

Language Teacher Development in Technology Integration: Exploration, Communication, Collaboration, and Reflection

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Abstract

It is essential for second/foreign/additional language teachers to develop their digital competence in digital environments. This article explores language teacher development in digital technology integration in terms of exploration, communication, collaboration, and reflection (ECCR). It presents the results of a study that investigated how language teachers explore, communicate, collaborate, and reflect for technology-enhanced language teaching (TELT), how they approach ECCR, how much they engage with ECCR activities, and what support they need to improve their competence in TELT. Data were collected from an online questionnaire and semi-structured interviews with groups of in-service language teachers in Hong Kong and Taiwan. Findings indicate that the teachers in both countries are engaged with various ECCR activities with different interests and competencies in their contexts. They enhance our understanding of language teacher development and provide implications for professional development with ECCR.

Keywords: language teacher development, professional development, computer-assisted language learning, technology-enhanced language teaching, online activities

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Given that there is a great need for the use of digital technology in language learning and teaching (Carrier et al., 2017; Son, 2020), language teacher development in technology integration is undoubtedly an important issue to address (Cutrim Schmid, 2017; Hubbard, 2023; Son, 2018). It involves formal training (e.g., Son & Wendeatt, 2017) and self-directed informal learning (e.g., Son, 2014). With a focus on self-directed professional development, the study reported in this article explores how in-service language teachers report the development of their professional knowledge and skills for technology-enhanced language teaching (TELT). Based on Son's (2018) Exploration-Communication-Collaboration-Reflection (ECCR) model, which incorporates various aspects of teacher learning in computer-assisted language learning (CALL) and guides teachers to develop and improve personal and professional competence in TELT, the study investigated how different groups of language teachers explore, communicate, collaborate, and reflect for TELT, how much they engage with ECCR activities, and what support they need in order to improve their competence in TELT. This article presents the results of the study and provides suggestions and implications for language teacher education and professional development in digital environments.

ECCR and Teacher Development

Language teachers' professional development in CALL has received considerable attention and has been widely discussed in a number of studies (e.g., El Shaban & Egbert, 2018; Gràcia et al., 2022; Kohnke, 2021; Latif, 2021). Through the published studies, the questions of what language teachers need to know about the use of technology in CALL and how they can improve their competence in CALL have been responded in diverse educational contexts. In this study, the ECCR model (Son, 2018) and digital language teacher development framework (DLTDF) (Son, 2020) are of particular interest. They served to shape the study's design and data analysis. When compared with the technological pedagogical content knowledge (TPACK) framework (Mishra & Koehler, 2006), DLTDF focuses more on ways of doing things rather than types of knowledge needed by teachers. The ECCR model guides teachers to engage in exploratory, communicative, collaborative, and reflective activities. It incorporates various aspects of teacher learning and suggests that teachers can develop and improve their knowledge and skills through "active exploration, interactive communication, professional collaboration and critical reflection" (Son, 2018, p. 59). In line with this, DLTDF shows teachers what competencies and activities they can have, what they can do, and how they can engage with its four interrelated components (i.e., exploration, communication, collaboration, and reflection).

Exploration is a basis for teacher learning and an essential element of the success of TELT (Son, 2018). Teachers are encouraged to explore pedagogies and find out what technologies and resources are available to them. They are also encouraged to observe themselves and other teachers (Gebhard, 2005) and autonomously and continually experiment with new technologies (Robb, 2006). In CALL teacher education, McNeill (2013) explored situated learning in real contexts and Comas-Quinn (2011) highlighted teachers' adoption of technologies for online language teaching. In a different context, Son (2014) found that CALL practitioners read journal articles or books and used web search engines, communication tools, and social networking sites to explore, acquire new knowledge and skills, and keep up to date with what is happening in CALL. In order to effectively identify features of pedagogies and

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technologies, teachers need to constantly examine their teaching environments with critical eyes (Meskill et al., 2022; Stockwell, 2009).

Communication is the process of interacting and exchanging information with others. Computer-mediated communication (CMC) has been significantly used to promote language teacher development (Son, 2018) as CMC presents language teachers with a wide range of opportunities for professional development (Wu et al., 2014). Related to online communication and online presence, for example, Arnold and Ducate (2006) reported that social and cognitive presence was found in asynchronous discussions between pre-service teachers at two different universities. Wu et al. (2014) also found social and cognitive presence in an online community in a study of the professional growth of three Chinese teachers of English as a foreign language (EFL). Similarly, Satar and Akcan (2018) looked at and analyzed interaction and social presence in online communication among pre-service EFL teachers and argued that, through participation in online communities, the teachers could experience online interaction and develop an awareness of behaviors and skills to facilitate their future students' participation in online learning. In addition, Haines (2016) supported the use of CMC tools, particularly for the development of teachers' practical knowledge, and stated that the practical knowledge includes personal and professional understanding of the relationship between technology and pedagogical contexts and developing abilities to enhance learning to use new tools.

Collaboration is a core of professional communities. It should be effectively encouraged and supported in teacher professional development programs (Darling-Hammond et al., 2017). Informal collaboration is considered as a driving force of continuing professional development (Kohnke, 2021). By collaborating with peers, teachers can co-construct knowledge about learning and teaching (Musanti & Pence, 2010) and develop professional identity (Kitade, 2014) and autonomy (Xu, 2015). Collaborative learning facilitated through CMC (Nami et al., 2018) evidently occurs in online communities of practice (Macià & García, 2016; Sheffield et al., 2018). It is also discussed in many studies of telecollaboration (e.g., O'Dowd, 2015; Viáfara González, 2019), which allows intercultural collaboration with partners online. In online teaching, specifically, Ernest et al. (2013) argued that teachers need to develop skills for fostering learner collaboration in virtual environments by experiencing online collaborative work themselves. In other words, teachers need to develop and improve their skills for supporting and facilitating learner interaction and collaboration (Hample, 2009; Oyarzun & Martin, 2023).

Reflection is a critical component of teacher development. It is crucial for reflective practices and teaching experiences. Guo et al. (2019) pointed out that reflection is considered as one of the most effective approaches to help language teachers develop pedagogical knowledge and skills while Bustamante and Moeller (2013) saw reflection as an effective strategy in designing professional development programs. In a study of reflective practices of students in a master's degree program in TESOL, Farr and Riordan (2015) examined the use of online chat, discussion forums, and blogs as reflective media and found that blogs fostered narration whereas chat and forums promoted emotional engagement. In another study of the effectiveness of a blended CALL preparation program for pre-service teachers, Liu and Kleinsasser (2023) reported that the pre-service teachers experienced ongoing reflections when they explored CALL. Teachers need to adopt reflective thinking to develop their professional competencies (Guichon, 2009) and take a cyclic approach of action and reflection (Wang et al., 2010). They

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also need to be encouraged to continue self-evaluation (Ernest & Hopkins, 2006; Li & Walsh, 2023) and reflective engagement through critical reflection of technology use (Chao, 2015).

The Study

Aims

The study aimed to explore language teacher development with Son's (2018) ECCR model and investigate how in-service language teachers engage with their professional development in terms of ECCR. To address these aims, the following research questions were addressed:

- (1) How do language teachers explore, communicate, collaborate, and reflect for TELT?
- (2) How do they approach ECCR?
- (3) How much do they engage with ECCR activities?
- (4) What do they need in order to improve their competence in TELT?

Design

This article provides an in-depth examination and analysis of language teacher development in two different settings: Hong Kong and Taiwan. The same data collection instruments and the same procedures were used in both countries: a consent form—an online questionnaire—semi-structured individual interviews over Zoom. Four key elements (i.e., exploration, communication, collaboration, and reflection) of Son's (2018) teacher development model were used as main categories and questions to respond in the collection and analysis of data in the study. In each country, the data were collected from an online questionnaire, consisting of ten questions asking the teachers to indicate their background, prior experience, and engagement with professional development in TELT, and individual interviews, consisting of another ten questions directly related to ECCR activities. The questionnaire questions and interview questions were adapted from Son's (2020) DLTDF. Appendix A shows categorized questions that were used for the interviews. Thematic analysis was conducted to analyze qualitative data collected from the interviews, which were recorded and transcribed at each site. The interview data were independently coded by two researchers who subsequently came out with common themes. The themes were then reviewed by a third researcher and finalized through an agreement among the three researchers.

Participants

Participants in Hong Kong were six in-service teachers (four females and two males; 26–38 years old) from primary schools ($n = 4$) and secondary schools ($n = 2$) in Hong Kong (see Table 1 for their demographic information). They all completed a master's degree program in English language teaching at a university in Hong Kong and had 3–15 years of experience in teaching EFL. They self-rated their level of digital literacy (ability to use digital technologies) as acceptable (3 teachers), good (1 teacher), and very good (2 teachers).

Table 1

Participants' Demographic Information—Hong Kong

Code	Age	Gender	Teaching context	Years of teaching
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H1	28	Male	Primary	6
H2	38	Male	Secondary	15
H3	26	Female	Primary	4
H4	27	Female	Primary	4
H5	38	Female	Secondary	15
H6	26	Female	Primary	3

Participants in Taiwan were another six in-service teachers (all females; 36–56 years old) from secondary schools ($n = 3$) and universities ($n = 3$) in Taiwan (see Table 2 for their demographic information). With 7–30 years of teaching experience, they were teaching English (4 teachers), English and Chinese (1 teacher), and French (1 teacher). They self-rated their level of digital literacy as acceptable (3 teachers), good (1 teacher), and very good (2 teachers).

Table 2

Participants' Demographic Information—Taiwan

Code	Age	Gender	Teaching context	Years of teaching
T1	54	Female	University	30
T2	47	Female	Secondary	18
T3	39	Female	Secondary	7
T4	36	Female	Secondary	8
T5	56	Female	University	20
T6	44	Female	University	19

In summary, a total of 12 in-service teachers (2 males and 10 females; age ranging from 26 to 56 years old) from two countries participated in the study. The recruitment of the participants was made based on their willingness and availability. According to ethical principles at each site in Hong Kong and Taiwan, the participants received an information letter explaining the research project and then signed a consent form confirming the protection of their confidentiality and privacy in the study.

Results

This section presents data collected from the questionnaire and interviews. Considering different backgrounds, experiences, and educational environments of the participants in the two countries, interview data are presented respectively for each country in connection with ECCR. They are combined and discussed in the Discussion section.

Data from the Questionnaire

The online questionnaire was administered in English. In response to the question of how they learn about new ways of using technology for language learning/teaching, the teachers in both countries were allowed to choose all options that applied to them. In Hong Kong, the teachers (H1–H6) chose colleagues (85.71%), workshops (85.71%), experts (57.14%), seminars (57.14%), and social networks (42.86%) in order. In Taiwan, similarly, the teachers (T1–T6)

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chose colleagues (83.33%), workshops (83.33%), social networks (66.67%), experts (50%), and students (50%) in order.

Most teachers in Hong Kong generally indicated that they were highly or moderately engaged with information collection; learning about CALL and how to use technology for teaching; trialing new technologies; interacting with colleagues; using CMC tools; sharing ideas and resources with other teachers; and planning, designing, and managing collaborative activities. Some teachers were less engaged with the following activities: interacting with researchers; examining teaching experiences critically; reflecting on one's own learning and teaching practices; thinking and practicing reflectively; and self-monitoring with critical and contextualized reflection. The teachers' responses in Taiwan were slightly different from the teachers' responses in Hong Kong. Most teachers in Taiwan indicated that they were highly or moderately engaged with interacting with students; using CMC tools; working together with others online; sharing ideas and resources with other teachers; and planning, designing, and managing collaborative activities. While some teachers were less engaged with learning about CALL and trialing new technologies, one teacher was not engaged with each of the following activities: interacting with researchers; facilitating collaboration with CMC tools; and self-monitoring with critical and contextualized reflection.

In an open-ended question about teacher development and TELT, most teachers in both countries showed their interest in teacher development and responded with several tools they used. Here are example responses:

I use Instagram, Google Classroom, WhatsApp, WeChat as well as Zoom to help in my daily teaching as they are user-friendly for communication with students as well as posting teaching materials and collaborating with colleagues. (H2)

I believe the potential of exploring technology-enhanced language teaching for professional development is huge. Especially at times when teachers cannot meet each other, using online platforms is the best choice to connect and exchange ideas among teachers. I personally use different online collaborating platforms, namely Google Suite and Microsoft Teams. (H5)

I think teachers should develop technology-enhanced language teaching ability not only to attract students' attention in class, but also to increase their motivation in learning. ... I joined in a Facebook group for sharing resources such as YouTube videos, Kahoot, and PowerPoint slides to increase visual attraction in class, and so on. (T3)

I think it is extremely necessary for teachers to learn and apply computer technology in language instruction. ... Usually, I play a video clip which is related to the lesson as a warm-up. As for vocabulary, Quizlet is a good idea to apply. ... Moreover, when it comes to teaching reading, I use Kahoot to help my students in reading comprehension. (T6)

These responses could be considered as a reflection of individual teachers' familiarity with and use of online tools available in their contexts.

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Data from the Interviews

All teachers in both countries participated in individual semi-structured interviews online. The interviews were conducted in English in Hong Kong and in English and Chinese in Taiwan. The teachers' interview responses to the ten interview questions demonstrated how they explored, communicated, collaborated, and reflected as teachers. In this section, their responses are presented in respect of ECCR.

Responses from Teachers in Hong Kong

Exploration. Out of the six teachers, two teachers (H1 and H5) identified themselves to be active in collecting information on technological options for their teaching. They said that they collected the information by surfing the internet and reading blogs and posts in online communities. They also indicated that the information affected their teaching in several ways, such as adopting a learning management system and using mind maps.

I have known them by surfing the internet, by reading blogs and also sometimes Facebook entries by following some e-learners, I mean, like e-learning teachers. (H1)

We can do mind maps and like students do brainstorming and then we can use it in our writing and speaking activities. (H5)

Four teachers identified themselves as being less active or inactive. The reasons for not being active given by them included relying on colleagues' sharing, the fast-changing nature of technology, and lack of opportunities. Among them, two teachers (H2 and H6) stated that they were being forced to become active online due to COVID-19 as their schools adopted online teaching. They admitted that their pedagogy has been influenced by the adoption of online teaching. One teacher's response below shows what she did:

We have been using some platforms like Google Classroom. ... We made use of the online platforms and in the very beginning we set questions to students, we sent teaching materials and exercises to the students, and they do them on the platforms, and the questions will be auto marked, and the students can see the results and see teachers' remarks after they have done the work. (H6)

When it comes to the selection of online tools for teaching, the teachers considered the following factors important: usability, accessibility, educational approaches, user-friendliness, and price. Here are example responses:

The first one will be how easy it could be implemented in the lesson, and the second one will be about how intuitive the learning tools, and lastly how versatile it can be. (H1)

First of all, it should be user-friendly ... Maybe I will just share those kinds of resources with my students and let them have a try by themselves. ... I also think that it's important that the resource is free, or the price is acceptable enough. (H3)

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As iPads have been widely used in Hong Kong primary and secondary school contexts, the compatibility of online tools with iPads was also a concern to one teacher: “Our school uses iPads ... so obviously I think the main concern will be whether the iPad is compatible with specific applications” (H4).

These responses imply that the teachers’ technological options for their teaching were mainly influenced by their own interest, preference, need, and accessibility in their contexts.

Communication

All teachers recognized the importance of communication and made comments on skills and strategies to promote learner interactions online (e.g., facilitating cooperative environments, proving learners with step-by-step procedures to perform online tasks, motivating learners, turn-taking in communication). For example:

I try my best to make it cooperative where students can get together to work on one thing instead of working individually. (H1)

I think it’s really about increasing motivation, and also using that motivation for good use, and not just motivating them to be interested in the English lesson but motivating them and directing that motivation to proper use. (H4)

One teacher underlined the significance of nonverbal skills such as facial expressions and turn-taking strategies for more constructive interactions online:

For my students, I think that they need to have a body language because when I have Zoom speaking lessons with my students, they all speak but it’s too small to observe their facial expressions like their body language. ... I think that turn taking is, yeah, maybe it works a bit on that, but my students are weak in turn taking. (H5)

All six teachers also mentioned that they use WhatsApp, LINE, Facebook, and/or Zoom to communicate with other professionals. Taking advantage of such online tools, the teachers adopted self-driven professional development by attending various online workshops/seminars and special interest groups and following some professionals through YouTube channels. They also actively participated in school-driven professional development as each school offered regular online workshops to its in-service teachers. Their views are reflected in the following example responses:

I think more and more professionals are sharing more resources online. So just like some very famous teachers, they will have their blogs or their own webpage to share what they explore or what they find from their aspects. Also, some YouTube channels, yeah. I think they are useful. (H3)

Every school has got an IT department, and the IT department is more proactive in a sense ... and they share to the class, how to make use of online tools that we have never come across and they even made some short videos, teaching us how to use the platforms as

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well, and then some other colleagues from different departments shared their experiences. (H6)

It appears that the teachers were actively involved in communication with others while using a range of online tools. This finding demonstrates that communication is a key of online teaching in their contexts.

Collaboration

The teachers pointed out that learners' willingness and positive attitudes are critical for working in a team environment. Example situations were given as follows:

If the students need to work as a team and then they need to communicate with each other, but for some online, during the school suspension, it is difficult for students to have the teamwork in online learning. Because they are too shy to share their voices over Zoom, they don't like to speak in Zoom. They think that's embarrassing. (H2)

When using Zoom, some students are reluctant to turn on their camera. It would be so difficult, you know, without face-to-face communication seeing the other person face-to-face, it would be, it will be, it might be an obstacle for people to communicate. (H6)

They also mentioned that it is beneficial to work in a team with other teachers as collaboration with the teachers offers models of growth, strategies, and experiences. For example:

Yeah, because every teacher has a different perspective on teaching the same item. By asking them to take a look at what you have prepared, they may have some new insights and maybe they can inspire me to do some other things or just to do the other way around to help the students. (H1)

There was also one teacher who preferred working by herself: "From my experience, I just do more by myself. For a team, we just share useful platforms" (H3).

Regarding tools for collaboration, the teachers indicated that they use email, Google Drive, Google Docs, Google Slides, Microsoft Teams, WhatsApp, Zoom, and/or Facebook. For example:

To collaborate with colleagues online, I would use, make use of platforms like Google Suite and also Microsoft Teams. These platforms allow teachers to upload files and store them online. And they allow teachers to work on the same file collaboratively. (H1)

The teachers showed their understanding of collaboration and how they could use online tools for meaningful collaboration. This finding shows their ways of working with others in online environments.

Reflection. The teachers listed several common challenges of using online tools in their teaching contexts such as budget issues, technical issues, and administrative issues.

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In my school context, number 1 is that we don't have enough iPads, you need to book the iPads in advance, and sometimes, if I don't have enough, two students have to share one iPad. (H2)

First of all, we always meet technical problems no matter how and no matter when. So yeah, it's a really struggling thing. (H3)

Sometimes because some applications require you to log in, but because it's the school iPad, you don't have even as a teacher, because there's only one administrator who can update the iPad. (H4)

Five teachers thought that they were not competent enough in TELT, as exemplified below:

I am not competent because I don't use it a lot, like I don't use it every day. I use it only sometimes. (H5)

I think I'm not proficient in doing that. But at least I could try. I think after you know this year actually the outbreak of the coronavirus is actually a good opportunity for every one of us to improve our IT proficiency. (H6)

On the other hand, one competent teacher said: "I am a facilitator of learning in the classroom. But with another job title, a bit like a technician as well" (H1). These teachers' reflections demonstrate how the role of the teacher is important in facilitating TELT.

Approaches and Needs

The most common approach the teachers took to learn about TELT was self-directed professional development while attending workshops or seminars, joining special interest groups, and/or doing online searches. It is exemplified by the responses below:

I can get that knowledge and also for colleagues, we will share. Yeah, I will also try websites one by one and also pick some websites, which are suitable for me and also for the students. (H3)

I would try to attend some more seminars about the use of different online platforms in really practical situations. Um, so that you know I can get some inspiration from other professionals. Attending seminars is one of them, and then self-directed learning is another thing. (H6)

Another approach mentioned by one teacher was a formal degree program:

I started my study for a master program. I think this is one of the first steps of the professional learning about technology-enhanced language teaching. (H4)

The teachers expressed that they needed to seek more new online tools and relevant pedagogy and wanted more opportunities to apply technology into teaching. They also

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commented that support on hardware, software, and training from schools can help teachers improve their competence in TELT. Here are example responses:

I think it's the opportunity to apply on it, like if the school policies, if the principal is open-minded to let me try, I think that's most needed. (H2)

Another thing is about support from the school, the support in terms of hardware, and also the sharing software, the sharing sessions from the IT department or other colleagues who are more professional in the use of that can help as well. (H6)

These responses indicate that the teachers had a high interest in formal and informal learning for their professional development and in the use of new online tools and resources for their teaching. This finding shows the teachers' willingness to develop and improve their TELT knowledge and skills.

Responses from Teachers in Taiwan

Exploration. Out of the six teachers, five teachers indicated that they were active in collecting information for technology-enhanced instruction. For example:

I started to teach online two years ago, and I started to search for more technological options for my teaching. (T4)

I feel that I am quite active. Yet too many software applications spring up like mushrooms, and I really could not catch up with learning or using all of them. I am still using some I am familiar with and share them with students. (T6)

Although one teacher confessed that she was not very active compared with other colleagues, she stated that she made use of PowerPoints, websites, and YouTube videos:

Several websites and some YouTube video clips are quite useful. They could serve as supplementary materials. For instance, we recently talked about an article related to Formula 1 car racing. Formula 1 is not that popular in Taiwan, and students are not familiar with it. So, I found some videos and photos online to build their background knowledge. (T5)

The teachers mentioned various factors affecting the selection of online tools for their teaching. The factors included: relevance to teaching objectives/contents (T1, T2, and T5); game-based, entertaining, interesting, and fun components (T2, T4, and T6); user-friendliness concerns (T2 and T5); relevance to language training (T1 and T3); grammar-checking functions (T3); and cooperation among students (T6). For example:

It's up to my students and whether the teaching objective focuses on listening, speaking, reading, or writing. Also, whether it's about presenting what I am telling them or about how they could apply the language. These will all affect my selection of tools. (T1)

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It should be easy and practical. ... The first one is a user-friendly issue, and the second is content in accordance with my teaching unit. (T5)

These responses reveal the teachers' motivation to explore, find, and select potential online tools for their teaching. Contextual factors they encountered at respective workplaces seemed to contribute to active or inactive engagement in TELT. This finding signifies the relationship between teacher exploration and school teaching culture in promoting online instruction.

Communication.

The teachers said that they applied various pedagogical practices and online tools to interact with their students. The prevalent strategies they used were related to teacher-student interaction in teacher feedback (T2, T3, T5, and T6), quizzes (T1 and T2), and online games/activities (T2 and T3). For example:

As to interaction, for example, I present some online content during class sessions. I have language classrooms in which I always put some thematic YouTube videos for students' review. Links to these videos are in my course syllabus, and I show them the videos in class as well. (T1)

However, four teachers (T1, T2, T4, and T5) indicated that they did not fully facilitate the interaction with and between students during online activities as noted below:

Comparatively, I have very little interaction with students online. I usually post quiz items on Kahoot or Quizlet and students immediately complete for quick answering to the items. So, the interaction between the teacher and students is quite limited. (T2)

I use limited online learning activities and communication strategies. ... I would set up a LINE group for each class to increase student-student interactions. (T5)

There were several communication channels the teachers tried to build and maintain while taking advantage of online tools and platforms. The channels included: colleagues sharing either face-to-face or via LINE/Facebook (T2, T3, T4, T5, and T6); workshops organized by schools or departments (T2, T4, and T5); experts or university faculty (T1, T3, and T4); teacher associations or research teams (T1 and T2); or academic conferences (T1 and T4). For example:

I will attend workshops with my colleagues and share the information with university faculty. (T4)

We have our own Facebook group where we interact, communicate, and exchange teaching experience among each other. In particular, some new teachers are not familiar with our teaching environment, not so familiar with students. They would often raise questions and we offer them some suggestions or share something with them. (T5)

All teachers were engaged with different levels of interaction while employing a range of communication channels for different groups of people. They intended to communicate with their students by referring to specific pedagogies, yet most of them appeared not ready for

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facilitating online teacher-student and/or student-student interaction. This finding implies the necessity of offering relevant teacher training to trigger meaningful technology-enriched communication.

Collaboration

All teachers highlighted the significance of teamwork promoting mutual learning and professional growth. For example: “I feel like learning a lot of novel teaching methods and how others would apply technology into classroom instruction” (T2).

Two teachers stressed that team members need to have similar teaching ideas to have teamwork in a more efficient way:

I think working in a team environment is helpful. However, I think this depends on team members. I think as a teacher the teaching idea has to be similar. (T4)

In a team, teachers with similar teaching ideas will be able to inspire each other and come up with more ideas. (T5)

There were also comments on ways of online collaboration they had:

I have more collaboration with colleagues via LINE. ... We directly post some application methods, websites, or the latest news each other got. That is, our teaching team shares useful information via LINE interaction. (T2)

My collaboration with students often happens via Google Docs. For example, if I start a new task today, I'd present what I would teach via Google Docs, or give them a template or a format. Then, I will send them the link and have them finish the rest of it. (T6)

One teacher reported that she had a time issue in collaborating with others: “It’s actually about a time issue. If I could have enough time, I would like to work together with others or collaborate with my colleagues and students” (T1). Another teacher, on the other hand, mentioned a dynamic process she had when working with colleagues:

It’s a dynamic process because we have to do our best to show understanding, sympathy, and consideration. If the other colleague could not accept your ideas and insist on his/her own teaching philosophy, I then will lower my own expectation. (T5)

These responses outline the teachers’ acknowledgement of and expectations on collaboration and their approaches to online collaboration. Time issues or the nature of dynamic process of teamwork seemed to hinder few teachers from effective collaboration. These teachers’ actual practices in professional collaboration are noted in this finding.

Reflection

The teachers reported infrastructure issues in using online tools in their teaching contexts. For example: “They ask their classmates to share the internet with them. So, they can email to me. Or, if they have some relatives that can share with them, so they can email to me” (T3).

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A couple of teachers pointed out issues on student motivation and attitudes:

First of all, students are too passive or rely too much on group members, so you could not see the progress they made. (T2)

Whether students are active is challenging. Sometimes you have given them tools, yet some of them never would like to give it a trial. (T6)

Other comments included implementation issues related to time and teachers' knowledge and skills:

For my online teaching, the challenge is to make them focus on me when teaching. If I have to use online tools, like Kahoot and Quizlet, I also think it's time consuming. For Quizlet, I have to type all of the vocabulary and for English translation and maybe photos for low level class. (T4)

It's because my lack of knowledge and skills. Other teachers may be very familiar with Zoom and iLearn, and they could face and deal with urgent situations. Yet, I could not make it to fix the problem and will spend a lot of time. (T5)

Five teachers regarded themselves somehow competent in the implementation of TELT:

I become a mediator to make students and technology information go together. (T1)

I am a curriculum designer and helper, as technology is just a teaching aid rather than the main focus. (T2)

I think I'm the person who picks up what kind of technology students use or what kind of media I want to use in class. It makes me like a gatekeeper in terms of technology-enhanced language teaching. (T3)

I think I have the potential to be competent and confident in TELT. But it really takes time. ... Actually, I'm now using them to organize class schedule and create practices and design after-class practices. (T4)

I feel I am now more like a guide. It's because nowadays there are too many self-study websites, yet students may not know how to use them. Then, my role is to have them know how to maintain their English learning after they leave the classroom setting. (T6)

One teacher, on the other hand, felt incompetent in TELT:

I feel like I don't know anything about live broadcasting software. In comparison with other colleagues who are technology natives, I am just an immigrant without any sense of the technology. Except for easy applications of PowerPoint and the internet, I am not confident in using others. (T5)

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Regarding plans for TELT, four teachers described communicating with students online as a priority (T2); applying more online activities (T3); learning more about an online platform (T5); and having self-study via YouTube videos (T6). For example:

If possible, I would like to improve what you mentioned about communication with colleagues and students. (T2)

I will check YouTube videos or learn from new younger teachers who are good at using some software. (T6)

Two other teachers did not state specific future plans, but one of them mentioned that she would consider trying more online tools: “I have to try out some online tools. Then, also for creating practices, I think it’s on the content level, so I also need to spend time to create class practices” (T4).

Through reflection, the teachers pointed out infrastructure, student engagement, and implementation issues in online environments. While they indicated their self-assessed competencies in TELT with plans for using online tools and activities, few teachers reflected on personal weaknesses and desire to improve the status quo. This finding seems to be related to limited online instruction promoted in their workplaces before this study was conducted.

Approaches and Needs

The Taiwanese teachers voiced learning about TELT from online resources or workshops offered at their workplace. For example: “I will pay attention whether there is any new teaching approach or method online. I am quite quick to get the new ideas and start my research on them, and pick something suitable for my students, Taiwanese students” (T1).

Other approaches mentioned by the teachers included learning from colleagues, conferences, research papers, or communication with previous classmates. Here are example responses:

I will approach my professional learning about TELT by accumulating people’s experiences, using tools on my own in my teaching, and reading research papers. (T4)

I am checking some journals in a regular manner. Perhaps two or three times per semester. (T5)

Five teachers highlighted the need to participate in teacher training workshops to improve their TELT competence. For example:

For now, workshops and articles about the effectiveness of online tools are most important. The articles can be from blogs, news, Facebook groups, or research journals. (T4)

We senior teachers could not handle new technology very well, and it is really exhausting to us. Yet, those new junior colleagues are different from us when infusing technology into

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designing learning activities. ... If possible, we could mutually offer workshops or have more communication. (T5)

These responses reflect the teachers' engagement with and willingness to learn from workshops, colleagues, and/or online resources. This finding highlights the importance of and need for teacher learning and training in technology integration.

Discussion

The results of the questionnaire indicate that most teachers in both countries tended to actively learn about TELT from colleagues and experts or through workshops and social networks while collecting information, trialing new technologies, interacting with colleagues and students, and using CMC tools. The teachers used several online tools for their teaching, including Google tools, Microsoft Teams, Zoom, WhatsApp, Facebook, Kahoot, Quizlet, and/or YouTube. In terms of the four components of the ECCR model, there were few teachers who showed relatively less engagement with reflection than exploration, communication, and collaboration. This indicates that reflective practice needs to be encouraged and improved through reflection for action (Prieto et al., 2020).

Through the interviews, the teachers in both countries provided further elaboration regarding what and how they do for their professional development in TELT. The analysis of qualitative data from the interviews reveals that individual teachers explore, communicate, collaborate, and reflect with different levels of engagement and approaches to professional development in their teaching situations. Out of the twelve teachers in the study, seven teachers (two in Hong Kong and five in Taiwan) stated that they were active in collecting information on technological options while exploring the web and online communities. This finding is congruent with Son's (2014) study, which found that web search engines, communication tools, and social networking sites were frequently used for exploration by CALL practitioners. In selecting online tools for teaching, the following factors were mentioned by the teachers in both countries: usability, accessibility, teaching objectives, enjoyment, and user-friendliness. These factors seem to affect the use of online tools not only for their teaching but also for their professional development.

All teachers in the study agreed that communication is vital for their professional development, and they need effective communication skills and strategies for their learning and teaching. They showed similar engagement with professional communication, but they had a slightly different interest: the teachers in Hong Kong talked more about communication tools, whereas the teachers in Taiwan talked more about communication strategies. They also showed a great interest in collaboration with others and their involvement in collaborative activities offering opportunities for their professional development. This finding supports the value of peer collaboration discussed in Meskill et al. (2022). Collaborative learning seemed to be facilitated through CMC, as similarly reported in Arnold and Ducate (2006). When they were asked to reflect on their own teaching with technology, the teachers pointed out several challenges such as infrastructure issues, technical issues, administrative issues, and implementation issues. They also indicated that they would welcome professional development opportunities for effective collaboration and reflection. Hence, it is important for teachers to create or join context-specific

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teacher learning communities through peer communication and collaboration, along with hands-on experiences with the use of technology, which can facilitate teacher preparation for technology integration (García-Martínez et al., 2022; Yurtseven Avci et al., 2020).

In self-assessments of their own competence in TELT, interestingly, five teachers in Hong Kong said that they were not competent enough, whereas five teachers in Taiwan said that they were competent. This difference seems to come from different individual experiences with TELT in actual language classrooms. Based on their TELT experiences, the teachers played different roles and commented on things they could do with their students differently. In response to their approaches to professional learning about TELT, they mainly mentioned self-directed professional development activities, workshops, colleagues, and online resources. This finding supports the ideas of autonomy in teacher development discussed in Robb's (2006) study and situated learning for teachers discussed in McNeill's (2013) study.

There were also contextual factors to consider. In Hong Kong, sudden transition to online teaching during the COVID-19 pandemic seemed to provide a great challenge for the teachers. At the same time, it provided a great opportunity for them to explore online tools for online teaching by exploring the web and communicating with other professionals. For the implementation of online teaching activities, they stated that they needed effective communication skills, which are required to be competent in TELT. In Taiwan, the secondary school teachers appeared to have more motivation in enhancing their TELT competence than the university teachers, due to the impact of curriculum guidelines promoted by the Taiwanese Government. The university teachers, comparatively, seemed less active in TELT because of no specific requirement of their workplace, except for the urgent need to deliver online teaching under the impact of the COVID-19 pandemic (for discussions on online language teaching and the pandemic, see Cheung [2021] and Moser et al. [2021]). Yet, they said that they would like to develop and improve their practical knowledge and skills for TELT if possible.

Conclusion

There is a critical need for professional development that supports teachers to integrate technology into their teaching effectively (Howell et al., 2021). Without adequate professional development, it is difficult for teachers to be competent in CALL and keep up to date with new knowledge and skills for TELT. In light of this, ECCR-based activities can be considered and recommended for formal and informal learning. Also, the ECCR-based professional development framework (i.e., DLTDF) can be adapted to support language teachers to identify and improve their CALL competency levels. While responding to Son's (2020) call for research on language teacher development in digital learning and teaching environments, this article offers a better understanding of language teachers' ECCR. It makes a unique contribution by presenting a study using the ECCR model to document language teacher development in technology integration.

Most participants in the study explored technological options, communicated with colleagues and students, collaborated with others, and reflect themselves for their learning and teaching while they had individual differences in the levels of ECCR and TELT competencies. This finding encourages further examination of additional aspects of ECCR. For example, what

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types of ECCR activities would support teachers more in improving their TELT competencies? How would teachers engage with ECCR better in hybrid or online learning environments? How would teachers use ECCR to develop context-specific approaches to CALL? How would CALL teacher training programs or workshops facilitate ECCR for teachers' professional growth? How would teachers use DLTFD in their continuing professional development?

The study involved a small number of in-service language teachers and relied on self-reported data to investigate individual teachers' engagement with ECCR. Despite these limitations, the study has specifically investigated the teachers' professional development and practices by exploring their ECCR and TELT competencies. The findings of the study offer some insights into what and how in-service language teachers do for their professional development in TELT and contribute to our understanding of CALL teacher development. They recommend continuing professional development for teachers to explore, communicate, collaborate, and reflect themselves in their contexts. For example, teachers are recommended to develop and improve their knowledge and skills for selecting useful online tools and resources while being active in collecting information on technological options for their teaching; have interpersonal communication skills and strategies that are needed to increase online interaction; develop constructive ways of collaborating with others in online communities; and continue reflecting on their own learning and teaching practices in online environments.

For future research, researchers may recruit a larger sample of participants in various contexts and conduct peer assessment together with self-assessment. They may also consider collecting data from observations and recordings of online activities and behavior in the long-term. In addition, as suggested by Liu and Kleinsasser (2015), they may make follow-up inquiries to examine and document language teachers' continuing process of professional development in technology integration. While it is challenging to examine teachers' experiences and practices, it is necessary to keep addressing the questions of how teachers can integrate technology effectively and how they can improve their knowledge and skills for TELT in continuously changing educational environments.

Declaration

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Appendix A Interview Questions

[Exploration]

1. Are you active in collecting information on technological options for your teaching? If yes, how do you collect the information and how does the information affect your pedagogy? If no, why not?
2. What factors do you think are important in the selection of online tools for your teaching?

[Communication]

3. What communication skills and strategies do you think are needed in increasing student interaction during online learning activities?
4. How do you build and maintain your communication channels with other professionals?

[Collaboration]

5. What do you think about working in a team environment for online learning activities?
6. How do you think you can collaborate with your colleagues and students online?

[Reflection]

7. What are the challenges of using online tools in your teaching context?
8. Do you consider yourself a teacher who is competent in technology-enhanced language teaching (TELT)? If yes, how do you see your role in the technology-enhanced language classroom? If no, why not? Any plan for TELT?

[Overall]

9. How do you approach your professional learning about TELT?
10. What do you think you need most to improve your competence in TELT?