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Bibliometric Analysis of Technology-based Language Learning

Xiaoquan Pan[1*], Hongyan Zhang[2]

1 Xingzhi College, Zhejiang Normal University, Jinhua, China
pxq@zjnu.cn
2 Xingzhi College, Zhejiang Normal University, Jinhua, China
zhyteresa@163.com
*Corresponding author: Xiaoquan Pan, Xingzhi College, Zhejiang Normal University,
688 Yingbin Road, Jinhua, Zhejiang Province, People's Republic of China.

Xiaoquan Pan is a Professor at Zhejiang Normal University, Jinhua, China. He is supervisor of doctoral students. His research interests are English Language teachers' technology use for professional development and intercultural English education. His publications have appeared in *International Journal of Computer-assisted Language Learning and Teaching*, and *SAGE Open*, and *Asia Pacific Journal of Education*, and *Frontiers in Psychology*, and *Current Psychology*.

Based on the Web of Science Core Collection database, this paper analyzed the research hotspots and the development vectors in the field of technology-based language learning in the past 10 years (2014-2024) to provide a groundwork for future research related to language acquisition in technological environments. The bibliometric analysis software of VOSviewer 26.0 was adopted to statistically analyze the Web of Science Core Collection database in the field of technology-based language learning in terms of issuing countries or regions, research institutes, keywords, journals and so on, and to show the development of international research in the field of technology-based language learning from the perspective of bibliometrics. The analysis revealed the development of international research in the field of technology-based language learning from a bibliometric perspective. A total of 458 documents were retrieved. Research findings showed that: (1) in terms of the countries and regions where the amount of research articles was posted, the Chinese mainland, the United States, and Taiwan region were ranked in the top 3; (2) the articles contained were mainly published in such journals as Computers & Education, Computer-assisted Language Learning, Interactive Learning Environments, etc.; and (3) the keywords of the papers were mainly reflected in technology, language, teaching and learning. This study drew the following conclusions. Currently, the attention of technology-based language learning research at home and abroad is increasing; the research mainly focuses on language learning in technological environments and the application of technology in language learning and teaching. Scholars from the Chinese mainland have been influential in the field of technology-based language learning. In the contexts constructed by technology, we should pay more attention to technology-based language learning in the future.

Keywords— bibliometric analysis; technology-based language learning; English learning

1. INTRODUCTION

Technology has become an integral part of today's language learning environment. Chronologically speaking, technology-based language learning tools evolve from CD-ROMs, certain software programs, interactive online websites to the use of emails, chatrooms and discussion boards, and iPod, smartphones, tablets, robots, ChatGPT, and artificial intelligence, etc. In classroom, instructors and language learners mainly adopt PowerPoint slide and Multimedia software suites. Out of class, learners can develop personal and self-directed learning capabilities by themselves with the help of such devices and digital gadgets. Therefore, the concept of technology-based language learning encompasses the relevant terms, such as distance learning, online learning and electronic learning for the purpose of language acquisition, and computer assisted language learning (CALL) (Afshari et al. 2013), information, communication and technology (ICT) (Ghavifekr & Rosdy, 2015), technology-enabled active learning (TEAL) (Tong et al., 2018), and robot assisted language learning (RALL) which can be used simultaneously and almost interchangeably (Huang & Moore, 2023). Thereby, globally speaking, the conventional classroom with no emergence of digital devices is really rare.

With so many electronic communicative devices becoming the integral part of language instruction, the widespread utility of them in language acquisition has been steadily increased. The existing literature of technology-based language learning is vast. Positive benefits of technology use for supporting language learning have been consistently identified (Lee, 2022; Huang & Moore, 2023; Buddha et al, 2024). The reasons that the utility of technology-based language learning is so widely accepted at all levels of education lie in its numerous benefits, including but not limited to language performance development, the improvement of learning motivation and metacognitive skills, collaborative learning and providing of a wealth of learning possibilities. For language performance development, the educational advantages in increasing learners' mastery of spoken language skills are significant (Hsieh et al., 2017), as technology-based language learning improves learners' academic performance (Tawafak et al., 2018), and helps assist learners with minimal writing expertise in stepping up their writing skills (Chen et al., 2019). With their empirical studies, Vaezi et al. (2019) proved that the transportable digital gadgets learning environment

authenticates its efficiency to help learners improve their hearing capability. Combining blog with motion pictures, Albadry (2017) found students' comprehension of sentence structure was improved. Tawafak et al. (2018) reported that students are more active and autonomous when using technology to learn. Liaqat et al. (2021) demonstrated that compared with individual learning, participation in collaborative learning would lead to a decrease of students' learning anxiety levels. In his empirical research, Albadry (2017) revealed that iPad, with its portability and the specific features, would enhance the communication between instructors and learners, and improved the learners' performance in collaborative settings. Another major reason of employing technology-based language learning is that it would offer extensive learning opportunities. Ngui et al. (2020) emphasized that students' learning opportunities were largely enlarged with ample reading time due to the lack of constraint of time and space. The pandemic of COVID-19 has clearly demonstrated that technology-based language learning has been a crucial part of instructors' and students' diverse levels of language activities.

As both instructors and learners had positive attitudes toward technology-based language learning, it still has posed some challenges to them. These barriers may be roughly classified into three types: anxiety related to learning, inadequate proficiency in technology, and constraints associated with technical drawbacks (Buddha et al, 2024). The use and implementation of technology-based language learning demands that learners thoroughly use their digital gadgets. Kurt and Bensen (2017) showed that learners would experience frustration with completing tasks because of the labor-intensity and complexity of the applications. Also, "poor technical skills" and "inadequate technical proficiency may prevent individuals from exploring the potential of handheld gadgets for language acquisition" (Buddha et al, 2024). Technological impediments, including network availability, internet connectivity and poor internet bonds would be annoyed (Ataeifar et al, 2019). The existing literatures also demonstrated the tuff problems of the availability and affordability of digital devices, and the affordability of such devices has been strengthened due to its increasingly upgrading and changing (Huang & Moore, 2023). Huang and Moore (2023) also revealed that the artificial intelligence incorporated in the chat-Robot still is not sufficient to automatically and fluently talk to any second language learner due to the limitation of inexactitude of visual recognition system, automatic speech recognition system and dialogue system and the unpredictability of L2 speakers' speeches.

Some other challenges arose from the smaller screens of the mobile gadget (Yu, 2018) and limited features in its free edition and its exclusive accessibility on Android devices (Le, 2020). Although technology-based language learning has widely been used and researched, it has posed some urgent problems and at the same time leaves much discussed space. For example, the development of the state-of-art technologies in L2 and foreign language learning still needs to be cultivated. The discrepancy between intention (to use) and actual adoption in the specific domain (the exact implementation of technology) should be explored in-depth (Lee, 2022). In addition, technology-based learning needs to address the ethical question of whether robots will maintain long-term, healthy relationships with students (Buddha et al., 2024).

2. SOURCES AND METHODS

2.1 Literature Searching and Ranking Criteria

The core collection of Web of Science was selected as the data source, and was searched by advanced search with the search formula: TS= (technology-enhanced language learning) OR TS= (technology-based language learning), and the language was confined to English documentations. Excluding the documentations in the form of non-research papers, such as contracted manuscripts, a total of 458 documents were retrieved, of which 376 were journal articles, 77 were reviews, and 5 were editorials.

2.2 Research Methods

The bibliometric analysis software of VOSviewer 26.0 was adopted to analyze the retrieved literature. The specific method was to search the literature in the Web of Science Core Collection database according to the search formula, and further screened the literature on the basis of the ranking criteria, and finally got the literature results. Literature information was imported into VOSviewer 26.0 software to analyze the countries or regions of issuance, research institutions, keywords, journals of publication, etc., and the graphs drawn by the software were exported. Based on the results of the study, analyses and discussions were conducted.

3. RESULTS

By analyzing the literature on the basis of VOSviewer 26.0 software, this study came up with the following three findings and insights.

3.1 The Countries and Regions of the Published Articles

In terms of the countries and regions where the amount of research articles was posted, the Chinese mainland, the United States, and Taiwan region were ranked in the top 3. This research finding is aligned with the previous studies which verified that technology-based language learning has heavily depend on technology as its foundation (Lai, 2015), and adopted such a learner perspective and documented the types of language learning experience that learners used technologies to support outside the classroom (Lai et al., 2018). Technology has a multifaceted and important role to play in technology-based language learning mainly in terms of creating rich learning resources and authentic language environments, personalizing the learning experience, stimulating interest and motivation, and expanding learning pathways and approaches.

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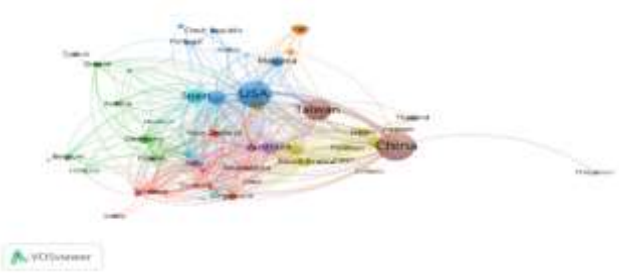
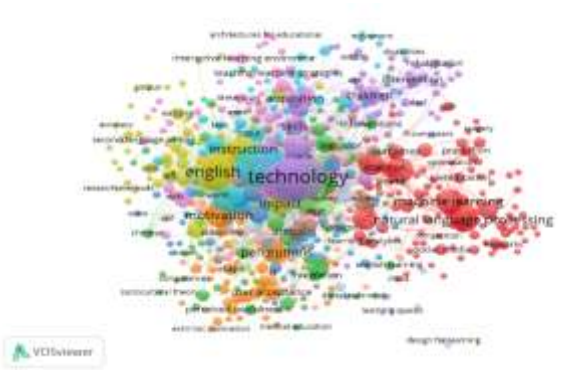


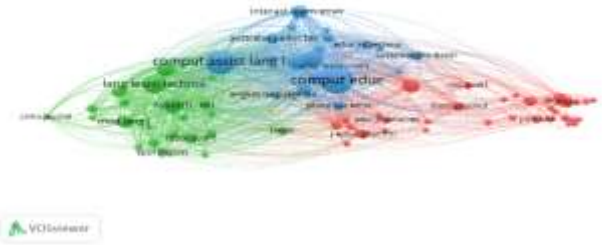
3.2 Technology, Instruction, Motivation Acting as Topic Words

The frequency value of a topic word can reflect its degree of attention in the field of study, and the higher the frequency value, the higher the importance of the topic word in the field. The topic words of 458 papers were analyzed using VOSviewer 26.0 software and focused according to the frequency of occurrence of the topic words. From the focus of frequency of occurrence, it can be seen that technology, instruction, and motivation are the most popular topics, which reflects that these core topics are most likely to appear in technology-based language learning and have the greatest impact on students' language acquisition. In addition, machine learning and natural language processing appeared in the high-frequency vocabulary, indicating that the areas of machine learning and deep learning are becoming hotspots of research and receiving more attention (Janiesch et al., 2021).



3.3 Journals of the Published Articles

The articles contained were mainly published in such journals as Computers & Education, Computer-assisted Language Learning, Interactive Learning Environments, etc. These mainstream journals, as mature technology-based and interdisciplinary publication platforms, publish authoritative research results that can be used as reference standards for assessing the latest technologies in the current field of educational technology, providing important theoretical support and practical guidance for the development and application of educational technology. Research on the application of technology in education, including but not limited to computer-assisted instruction, online education, multimedia learning, and artificial intelligence applications in education, will help to explore how technology can be used to enhance the effectiveness of education and teaching, and to promote students' learning and teachers' professional development.



4. DISCUSSION

The results of the study showed that research on technology-enabled language learning is in the developmental stage and has not yet formed a larger, mature and stable research community, but the number of related studies has shown a trend of gradual growth and increasing research attention. The hot research directions are mainly reflected in the following aspects: (1) Learning content. The research mainly focuses on how to use multimedia, virtual reality and other technologies to optimize the presentation of language learning contents as well as the use of virtual reality technology to create immersive language learning scenarios, so as to make the learning contents more vivid, rich and varied, and to enhance the interest and attractiveness of learning. (2) Learning environment. It focuses on how to build a good technology-supported language learning environment, including online learning platforms, mobile learning applications, etc., to provide learners with a convenient and personalized learning space. For example, online language learning platforms and AI technology can be used to create an adaptive learning environment for learners (Xia et al., 2024). (3) Individual learners. Through the analysis of learning data, in-depth exploration of learners' learning behaviors, learning psychology and learning styles in the technological environment, we can better understand students' learning habits and preferences, and provide personalized learning support by pushing learning contents and learning tasks that meet their characteristics. (4) Learning systems. Educators are committed to developing and improving various language learning systems, such as intelligent tutoring systems and automatic assessment systems, so as to improve the efficiency and quality of learning.

Based on the findings, the study concluded that the research on the application of different technologies in language learning will involve the following aspects. First of all, the integration of information technology and language education will flourish. Foreign studies showed that the use of IT-assisted teaching can promote students' language development; domestic studies paid more attention to the integration of IT with education and teaching, as well as the psychological mechanism of language education in the IT

environment. Secondly, computer-assisted language learning will continuously improve. Foreign research on computer-assisted language learning was more in-depth, involving grammar, vocabulary, listening, speaking, reading and writing and other aspects, and has developed a variety of language learning software and systems (Hsieh et al., 2012). In addition to focusing on international cutting-edge research, domestic researchers are also actively exploring how to apply computer-assisted language learning technology in domestic language teaching, in order to improve teaching effectiveness and learning efficiency. Again, mobile technology-assisted language learning will become a hotspot. With the popularity of mobile devices, mobile technology-assisted language learning has become one of the hotspots of research. It is found that mobile learning has the advantages of convenience, flexibility and personalization, which can provide learners with the opportunity to learn anytime and anywhere, and improve the enthusiasm and initiative of learning. For example, vocabulary learning and listening training are assisted by mobile phone text messages and mobile applications, which have achieved better learning outcomes. Finally, the combination of AI technology and language learning is promising. For example, AI technology can provide learners with personalized learning support, improve learning efficiency and quality, and also bring new modes and methods for language teaching (Bayly-Castaneda et al., 2024). However, some limitations in the current application of AI technology in language learning, such as the accuracy of language comprehension and generation as well as the lack of emotional communication, need to be further solved.

5. CONCLUSION

In general, the attention of research on technology-based language learning has been increasing in recent years, and topics such as the integration research of technology and language teaching, technology acceptance and psychological research in the technological environment are the current research hotspots in this field. The contribution and international presentation of current scholars in this field have been significantly enhanced. In the future, China's research in technology-based language education needs to further follow the research hotspots, conduct in-depth research and actively explore in the field of technology-integrated teaching, and help students' language learning and innovative thinking development.

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