang et al., 2020). This shift was reflected in more purposeful participation during the activity stage, where learners actively engaged in simulated dialogues resembling authentic real-life communication. Consequently, the experimental group displayed enhanced readiness to initiate interactions, gradually overcoming their initial reluctance and avoidance behaviors.

During the activity stage, the immersive nature of the VSP platform enabled students to transition from static, repetitive vocabulary drills common in mobile apps toward dynamic, context-rich speaking practices. Unlike general-purpose platforms like Quizlet or WordWall, the VSP technology aligned directly with the students' linguistic needs, allowing for immediate corrective feedback and reinforcement through AI voice recognition and VR-based simulations (Tai et al., 2022). As a result, students developed not only lexical recall and pronunciation accuracy but also pragmatic competences such as turn-taking, speech etiquette, and topic maintenance. These are essential components of communicative proficiency,

particularly in second-language learning environments.

The reflection-evaluation stage further reinforced these gains. Self-assessment tools, integrated quizzes, and peer evaluation activities enabled learners to critically examine their progress, fostering metacognitive awareness of language acquisition. Students reported increased confidence in evaluating their own proficiency and setting new learning goals. This finding is particularly important in suburban university contexts, where teacher-led one-to-one interventions are limited (Zimmerman, 2000). By internalizing reflective practices, students began to demonstrate autonomy in managing their speaking development, confirming the effectiveness of the VSP model in bridging the gap between teacher guidance and independent learning.

The distribution of communicative skill levels across the experimental group further underscores this progress. The proportion of students remaining at a reproductive (low) level of speaking competence decreased significantly, while those achieving reproductive-creative (average) and creative (high) levels increased markedly (Huang & Liaw, 2018). Statistical validation through comparative diagnostics confirmed the reliability of these outcomes, underscoring that the VSP technology not only facilitated language practice but actively strengthened learners' communicative strategies in diverse contexts.

These findings align with international studies emphasizing the role of digital immersion and adaptive feedback mechanisms in second language acquisition (Qiao & Zhao, 2023). However, the present study extends prior research by situating this innovation within resource-limited suburban university settings, thereby demonstrating that advanced tools such as AI- and VR-based systems can prove effective beyond urban, resource-rich contexts (Aisyah, 2025). It also highlights the importance of systematic scaffolding through orientation points, which supported both linguistic and metacognitive growth in participants.

CONCLUSION

The Virtual Speaking Partner (VSP) technology for improving students' speaking competence in the university digital educational environment has proven its effectiveness in three interrelated aspects: didactic, enriching, and personal. The didactic aspect was expressed through the structured orientation–activity–reflection sequence, which supported the expansion of linguistic knowledge, guided vocabulary activation, and mastery of authentic communicative strategies. The enriching aspect was reflected in the simultaneous improvement of multiple components of speaking skills, including fluency, pronunciation accuracy, pragmatic competence, reflective awareness, and the integration of digital interaction skills. The personal aspect became evident in the development of essential learner qualities,

such as self-confidence, autonomy, creativity, intrinsic motivation, and readiness to perform in real-life communicative contexts, shaped by engagement with AI and VR based immersive environments.

The results of applying the VSP technology have shown that this innovative model realizes its didactic potential most effectively when integrated into a digitalized foreign language environment that combines formal classroom instruction with self-directed, immersive learning experiences. We are confident that, when implemented through AI- and VR-supported platforms, the technology has a universal pedagogical nature and can be widely applied to strengthen spoken communication skills across various academic disciplines and training programs. Nevertheless, the successful and broad application of this system requires a parallel increase in digital literacy levels among both teachers and students, ensuring they can fully utilize the technological features offered by immersive platforms.

The empirical findings of the study further enabled us to formulate methodological principles for applying VSP technology within higher education settings: (1) ensuring interactive communication and dynamic collaboration among students, digital content, teachers, and peers within immersive communication scenarios; (2) organizing speaking tasks hierarchically from simple to complex, in accordance with didactic progression principles, while embedding them in AI- and VR-enhanced dialogues; (3) implementing "soft" instructional management, wherein teachers guide learners' activities both in offline and online modes but with a gradual transition toward self-management and autonomy; (4) embedding reflective practices into the learning cycle using clearly defined assessment criteria, supplemented by diverse formats such as quizzes, peer evaluation, and project-based learning; and (5) creating favorable motivational conditions that foster cognitive interests, creativity, self-sufficiency, and sustained activity, achieved by renewing and diversifying authentic resources within the digital educational environment.

At the same time, careful attention must be directed to potential risks in implementing the VSP model. Challenges of both technical and pedagogical nature were noted: (1) limitations in platform accessibility due to unstable internet connections or restricted availability of VR hardware in suburban areas; (2) partial reliance on asynchronous learning modes, which may curtail opportunities for spontaneous verbal practice and thus require complementary synchronous learning measures such as video conferencing and virtual consultations; (3) possible communicative detachment between teachers and students in purely digital environments, complicating the development of reactivity and situational awareness in free speech, which are crucial for mastering unprepared discourse; and (4) inconsistent student adherence to timelines and independent learning tasks, which can

weaken the intensity and continuity of skill development when using the VSP system.

Considering these factors, we strongly affirm that the VSP technology carries both the necessary and sufficient linguistic-didactic potential to be practically and effectively implemented in higher education institutions, even in suburban settings with limited direct access to authentic communicative environments. By combining immersive AI- and VR-based features with a structured pedagogical design, this technology not only enriches traditional EFL teaching practices but also establishes a promising, universal model for advancing students' communicative competence in the context of digitalized language education.

In conclusion, the VSP technology represents a promising solution for improving speaking skills among EFL students in suburban Indonesia. By integrating AI and VR, this research provides an innovative approach to language learning that overcomes geographical and infrastructural limitations, offering students in underserved areas a pathway to improve their language skills and become more confident communicators.

REFERENCES

Aisyah, S. (2025). The Role of Immersive Technology and AI-Based Adaptive Learning in Enhancing Intercultural Competence of EFL Students. *International Journal of Innovation and Thinking*, *2*(8), 517–523. https://doi.org/10.71364/ijit.v2i8.73

Creswell, J. (2015). Riset pendidikan: Perencanaan, pelaksanaan, dan evaluasi riset kualitatif & kuantitatif. *Yogyakarta: Pustaka Pelajar*.

Godwin-Jones, R. (2021). *Evolving technologies for language learning*.

Huang, H.-M., & Liaw, S.-S. (2018). An analysis of learners' intentions toward virtual reality learning based on constructivist and technology acceptance approaches. *International Review of Research in Open and Distributed Learning*, *19*(1). https://doi.org/10.19173/irrodl.v19i1.2503

Kessler, G. (2018). Technology and the future of language teaching. *Foreign Language Annals*, *51*(1), 205–218. https://doi.org/10.1111/flan.12318

Liu, C.-C., Guo, Y., Hwang, G.-J., Tu, Y.-F., & Wang, Z. (2024). Effects of an article-structure strategy-based spherical video-based virtual reality approach on EFL learners' English reading comprehension and learning conceptions. *Interactive Learning Environments*, *32*(6), 2647–2664. https://doi.org/10.1080/10494820.2022.2155840

Parmaxi, A. (2023). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive Learning Environments*, *31*(1), 172–184. https://doi.org/10.1080/10494820.2020.1765392

Putra, Y. I., Irawan, D., & Idrus, A. (2026). Offline Internet Innovation: New Opportunities for Entrepreneurs in Remote Districts. *Jurnal Inovasi Pendidikan Dan Teknologi Informasi (JIPTI)*, *7*(1), 182–190. https://doi.org/10.52060/4mq3ej90

Putra, Y. I., Kusmana, A., & Fitrah, Y. (2023). Falsifikasi sebagai pedoman Memahami Informasi di Media Sosial

secara Objektif. *Jurnal Inovasi Pendidikan Dan Teknologi Informasi (JIPTI)*, *4*(2), 289–295. https://doi.org/10.52060/pti.v4i2.1515

Putra, Y. I., & Yanti, F. (2025). Pengembangan Modul Berbantuan Augmented Reality Pada mata pelajaran Informatika Kelas VII Di SMP Negeri 1 Muara Bungo. *JURNAL KEILMUAN TEKNOLOGI DAN PENDIDIKAN TERPADU*, *1*(1).

Qiao, H., & Zhao, A. (2023). Artificial intelligence-based language learning: illuminating the impact on speaking skills and self-regulation in Chinese EFL context. *Frontiers in Psychology*, *14*, 1255594. https://doi.org/10.3389/fpsyg.2023.1255594

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, *147*, 103778. https://doi.org/10.1016/j.compedu.2019.103778

Tai, T.-Y., Chen, H. H.-J., & Todd, G. (2022). The impact of a virtual reality app on adolescent EFL learners' vocabulary learning. *Computer Assisted Language Learning*, *35*(4), 892–917. https://doi.org/10.1080/09588221.2020.1752735

Yang, F.-C. O., Lo, F.-Y. R., Hsieh, J. C., & Wu, W.-C. V. (2020). Facilitating communicative ability of EFL learners via high-immersion virtual reality. *Journal of Educational Technology & Society*, *23*(1), 30–49.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In *Handbook of self-regulation* (pp. 13–39). Elsevier. https://doi.org/10.1016/B978-012109890-2/50031-7