Editorial

Examining the Roles of Technology in Sustaining Language Teaching and Learning

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The use of technology is currently pervasive in language teaching and learning, and technology adoption is especially important to sustain teaching and learning, which could be affected by unexpected events. Furthermore, studies suggest that technology-enhanced language teaching and learning is an innovative approach to enhancing students' language acquisition and communication skills [1] (pp. 70–105), [2] (pp. 113–129). By integrating technology into language instruction, teachers can engage students in interactive and immersive learning experiences that simulate real-world language use scenarios, making the learning process more effective and authentic. This is especially beneficial for regions or countries where language education is lagging due to insufficient language teachers and resources [3].

Teachers use technology in various forms to cater to students' needs, including the use of online learning resources such as MOOCs [4], social networking sites [5] (pp. 181–196), digital games [6] (pp. 877–904), interactive whiteboards, language-learning apps, and, recently, artificial intelligence [7]. These tools provide a wealth of opportunities for language learners to practice their skills in a supportive and engaging environment. Technology also facilitates self-directed learning, enabling language learners to access materials, conduct learning at their own pace, and focus on areas where they need the most support [8,9].

For countries or regions that are short of teachers who are native target language speakers, one of the key benefits of technology adoption is the ability to provide language learners with more authentic language exposure. Technology tools can simulate real-world situations, allowing learners to engage with language in a natural and meaningful way. This type of learning experience can help learners develop a deeper understanding of language structure, vocabulary, and communication skills.

Technology-enhanced language teaching and learning also encourages active participation and collaboration among learners. Many technology tools allow learners to interact with other users, making it easy to practice language skills in a social setting. This type of social interaction can help develop confidence and fluency in the target language while also providing opportunities for cultural exchange and mutual understanding.

Overall, technology has revolutionized the way we approach language teaching and learning, empowered teachers to personalize instruction, and particularly, sustained language teaching and learning, which is fragile by unexpected events [3]. The integration of virtual reality (VR), augmented reality (AR), and generative artificial intelligence (AI) has enabled students to engage in hands-on learning experiences, fostering greater interest and participation. Additionally, online platforms, digital games, and mobile learning tools have facilitated personalized learning paths based on individual students' needs, preferences, and pace. Moreover, digital games and other mobile learning tools have made teaching and learning more tailored to students' needs, providing a personalized path for each student based on their pace and preferences. Shifting from traditional classrooms to technology-enhanced teaching and learning, teachers and students face challenges [10]

(187–190), but technology has bridged the gap between the traditional classroom and the real world, making learning more relevant and applicable. This way, students' learning interests and motivations are largely improved, which leads to their academic retention and lifelong learning.

Teachers, too, have benefited from technology's integration into the classroom. Digital tools have simplified the planning and preparation process, allowing teachers to focus more on individual student needs and providing teachers with opportunities to improve their technological, pedagogical, and content knowledge (TPACK). Through data analytics, teachers can monitor students' progress, identify areas requiring additional support, and customize instruction accordingly, ensuring that each student receives tailored teaching based on their strengths and weaknesses. This level of customization ensures that every student is being taught according to their unique strengths and weaknesses. In a word, technology has empowered teaching and learning by providing more personalized, engaging, and practical learning experiences for students. As technology continues to advance, we can expect even more innovative and effective ways to use it in either a formal educational setting or an informal setting to transform the education landscape.

Language education plays a crucial role in fostering efficient and sustainable communication and cultural understanding in an increasingly interconnected world. In this editorial, we will provide an overview of eight research articles that explore the intersection of technology and language education. Among them, seven are original research articles, and one is a review article. These articles shed light on pedagogical design, self-regulation, autonomous learning, linguistic repertoires, game-based learning, mobile applications, multimodal literacies, and digital justice, etc.

In the article entitled "Pedagogical Design in Technology-Enhanced Language Education: A Scoping Review," Ting Liu and coauthors Zhipeng Zhang and Xuesong (Andy) Gao conducted a comprehensive review to explore the incorporation of technology in language teaching. They reviewed 51 studies on language teachers' technology use and applications of technology in technology-enhanced language education between 2012 and 2022. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, this review paper identified four clusters of topics these studies focused on: teachers' perceptions, technological application practice and experience, technological pedagogical content knowledge (TPACK), and teachers' role as pedagogical designers. This review article highlights further consideration of language teachers' roles as pedagogical designers in technology-enhanced language education to integrate technology into language education and facilitate sustainable language teaching and learning.

The study titled "Online English Learning Engagement among Digital Natives: The Mediating Role of Self-Regulation" was conducted by Xiaoqi Wang and coauthors Lianghong Hui, Xin Jiang, and Yuhan Chen. This study focused on examining Chinese digital natives' self-regulation in English learning. A total of 408 college students who study English were invited to participate in the study, and partial least squares structural equation modeling was performed to test the hypotheses. Results suggested that digital nativity is related to online self-regulated English learning, which, in turn, influences students' online engagement. The study emphasized the importance of equipping students with computer literacy and self-regulation for sustainable English learning in online environments. This study offers plenty of practical information on students' engagement in language learning contexts and provides crucial advice for language learners as well as teachers and instructors to better understand the variables influencing engagement with English.

Li-Tang Yu compares the autonomous use of technology-enhanced language learning among 99 EFL Taiwanese college students of different proficiency levels in the study titled "A Comparison of the Autonomous Use of Technology for Language Learning for EFL University Students of Different Proficiency Levels." The research conducted both quantitative and qualitative analyses and found that students' proficiency levels do not significantly affect their autonomous use of technology for language learning. The study underlined the importance of instructors' support and guidance to maximize the benefits

of autonomous technology use for language learning. This research provided useful advice that it is essential not only to be aware of the online learning resources accessible to students but also to understand how to effectively utilize them to foster autonomous learning. A crucial step is to assist students in expanding their knowledge of valuable technology-enhanced materials for English learning and encourage them to actively engage in exercises that enhance both writing and speaking skills, thereby nurturing both the receptive and productive aspects of language acquisition.

Siqing Mu and coauthors Aoxuan (Douglas) Li, Lu Shen, Lili Han, and Zhisheng (Edward) Wen introduced a computer vision-aided analytical method to examine multilingual youths' linguistic repertoires through their digital language portraits in the study titled "Linguistic Repertoires Embodied and Digitalized: A Computer-Vision-Aided Analysis of the Language Portraits by Multilingual Youth." Using discourse and register analysis as a qualitative method to interpret participants' perceptions, beliefs, and emotions, this study suggested that Macanese heritage speakers have a higher degree of linguistic "scope" but lower "access" than Chinese sojourners in Macao. Follow-up interviews further confirm their self-perceptions across registers. The findings enhance our understanding of the scope and access of multilingual repertoires in lived experiences. The online platform used in this study has the potential to create a positive and constructive educational environment. The various networking tools available on the platform allow educators and learners to interact in multiple ways, enabling effective language teaching and learning through adaptable and non-intrusive communication and collaboration.

The study entitled "Factors Influencing Game-Based Learning in the Colombian Context: A Mixed Methods Study" by Aguilar-Cruz and coauthors Peiyu Wang, Zongping Xiang, and Heng Luo identified factors influencing game-based vocabulary learning outcomes among 64 Colombian high school EFL students. Using a mixed method, this study collected both quantitative and qualitative data from surveys, interviews, and pre- and post-tests. The results indicated engagement and prior knowledge positively predict, while contextual factors and family conditions negatively impact the game-based learning outcomes. The study enriches our understanding of game-based learning in less-developed countries and provides suggestions to further investigate the impact of contextual factors and family conditions on game-based learning outcomes. This research offers valuable implications and practical recommendations, such as emphasizing the focus on the involvement and achievements of female students in game-based learning, acknowledging the variations by offering personalized support and collaborative opportunities within game-based learning interventions, and encouraging game designers to not only integrate elements that emotionally and behaviorally engage students in serious games but also address the concern of cognitive overload by minimizing the extrinsic cognitive load.

Using a quasi-experiment, Huashan Lu and coauthors Xingxing Ma and Fang Huang examined the effects of a mobile app on English vocabulary learning among 108 Chinese tertiary EFL learners in the study "Exploring the Effects of a Theory-Based Mobile App on Chinese EFL Learners' Vocabulary Learning Achievement and Memory." This study revealed that the experimental group (using the app) showed significantly higher vocabulary learning achievement compared to the control group. The app also helped prevent rapid memory loss of the learned words. The study underscored the usefulness of mobile technology in enhancing English vocabulary learning with several major implications, such as suggesting educational administrators and policymakers take into account the utilization of specifically designed mobile applications (on various aspects, including listening, grammar, and reading skills) to enhance English learning and that teachers supervise students' mobile learning. Furthermore, students should be motivated to foster their self-reliance in vocabulary acquisition through the use of such apps. In today's age of mobile technology, where classroom time for vocabulary learning is often limited, the development of learning autonomy becomes exceptionally significant.

In the article "Teaching Multimodal Literacies with Digital Technologies and Augmented Reality: A Cluster Analysis of Australian Teachers' TPACK," Lynde Tan and

coauthors Russell Thomson, Joyce Hwee Ling Koh, and Alice Chik used cluster analysis to examine 142 Australian primary teachers' technological pedagogical content knowledge (TPACK) for teaching multimodal literacies with digital technologies/augmented reality. Based on their technological pedagogical content knowledge (TPACK), the study identifies two clusters of teachers (higher TPACK and technology usage versus lower TPACK and technology usage) and highlights the importance of differentiated teacher professional development to effectively incorporate digital technologies and augmented reality in teaching multimodal literacies.

Adopting qualitative methods, Gregory Scott Child and Kim Song's study titled "Digital Inequities: Promoting Digital Justice during the COVID-19 Pandemic" focuses on the actions taken by 12 US content teachers to provide a digitally just education for emergent bilingual learners (EBLs) during the pandemic. Based on the theory of digital justice, which aims to promote digital equity for minoritized populations, the authors conducted a series of semi-structured focus group interviews. After careful data coding and analysis, this study explored the particular methods employed by teachers to incorporate technology settings, the strategies implemented to enhance students' digital literacy skills, and the impact of virtual instruction on educational expectations. The findings emphasize the digital inequities faced by EBLs and the need to promote digital equity through supportive measures and resources. The research sheds light on the practical strategies employed by teachers to support EBLs in virtual schooling environments, such as improving communication between teachers and families, which would have been beneficial in establishing a mutual understanding of expectations that would satisfy the needs of both parents and teachers. It is also essential to go beyond simply granting access to digital materials and instead educate students on how to pose inquiries and utilize the available digital resources to find answers.

The articles presented in this Special Issue, entitled "Technology-Enhanced Language Teaching and Learning: Innovations, Challenges, and Concerns," contribute to our understanding of how and to what extent innovative technology can sustain and enhance language education. Using various research methods, they address important aspects such as pedagogical design, self-regulation, autonomous learning, linguistic repertoires, game-based learning, mobile applications, multimodal literacies, and digital justice. The results of these studies provide valuable insights and practical implications for educators and policymakers to create effective and sustainable language learning environments. By embracing technology and leveraging its potential, we can foster sustainable language teaching and learning practices that empower learners in the digital age.

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