

Review

Pedagogical Design in Technology-Enhanced Language Education Research: A Scoping Review

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Abstract: This scoping literature review aims to explore how language teachers incorporate technology into their teaching and learning experiences. It does this by reviewing studies related to language teachers' technology use and applications of technology in technology-enhanced language education that were published between 2012 and 2022. By using the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines to analyze 51 empirical studies, this review categorizes and identifies 4 clusters of topics that these studies focused on: teachers' perceptions, technological application practice and experience, technological pedagogical content knowledge (TPACK), and teachers' designing/developing scale for the promotion of language learning in pedagogical design in technology-enhanced language education research. The review concludes that researchers have mainly investigated language teachers' perceptions and experience of technology-enhanced language education, not their pedagogical design processes. The results suggest that more studies are needed to explore the role of language teachers as pedagogical designers in technology-enhanced language education in order to integrate technology into language education and facilitate sustainable language teaching and learning.

Keywords: technology-enhanced language education; pedagogical design; language teacher; technological application practice



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1. Introduction

Over the past few decades, information and communication technology (ICT) has been widely used in teaching and learning. ICT facilitates collaboration between teachers and students in the pedagogical process [1] and provides rich and authentic online resources for language learners [2]. Relevant research and reviews have documented that a variety of technologies are used, including gamification for language learning skills, Corpus-relevant, computer-supported automated corrective feedback, virtual reality (VR) for language learning and teaching, computer-based speech-to-text recognition applications, and online collaborative writing tools, as well as computer-based intelligent tutoring [3–6]. These types of technology, such as gamification, make learning activities more enjoyable than traditional classroom activity. As another example, Shadiev and Feng's review of the use of automated corrective feedback (ACF) tools highlighted the roles of ACF tools (e.g., grammar checkers, spelling checkers, and collocation tools) in facilitating language learners' skill development for language learning [7]. Advances in educational technology have enabled researchers to explore the incorporation of technology into the study and teaching of foreign languages [8]. In this paper, we use the term technology-enhanced language education (TELE) to refer to a variety of educational efforts to integrate the use and applications of technology into language learning and teaching. These applications include computer-assisted language learning (CALL), mobile-assisted language learning (MALL), technology-enhanced language learning (TELL), and technology-enhanced language teaching (TELT) [9,10]. Over the last few decades, an increasing number of studies

have investigated language learners' experiences, perceptions, and attitudes with regard to the use of technology in language learning [11–13]. Research has also examined language teachers' technology use, especially the pedagogical design of their technology-enhanced teaching processes, due to the critical role that language teachers play in integrating technology into language education. Researchers have argued that it has become necessary for language educators to shift the focus from what technologies can do in language education to how technological affordances can be made use of in a pedagogically sound manner [10]. For this reason, it has become important for us to take stock of the research that has so far been conducted on language teachers' pedagogical designs in TELE in order to identify what needs to be done to understand language teachers' design and implementation of technology-enhanced language pedagogy.

Sustainable implementation of TELE pedagogy will provide quality learning opportunities for language learners, allowing them to sustain their learning both within and beyond the classroom. For this reason, this review aims to explore the existing literature on language teachers' use and application of technology as pedagogical designers. This scoping review addresses the following research question:

What does research on language teachers' use and application of technology in technology-enhanced language education focus on?

2. Methods

In the review, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Figure 1) to guide our efforts to collect, select, summarize, analyze, and interpret empirical data related to the review's focus. The PRISMA guidelines were chosen because their application increases the transparency of systematic reviews (SRs) and meta-analyses [14]. Based on the PRISMA guidelines, a systematic search was made of the Education Resources Information Center (ERIC), Scopus, and Web of Science databases. Given the large volume of research outputs in the field of TELE, we decided that this review should focus only on studies in the educational context published in international journals in the last decade (January 2012 to December 2022). According to Guichon and Hauck, for the past two decades, the use of digital technologies in language instruction has increased, but pedagogical developments and methodological research have rarely kept up [15]. In addition, several studies indicated that although technology use has increased for both personal and professional reasons, there have been few changes in actual pedagogical practices [15,16]. Publications before the year of 2012 have been examined multiple times in reviews [5]. For this reason, the year of 2012 was chosen as a dividing line from technological affordances to pedagogical affordances and practices for this review. The last decade is crucial for the field of TELE, especially related to the rapid development of technology and the need for the realization of pedagogical affordance with technological integration in practice.

2.1. Search and Selection Procedure

The systematic literature search was conducted using the aforementioned databases. We identified as many potential articles as we could to address the guiding research question. We used five types of search term in the title, abstract, and keyword fields: "computer-assisted language learning (CALL)", "mobile-assisted language learning (MALL)", "technology-enhanced language learning (TELL)", "technology-enhanced language teaching (TELT)", and "pedagogical design" terms. Variations of these terms were used to capture all the relevant articles.

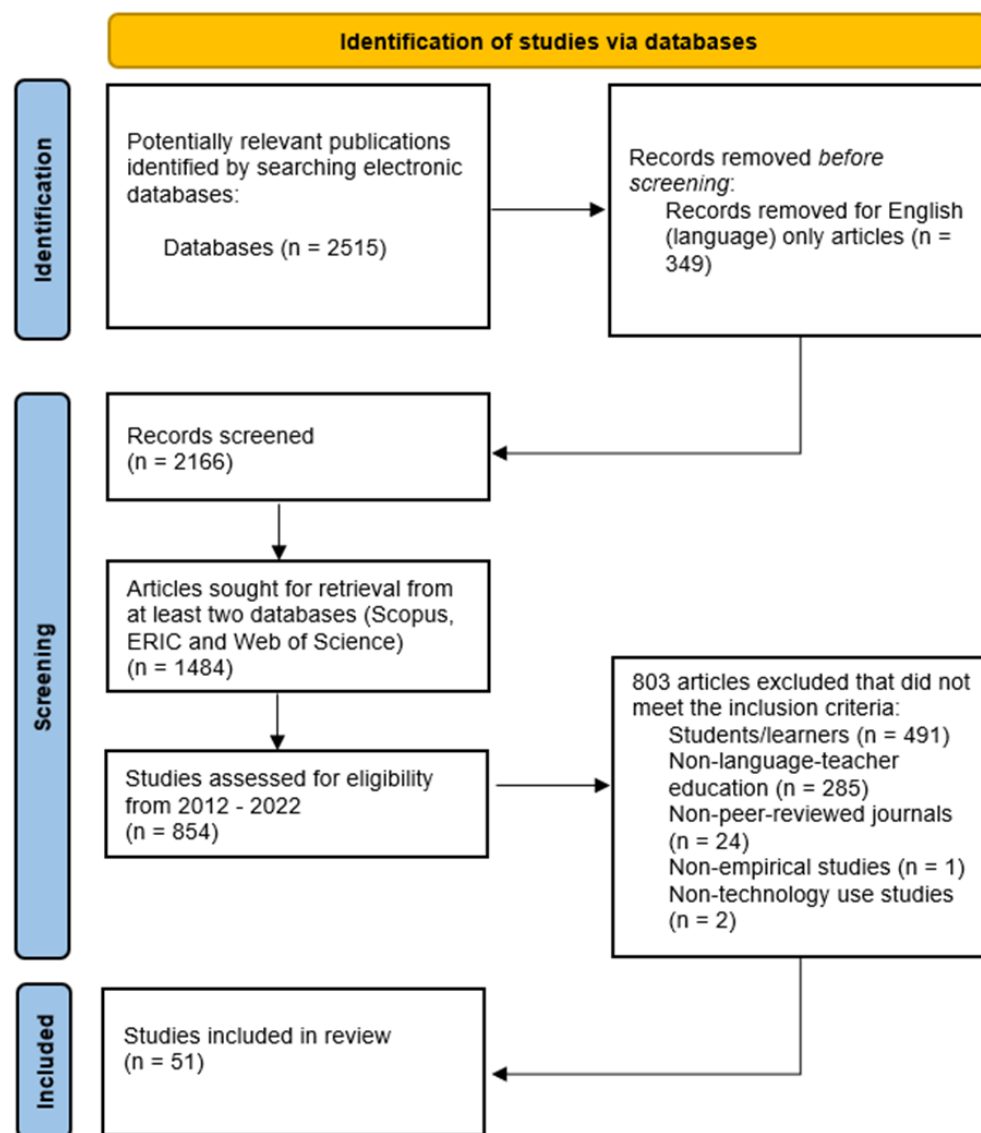


Figure 1. PRISMA flowchart of the study selection process.

Our keyword search yielded an initial list of 2515 publications, as shown in Figure 1, that were relevant to our topic of language teachers' use and integration of technology in CALL, MALL, TELL, and TELT. Additionally, we searched Scopus, ERIC, and Web of Science for research articles in English without year restrictions ($N = 1484$). The search was later limited to articles published from 2012 onwards because the volume of results produced without this limit was too vast for in-depth study. This limit reduced the number of relevant results to 854. During the screening process, we excluded 800 articles, which were mainly about students/learners ($N = 491$) or non-language-teacher education ($N = 285$) or were published in non-peer-reviewed journals ($N = 24$) and thus did not meet the inclusion criteria. In the review process, we used technology-enhanced language learning (TELL) to refer to the use of a computer or other device to display multimedia as a technological innovation to augment a teaching method by language teachers [17]. Several types of technology have been incorporated by teachers to support their instruction, involve students in the learning process, provide solid examples of the target culture, and connect students' classrooms activities with technology, which links TELL and TELT inseparably in TELE. The review of Shadieva et al. related to students' perceptions of technology and language proficiency reveals that the majority of the technology enhanced learning activities were based on an instructor-centered approach; regardless, language learning

activities took place in classrooms or specific off-campus locations [3]. A number of studies on technology-enhanced language learning also examined language teachers' pedagogical design. Therefore, the term technology-enhanced language learning was used as a keyword to screen and search studies on teachers. Furthermore, the first and second author reviewed and manually removed three articles which were non-empirical studies ($N = 1$) or studies unrelated to technology use ($N = 2$), which are relevant to technological software, such as the assessment of technological software. Only research that mentioned language teachers' use or integration of technology was included in the scoping review. Finally, we read the remaining 51 publications to assess their applicability to the research question; all these studies met the selection criteria. Meanwhile, we omitted language learning from searching keywords and undertook another search of the literature. The search results remain the same as our initial attempt.

The studies we reviewed adopted the methodologies shown in Figure 2 and were conducted in a variety of research contexts, as shown in Figure 3.

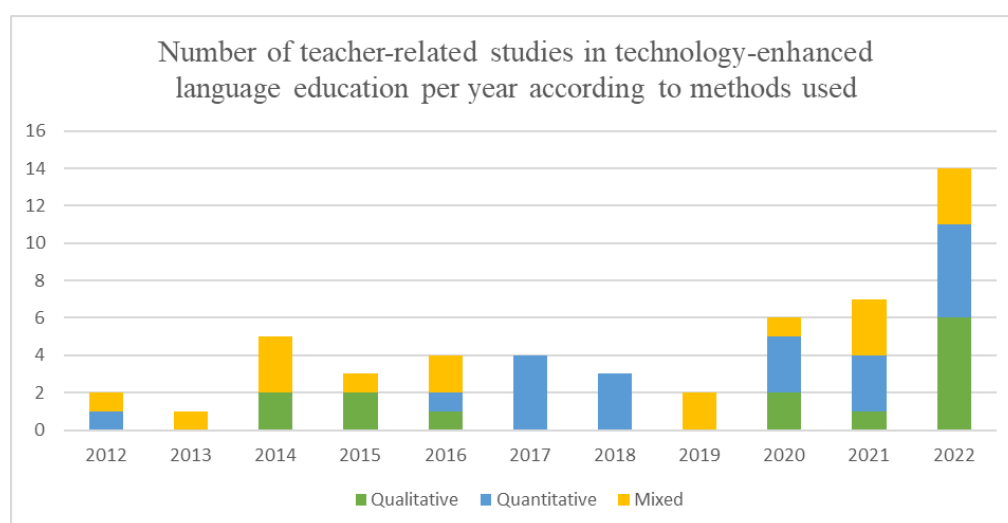


Figure 2. Number of teacher-related studies per year according to methods used.

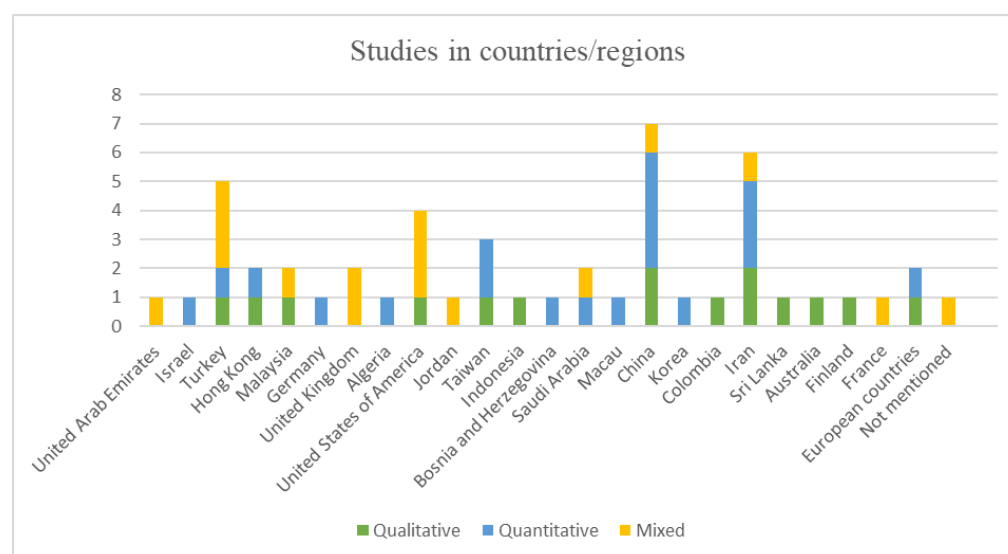


Figure 3. Number of relevant studies by country/region.

2.2. Data Analysis and Procedure

As shown in Figure 4, we coded and categorized the selected studies that met the inclusion criteria into several groups based on various themes, in order to understand the aims of research into the integration of technology by language teachers. The studies were coded by the first and second authors, and any discrepancies in the coding were examined and discussed with the third author over the course of a number of meetings until disagreements were resolved and a consensus was achieved. The analysis yielded the following basic information about the studies selected for the review.

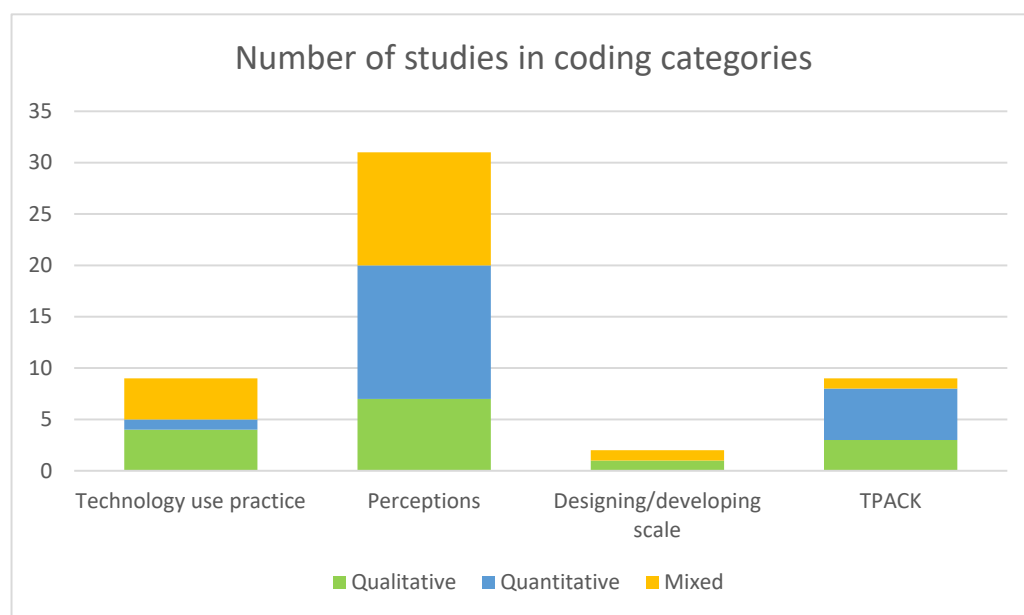


Figure 4. Finalized research area categories.

The research question guided our identification of four themes of the selected research: language teachers' practice/experience of the application of technology ($N = 9$), perceptions (e.g., opinions, motivational beliefs, and attitudes) ($N = 31$), technological pedagogical content knowledge (TPACK) ($N = 9$), and the development of a scale to promote language learning by language teachers ($N = 2$). We shall now elaborate on these findings.

3. Results

This review identified four categories related to the integration of technology into pedagogical design by language teachers, based on the different research areas. With regard to the research question "What does research on language teachers' technology use and technological applications focus on?", this section presents an overview of research on technology in language education. The following topics are covered: the practice of technological application by language teachers, teachers' perceptions of technology integration, TPACK, and research on designing a scale to promote language learning in TELE environments, as shown in Table 1.

3.1. Teachers' Perceptions, Attitudes, and Role in TELE

The reviewed studies in this category ($N = 31$) largely focused on language teachers' perceptions, motivational beliefs, attitudes, and opinions with regard to TELE [18–20]. The studies documented how teachers displayed positive attitudes towards TELE because it makes the classroom activities more interesting [21,22]. In terms of perceptions of technology use and uptake, many language educators refer to the effectiveness of technology-integrated language teaching as a major incentive for them to use technology in language teaching [21,23]. If teachers perceive ICT use as an effective tool for the enhancement

and promotion of teaching and learning, they may hold more positive attitudes toward technology use in blended and online teaching [24].

Table 1. Research focus.

Research Focus	Subcategory	Publication Number
Perceptions (N = 31)	Perception in general	23
	Attitude	7
	TAM	1
Practice (N = 9)	Online course/project	4
	Classroom instruction	5
TPACK (N = 9)	Examining TPACK levels	5
	TPACK framework	4
Developing scales (N = 2)	Designing a regulatory scale	2

Türel and Johnson surveyed 174 teacher participants to assess their perceptions of interactive whiteboards (IWBs) in Turkey, and found that they ‘frequently’ or ‘always’ used IWBs in class, and that half of them were confident about their technological competence [22]. Meanwhile, Kormos and Nijakowska used a questionnaire to investigate language teachers’ concerns and self-efficacy beliefs about Massive Open Online Courses (MOOC) pre- and post-courses [25]. Again, this study identified largely positive attitudes among the participants. In addition, Darling-Aduana and Heinrich’s study of teachers’ perspectives on technology-based language education reveals that the more frequently teachers use blended technology, the more effective their teaching is [26]. All these findings confirm that, in general, teachers are very positive about the use of technology in language education: they perceive TELE as a useful tool, and they are willing to practice it in class.

It is important to note that teachers who have positive perceptions of technology are more likely to use it and promote its use in teaching [27,28]. For this reason, a number of studies have examined the connection between teachers’ perceptions and technology use. Using qualitative research methods, Huang et al. investigated the attitudes of 14 university EFL teachers on the integration and use of technology, as well as the factors impacting their acceptance of technology [29]. The study reveals that Chinese EFL teachers generally hold a positive attitude toward technology use in their teaching. These findings are consistent with the research conducted by Teo [30], who surveyed 475 Singaporean pre-service teachers’ acceptance and perceptions of technology and discovered that positive perceptions enhanced the participants’ behavioral intentions and performance, suggesting a positive relationship between teachers’ attitudes and their use of technology. However, Avidov-Ungar and Amir used questionnaires to explore the use of ICT by 391 in-service language teachers and found that while they had positive attitudes towards the integration of ICT into teaching, they nevertheless made limited use of ICT tools in their teaching due to both environmental barriers (e.g., problems or concerns with the use of computers, lack of internet access, and lack of technological knowledge) and human barriers (e.g., lack of pedagogical knowledge) [18]. This research confirmed the results of Kessler and Plakan’s study on teacher confidence in a North American university, which revealed that language teachers need support and training to increase their confidence and the potential for effective and creative use of technology [31].

Using technology in communicative classrooms alters traditional teacher–student roles, since technology allows language learners to manage their learning, learn at their own pace, and gather learning materials themselves [21,32]. The classroom becomes more learner-centered than teacher-centered, and, consequently, teachers become guides who facilitate the completion of tasks in language teaching integrated with technology. The study by Paratore et al. on preservice teachers’ perceptions of the integration of technology into teaching reveals that the use of educational technology can enhance teachers’ roles as instructors and facilitators [33]. Yang examined the problems experienced by six language teachers and the solutions they proposed to strengthen their preparation for blended instruction by interviewing them, observing their on-site and online instruction, and

observing interactions between students in the online system [34]. The results emphasize that the role of the teachers shifts from that of dominators to that of facilitators in blended instruction, providing students with the necessary scaffolding to meet their learning needs. These findings echo those of Bancheri [35], who asserted that the role of teachers in the new technological era is not only to transmit new knowledge but also to give students tools (i.e., the scaffolding) to acquire knowledge for themselves and to recognize the value of what they encounter in books and software as well as on the internet. Furthermore, Li mentioned that teachers need to address language learners' needs by facilitating understanding and establishing a context for the use of language with the assistance of technology [21], which again emphasizes the role of teachers as facilitators who can enable technology-integrated activities [36]. Overall, the use of computer technology in language education not only promotes the effectiveness of classroom practice but also enhances language teachers' new role as facilitators of their learners' educational needs [37].

This apparent shift in teachers' roles raises questions as to how language teachers design and implement technology-enhanced tasks in teaching as pedagogical designers. Kessler noted that it may be challenging for language teachers acting as facilitators to "identify which resources, tools, or web sites may best fit a particular lesson, activity, or goal" [38] p. 206, even for those who favor the adoption of emerging technologies in their teaching. Therefore, language teachers may show reluctance to use technology in their teaching, even if they have had time to prepare.

To sum up, language teachers play a significant role in TELE. The reviewed studies document and focus on language teachers' perceptions, beliefs, and attitudes to TELE. The findings reveal that teachers are highly positive about the use of technology in language education and that they perceive TELE as a useful tool which they are willing to use in class.

3.2. Teachers' Technological Application Practice in TELE

The reviewed studies in this category (N = 9) also focused on language teachers' practice and experience of applying technology in TELE research. The reviewed studies indicate that the TELE environment and technology use are beneficial for language learners and teachers, facilitating advantages such as the development of a more communicative classroom atmosphere by teachers [39]. Studies have shown that teachers and learners prefer using technology in online and hybrid foreign language learning over traditional classroom instruction methods and materials, as students may be more actively engaged in the learning process [5,6]. Fully online, hybrid, and blended courses are designed to provide flexible learning environments and individualized instruction for students of all ages. Hence, they appear to be appropriate for a range of educational and social objectives and demand active participation [40]. For example, studies on language learners' online social networking have investigated the ways in which communities assist L2 learners' learning beyond the language classroom, help them seek opportunities for L2 interaction, and provide mutual emotional support to them [41]. The studies that have been reviewed include five articles regarding training language teachers for classroom instruction [42–44], as well as four papers about online EFL courses and projects for language teachers [45,46]. However, language teachers experienced some barriers to their successful application of TELE, including technological issues and a lack of pedagogical or technological knowledge.

Foreign language teachers can benefit from the use of educational technology. The use of CALL technologies can enhance learning, promote group activities, and motivate learners by facilitating more interactions in class [47]. The use of technology in language classes is regarded as "an ideal solution to make up for the limitations of the traditional classroom" [48]. For instance, the use of computers supported, facilitated, or augmented by web-based technology can allow more communicative classroom activities than in teacher-centered learning [49]. To promote "best practice" or effective communicative language teaching (CLT) with interactive whiteboards (IWBs), Whyte et al. collected over 200 video examples of the classroom practices of 40 language teachers in 7 European countries with open educational resources [43]. This study highlighted that language teachers benefit

from IWBs, which facilitate more communicative classroom activities, as the technology supports their continued professional development both in formal training contexts and through informal independent study, forming/enhancing their practice and experience of the use of technology in language teaching.

In addition, Kuru Gönen examined the experiences of 8 pre-service teachers and 95 students in a 12-week technology-integrated language education program, finding that the technology-enhanced classes benefited both teachers and students [13]. In particular, the teachers who participated in the study believed that learning in technology-enhanced classes was more active and creative in designing enjoyable classes. Kranthi emphasized that technology enables language teachers to adapt classroom activities and homework assignments to enhance language learners' learning experiences [17].

Notwithstanding the enormous benefits of technology for language teachers, it also has important limitations that need to be addressed before full use of it can be made to improve the learning and teaching of languages. As mentioned in the previous section, language teachers may assume different roles in technology-enhanced language teaching [48], becoming guides and facilitators in technology-integrated classes [50]. To adapt to these new roles, language teachers also need training in promoting the use of CALL [24]. Celik surveyed 486 language instructors' perceptions and use of internet resources in Turkey and found that although English as a foreign language (EFL) instructors hold positive attitudes towards the use of the internet for teaching, they still need special training in the practice and implementation of internet-assisted language education [44].

Taghizadeh and Ejtehad investigated the experience of 100 pre-service English language teachers and their instructors with the use of online interactive tools by collecting data from semi-structured interviews and questionnaires on their experience with and knowledge of technology use and the challenges to technology use perceived by the participants [45]. Analysis of these data revealed that the majority of pre-service TELT teachers had little experience with online interaction tools other than email and social networking sites. The EFL teachers were found to lack adequate knowledge about interactive tools. The findings highlight some barriers encountered by the participants, including inadequate pedagogical and technological knowledge and limited online participation. Moreover, in another study of IWBs, Whyte and Alexander explored nine French EFL teachers' IWB use and their confidence in the technology, as well as their engagement with it [42]. By surveying and interviewing them, the researchers found that these EFL teachers were restricted in their use of IWBs and that the technology had not resulted in much technological or pedagogical development, indicating that these teachers were rather conservative and cautious when applying this technology in their teaching practice. The results indicate that "only two teachers designed and implemented a significant proportion of task-oriented activities" [42] p. 22.

Meanwhile, Park and Son also conducted a study to explore the experience and self-efficacy of six pre-service teachers when using technology [24]. To evaluate the current educational curriculum of English teachers using CALL at a university in Hong Kong, the researchers analyzed in-depth data produced by interviewing participants about their ICT experiences. The results indicate that although the pre-service language teachers evaluated themselves as competent users of ICTs, they generally had different levels of experience in the use of technology. Furthermore, the participants perceived various limitations hindering teachers' use of technology in the language classroom. These included lack of time, the difficulty of monitoring learners' progress, school policy issues, and so on. These limitations negatively influenced their confidence in the use of technology to enhance pedagogical practice.

In short, the above-mentioned studies show that language teachers focusing on technological application can benefit from TELE but can also encounter barriers to their use of technology in teaching. Given these benefits and limitations of technology use in language education, it is necessary for us to understand other research areas relevant to the use of technology in language learning and teaching: technological pedagogical and con-

tent knowledge (TPACK) and research on designing a scale and competence model in technology-integrated environments.

3.3. TPACK and Other Research Topics in TELE

ICT provides opportunities for foreign language teachers to reflect on the affordances of such technologies and their usefulness in teaching [51] and on the development of techno-pedagogical skills (e.g., TPACK) in TELE [52]. The TPACK model was initially proposed by Shulman as a means of understanding teachers' knowledge and use of ICT integration [53], and was further developed by Mishra and Koehler [54], who focused on teachers' knowledge and use of technology, pedagogy, and interactive content [55]. The TPACK framework consists of seven constructs: content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and TPACK [54].

In the reviewed studies within the TPACK category (N = 9), researchers tended to use quantitative research methods (e.g., surveys) to conduct TPACK studies [56]. Cheng collected quantitative data using questionnaires/surveys to examine 172 Hakka (the aboriginal language of Taiwan) teachers' perceptions of TPACK [57]. The results show that language teachers were somewhat satisfied with TPACK but indicate relatively low confidence in the CK, TK, and TPK constructs. Meanwhile, gender, age, and teaching experience were identified as significant factors in language teachers' perceptions of TPACK and therefore also influenced their teaching and the design of their pedagogical practice with ICT in TELE.

Also in a Taiwanese context, Hsu surveyed 158 in-service EFL teachers by integrating the TPACK framework and the technology acceptance model (TAM) into MALL [58]. The results reveal that the TPACK scale's various components had varying levels of knowledge and acceptance among language teachers using MALL. The researcher found that language teachers attained the highest mean score on TPK in TELE, which may have been the result of a high rate of smartphone ownership and the fact that EFL teachers were accustomed to the use of MALL devices. Although participants had some knowledge of technological integration, they lacked understanding in the three core areas of TK, PK, and CK, which affected their use of technology and pedagogical design in MALL. Hsu emphasized that teacher training programs should provide courses on how to make the most of ICTs and pedagogical design in accordance with the requirements of the curriculum [58]. In another TPACK study, Rienties et al. investigated the development of TPACK skills and among 622 pre-service teachers and the role of perceived foreign language (FL) competence when engaging students in online intercultural collaboration projects [52]. The researchers adopted the TPACK model to identify the competencies that language teachers need to acquire in order to successfully use technology in teaching. The findings indicate that pre-existing TPACK skills positively increased the perception of FL competence among teachers. Meanwhile, pre-service teachers were more likely to nurture their FL competence and integrate technology into their language teaching if they further strengthened their TPACK skills through online collaboration projects.

In addition to the use of quantitative methods in TPACK research, researchers have also used mixed methods and qualitative methods to investigate and address language teachers' pedagogies and technologies. Baser et al. used mixed methods to examine pre-service EFL teachers' knowledge of technological pedagogical content in a Turkish university [55]. The researchers conducted qualitative methods, including document analysis and expert interviews with 174 pre-service language teachers, alongside a quantitative TPACK-EFL survey of 204 teachers. Following two rounds of data analysis, the results present the development and validation of a self-assessment survey that examined TPACK among pre-service teachers learning to teach English as a foreign language, instead of investigating aspects of their pedagogical designs. In addition, Wong et al. conducted a study which employed the TPACK framework to explore how researchers and teachers co-design the

blended learning environment [59]. The researchers coded and analyzed data produced by various meetings throughout the co-design and development process and found that the researcher–teacher taskforce designed specific modules using the online platform MyCLOUD. Drawing upon collective TPACK knowledge to build/design the learning environment, the participants actualized and supported pedagogical practices/strategies (such as self-directed, authentic/contextualized, and collaborative learning) for learning Chinese by utilizing technological affordances.

Researchers have used the TPACK framework to promote teachers' professional development in TELE by developing a scale ($N = 2$) to promote the use of technology and pedagogical design in TELE environments. Piyumi Udeshinee et al. conducted a study which applied the sociocultural zone of proximal development (ZPD) theory, as well as mediation notions, to explore how English-as-a-second-language (ESL) teachers designed a regulatory scale based on dynamic assessment (DA) in the TELE context [60]. The DA-based regulatory scale was designed by language teachers to promote language learning in a text chat environment. By analyzing interview and text chat transcripts, the study revealed that ESL teachers found the design-based scale less challenging for them to integrate and use in TELE context. The researchers further suggested that language teachers should be given thorough training on the technical aspects of online platforms and workshops which are relevant to the design and development of a pedagogical scale in their technology-enhanced teaching environment.

Despite the body of knowledge presented above, little is known about how teachers assume their new roles as pedagogical designers in technology-enhanced language learning environments. What seems to be lacking in the literature of TELE teacher education is an examination of how language teachers pedagogically integrate technology into their teaching. Therefore, it is necessary for researchers to explore how language teachers adapt to and play out their new roles in TELE. Starting from this new perspective, it is necessary to focus on language teachers' pedagogy and pedagogical design, and in particular on how language teachers design technology-enhanced pedagogical tasks for language teaching [10].

4. Conclusions

This review has examined the existing research on language teachers' use and application of technology as pedagogical designers. With regard to the research question, the reviewed studies largely focused on language teachers' perceptions, beliefs, and attitudes towards ICT use in TELE environments. Their results describe a highly positive attitude towards the use of technology among language teachers [25] who are willing to use technology in their classes [26]. The reviewed studies also focused on language teachers' application of technology and experience in TELE, finding that language teachers can benefit from TELE (e.g., by facilitating more communicative classroom activities), and that there are certain limitations to their use of ICT (e.g., barriers, technical issues, and lack of time) [18,45]. The reviewed articles also focused on language teachers' research into TPACK, investigating their knowledge and use of technology, pedagogy, and interactive content by means of both quantitative and qualitative research methods. Language teachers display moderate TPACK skills in their ICT use in TELE but lack understanding in the areas of TK and CK [58]. Researchers thus suggest that appropriate training is needed to enhance language teachers' ICT use in TELE environments [52]. Finally, the reviewed studies indicate that language teachers are more likely to develop and design a scale to promote language learning in text chat environments when thorough technical training is provided [60].

Although these studies have generated critical insights into language teachers' perception, practice, knowledge, and use of technology in TELE environments, further research is needed to explore language teachers' role as pedagogical designers in TELE, as few studies have investigated language teachers' design of pedagogical tasks. Insights into language teachers' pedagogical design processes in TELE are important not only because they can

help us understand the kind of competences that language teachers need to develop to successfully practice technology-enhanced teaching but also because they can help language teacher educators to facilitate pedagogical efforts among language teachers that promote better learning among their students. Moreover, our findings reveal that most studies on this topic have only involved language teachers' perspectives on ICT use in TELE, ignoring language teachers' relationships with, for instance, their colleagues and institutional policies. Therefore, we suggest that future research should address the following issues related to language teachers as pedagogical designers in TELE:

1. Further research is needed to develop a deeper understanding of language teachers' interaction with educational policy, schools, students, colleagues, and resources when designing and implementing pedagogical activities in the context of TELE [61]. Since pedagogical design occurs in specific contexts, it is important for researchers to explore and understand how language teachers' interactions with contextual conditions (e.g., other language teachers and colleagues or school policy) mediate their preparation, planning, pedagogical design, and practice of TELE.
2. This review suggests that language teachers may need the training to develop knowledge that is essential to the successful integration of technology into language teaching [13]. Researchers may need to explore what essential knowledge language teachers need to develop to become effective pedagogical designers in TELE and how they can do so through professional development activities. It may be equally important for researchers to explore ways to enable language teachers to apply relevant knowledge to effective pedagogical design for the purpose of sustaining learning among their students.
3. This review has identified that studies have largely focused on language teachers' positive attitudes towards the integration of technology into teaching [20,29]. Researchers also need to explore language teachers' emotions, especially their negative emotions (e.g., anxiety, burnout, etc.), in their application of technology and to reach a better understanding of how they regulate these negative emotions when facing the challenges of ICT use in the context of TELE.
4. Most of the studies we reviewed focused on language teachers' positive perceptions, attitudes, and application of their technological affordances and pedagogical affordances, which is essential to promoting language learners' achievement and learning. The studies, however, did not mention having reliable, valid grading/evaluation systems to verify L2 learners' learning achievements. They do not examine the automated corrective feedback tools in language learning, analyze the speech-to-text recognition applications, and investigate how plagiarism detection take place using technological tools [4,62,63]. Therefore, researchers may need to focus on and explore additional facets of technology use in language teaching, such as how language teachers assess and evaluate students' learning progress and achievement using technological tools.

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