PaCKed with Technology: Pedagogically-driven technology professional development for language teaching

**Abstract**

This paper reports on the design and evaluation of “PaCKed with Technology”, a pedagogically-driven technology professional development program for pre-service teachers of primary English in Kuwait. PaCKed with Technology is novel in its focus on enabling teachers to identify technologies that align with second language acquisition pedagogy. Having provided learners space to revise and develop their pedagogical content knowledge, trainee teachers are taken through two reflective cycles. The first comprises: (1) *comprehension & connection* which encourages the development of pedagogical content knowledge and makes connections between technologies and pedagogical principles, (2) *experience* which enables teachers to “learn with technology”, and (3) *reflection* which encourages reflection based on their experience. The second comprises the same steps and provides trainee teachers the opportunity to “teach with technology”.

Pre- and post-module surveys of the teachers’ awareness of the range of technologies they might employ in their teaching, their rationale for doing so, and their Technological Pedagogical Content Knowledge (TPACK) were complemented with qualitative interviews exploring their experience of the training. While the trainee teachers’ self-reported levels of TPACK decreased, their rationales for using technology shifted from motivating and engaging learners to reasons grounded in approaches and methods of language teaching. Interview data suggests that these changes might be explained by changes in trainees’ understanding of what it means to use technology effectively to support their pedagogical goals and approach.

**Keywords**:Teacher education; TPACK; EFL; Teacher knowledge; Second Language Acquisition; Language pedagogy.

**1. Introduction**

New technologies continue to emerge at “dazzling speed” (Karatay & Hegelheimer, 2021, p. 275). It is therefore impossible to empirically evaluate every technology and intended pedagogical use of technology (Jones, 1986). Teachers therefore need to be able to make their *own* decisions about how to harness technology to support language learning.

Interest in technology professional development has therefore burgeoned (for some of the range of approaches see Debski, 2006; Egbert & Shahrokni, 2019; Hanson-Smith, 2006; Richard & Farrell,2005; Shaban & Egbert, 2018; Slaouti & Motteram, 2006). Teachers, however, still find it difficult to identify Computer-Assisted Language Learning (CALL) resources that respond to their pedagogical goals and align with their pedagogical approach (Stockwell, 2009; Sulaimani, Serhandi & Buledi, 2017) and consequently make quite limited use of technology in their teaching (DelliCarpini, 2012; Tseng, Cheng & Lin, 2011; Tseng et al., 2020).

In response to this challenge, we developed “PaCKed with Technology”, a novel approach to technology professional development for language teachers that emphasizes Second Language Acquisition (SLA) pedagogy and enables teachers to identify technologies that align with their pedagogical goals and principles. This paper reports the rationale for our approach as well as our evaluation of a training module for pre-service primary teachers in Kuwait that implements PaCKed with Technology. The evaluation is guided by the following research questions:

* What impact, if any, does a pedagogically driven model of technology professional development have on teachers’ reported familiarity with and use of technology?
* What impact, if any, does a pedagogically driven model of technology professional development have on teachers’ reported TPACK levels?
* What impact, if any, does a pedagogically driven model of technology professional development have on teachers’ reported planned use of technology?
* To what extent do teachers’ reported rationales for using technology demonstrate TPACK before and after training?
* What are teachers’ reported perceptions of “PaCKed with Technology”?

**2. Literature Review**

With a view to refining the Computer-Assisted Language Learning (CALL) module of a pre-service programme for primary EFL teachers in Kuwait, we reviewed the literature on technology professional development for language teachers. A summary of our review which covers teacher knowledge for technology integration and technology professional development is provided below.

***2.1. Teacher knowledge for technology integration***

***2.1.1. Technology Pedagogy Content Knowledge (TPACK)***

Technology Pedagogy Content Knowledge (TPACK; Mishra & Koehler, 2006) is the most popular model of teacher knowledge for technology integration. TPACK takes as its starting point Shulman’s (1987) seminal work on teacher knowledge and professional development. In this work, Shulman introduces the idea that the effectiveness of an individual teacher depends not only on their knowledge of their subject, i.e. content knowledge but also their ‘knowledge [of the subject] for teaching’ (Shulman, 1986, p. 9) or knowledge of how the subject matter can be represented to promote understanding, i.e. pedagogical content knowledge - while topics might be considered the content of language teaching programmes as in Content-Based Instruction (CBI) and Content and Language Integrated Learning (CLIL), we consider communicative competence, comprising grammatical, sociolinguistic, discourse and strategic competence (Canale & Swain, 1980) to be the core content knowledge of the language teacher, and language awareness (Andrews, 2003) an important component of language teachers’ pedagogical content knowledge. Building on Shulman’s (1986) concept of pedagogical content knowledge, TPACK claims that the effectiveness of a teacher is also determined by their technology knowledge and their contextual knowledge and the extent to which they can integrate these different areas of knowledge (Mishra & Koehler, 2006). Technology knowledge refers to teachers’ understanding of how to use technologies that could be used to support teaching. Pedagogical content knowledge (see above), technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge represent the integration of these different areas of knowledge. Technological content knowledge focuses on how technology might be employed to transform subject matter into representations which promote understanding. Technological pedagogical knowledge focuses on how technology might be employed to create conditions and engage learners in processes which promote learning. TPCK focuses on “how technology might be employed to represent content in pedagogically meaningful ways, as well as create conditions and engage learners in processes which promote learning” (Bostancioglu & Handley , 2018, p. 576). Finally, contextual knowledge includes knowledge of “everything from a teacher’s awareness of available technologies, to the teacher’s knowledge of the school, district, state, or national policies they operate within” (Mishra, 2019, p. 76).

Research developing and validating instruments based on the framework (e.g. Baser, Kopcha, & Ozden, 2016; Bostancioglu & Handley, 2018) as well as studies exploring teachers’ knowledge and practices in relation to the integration of technology through its lens proliferates (e.g. Tseng et al., 2019). Attempts to validate self-assessment instruments consistently fail to identify all of the different areas of knowledge proposed by Mishra and Koehler (2006). Specifically, pedagogical knowledge does not tend to emerge as an independent area of knowledge (e.g. Archambault & Barnett, 2010; Bostancioglu & Handley, 2018; Koh et al., 2010; Shinas et al., 2013). It is suggested that this is because pedagogical knowledge is intrinsically linked to content knowledge; any expression of subject matter is an attempt to represent that subject matter in such a way as to promote mutual understanding (McEwan & Bull, 1991; Segall, 2004). As such, Bostancioglu and Handley (2018, p. 587) highlight the importance of supporting teachers to make connections between pedagogical content knowledge and technology knowledge and enabling them to identify how “emerging and established technologies can be employed to represent language and provide opportunities for communication that are known to promote language acquisition”. Providing teachers the scaffolding they need to make these connections between pedagogical content knowledge and technology knowledge is therefore an important element of our approach to technology professional development.

***2.1.2. Pedagogical Content Knowledge for Language Teaching***

Some scholars also argue that pedagogical content knowledge (Shulman, 1986; 1987) and hence TPACK differs according to subject (Baser, Kopcha, & Ozden, 2016; Voogt, Fisser, Roblin, Tondeur, & van Braak, 2013). Language proficiency, for its part, it is claimed, differs from proficiency in other subjects in that it comprises skills (reading, writing, speaking and listening) as well as areas of knowledge (vocabulary, grammar and pronunciation). The subject matter is also the medium of instruction in many classes (Liu et al., 2014) and different theories have been developed to account for Second Language Acquisition (SLA; see Mitchell, Myles, & Marsden, 2019 for an overview). Our approach therefore introduces SLA specific theories and pedagogies as well as theories and pedagogies that are adopted across different subjects (see supplementary materials for module outline[[1]](#endnote-1)).

Technology can be “employed to translate a range of different SLA theories into CALL designs” (Bostancioglu & Handley, 2018, p 573) as illustrated in Macaro et al.’s (2012) systematic review of technology for primary and secondary EFL teaching. Reflecting Bostancioglu and Handley’s (2018) adaptation of TPACK for EFL, our approach is therefore also theory- and technology-independent.

***2.2. Developing TPACK***

***2.2.1. Formal Technology Professional Development***

The training offered on pre-service and in-service technology professional development programs in Kuwait (Al-Awidi & Aldhafeeri, 2017), as in other countries (Slaouti & Motteram, 2006), has tended to focus on developing teachers’ awareness of and ability to use (a wider range) of technologies, i.e. their technology knowledge, with limited focus on developing their knowledge of theories of learning and associated pedagogies, i.e. their pedagogical content knowledge. This is unsurprising, given the overly optimistic and deterministic nature of much literature on technology in education (Selwyn, 2011, 2016), with researchers frequently citing policies that highlight the need to equip students with the technical skills they will need when they leave education as their rationale for developing and evaluating technology-mediated educational activities and very little providing a rationale grounded in learning theory or pedagogy (see Macaro et al., 2012). Research exploring the relationship between language teachers’ technology knowledge and the extent to which they integrate technology in their teaching, however, suggests that technology knowledge is not sufficient to promote technology use (Kessler & Plakans, 2008). Moreover, studies in the broader field of educational technology, suggest that without a strong foundation in pedagogical content knowledge teachers are unable to identify technologies that can support them to achieve their pedagogical goals and align with their preferred pedagogical approach (Chai et al., 2010). Approaches which require students to first complete a module in learning theory and then support them to draw links between theoretical principles and the affordances of digital learning environments have also been shown to support pre-service teachers to develop effective learning materials that integrate technology (Kessler & Bikowski, 2011).

***2.2.2. Reflective practice***

With respect to the continued development of TPACK, Shulman (1987), suggested that following the completion of any formal teacher education program, teachers continue to develop their pedagogical content knowledge through reflection on the effectiveness of the different ways in which they transform subject matter into pedagogical representations for teaching purposes (see also Schon, 1983). According to Shulman (1987), there are five steps to the reflective cycle which culminates in new comprehension of the subject matter and how to represent it to facilitate learning: (1) comprehension of the pedagogical goals and relevant subject matter, (2) transformation of subject matter in to teachable representations and selection of appropriate pedagogic methods and techniques to introduce and engage learners with those representations, (3) instruction, (4) evaluation of student learning through questioning and testing, and (5) reflection on what worked, and what did not work, and why.

Starkey (2010), exploring the practices of early career secondary school teachers in New Zealand, however, notes that Shulman’s (1987) conceptualisation of pedagogical content knowledge is grounded in the “assumption that teaching involves knowledge being passed from a teacher to their students” (Starkey, 2010, p. 233) and needs to be extended to account for more student-centred approaches to teaching, such as connectivism (Siemens, 2004), which have become popular in more recent years along with constructivism and social constructivism (see Harasim, 2017 for an overview).

***2.2.2. TPACK interventions***

Research exploring the development of training to support the development of TPACK, has tended to focus on in-service teachers (e.g. Tai, 2015; Nami,2021), with few studies exploring the impact of training on pre-service teachers (e.g., Adipat, 2021; Kulaksiz, 2023; Tseng, Cheng & Yeh, 2019). Most of these studies incorporate an element of reflective practice as well as formal instruction supporting the development of pedagogical and curriculum knowledge, and knowledge of the technologies that might be deployed to support learning in educational settings. Tseng et al. (2019) explored the impact of engaging in design thinking on pre-service teachers’ TPACK. Whereas Kulaksiz (2023) explored the impact of engaging in reflections scaffolded by the ADDIE model on teachers’ TPACK. Tracking teachers’ discussions over the course of the study, Tseng et al. observed that teachers demonstrated greater knowledge of pedagogy than technology and made few connections between the two at the end as well as the start of the study. Kulaksiz’s (2023) approach which emphasized connecting technology and pedagogy to the teaching context, on the other hand appeared to support the development of TPACK. Together these studies highlight the importance of supporting pre-service teachers to make connections between technology, pedagogy, and the teaching context in order to support TPACK development. Tseng et al.’s (2019) study was, however, conducted in the context of supporting teachers to develop their TPACK for distance learning and the context of Kulaksiz’s (2023) study was unclear.

In conclusion, our literature review suggests that effective technology professional development for language teachers, foregrounds language pedagogy, enables teachers to connect the affordances of technology with language pedagogy, and provides teachers an opportunity to reflect on their experience as learners as well as teachers.

***3. An evaluation of PaCKed with Technology (PCK-T)***

PaCKed with Technology (PCK-T) was implemented on the Computer Assisted Language Learning (CALL) module of a pre-service programme for primary EFL teachers in Kuwait which ran in the summer course from June to August. In the sections that follow, we explain how we have implemented the features of effective technology professional development identified from the literature and introduce our evaluation of the module for Kuwaiti EFL teachers.

***3.1 PaCKed with Technology (PCK-T)***

Building on previous research, PaCKed with Technology (PCK-T) integrates the TPACK framework (Misha &Koehler, 2006) and Shulman’s (1987) model of pedagogical reasoning and action in the digital age. More specifically, language pedagogy and SLA are foregrounded (Chai et al., 2010; Kessler & Bikowski, 2011), highlighting the importance of engaging learners in processes that promote language acquisition as well as representing language in teachable ways (Starkey, 2010), It also supports teachers to connect the affordances of different technologies with pedagogy (Bostancioglu & Handley, 2018), and promotes further learning through reflection on experience “learning through technology” (Lorties,1975) as well as “teaching with technology” (Borg, 2003) - evidence suggests that an individual teacher’s’ pedagogical content knowledge iso influenced by their prior experience as learners, as well as any training they have received, their teaching experience and their reflection on that experience (Borg, 2003). In other words, learning is an apprenticeship to teaching (Lortie, 1975).

Before experiencing technology as learners and teachers, the trainee teachers revisit the knowledge of SLA and pedagogical principles introduced in the pre-requisite modules Applied Linguistics and Teaching English as a Second/Foreign language (ESL/EFL). Trainee teachers are then introduced to several different technologies. For each technology, they are taken through two reflective cycles (see figure 1). There are three phases to each reflective cycle. In the first phase of both cycles, Comprehension & Connection, teachers are encouraged to further develop their pedagogical content knowledge, that is their understanding of Second Language Acquisition (SLA) and the pedagogical principles associated with it as well as approaches and methods of language teaching (Comprehension), before developing their technology knowledge and engaging in activities that are designed to support them to make links between the affordances of different technologies and their planned language pedagogy (Connection) with a view to developing their technology pedagogy content knowledge. For example, the student teachers are provided a list of different technologies and asked to discuss which skills and areas of linguistic knowledge they might support the teaching of. In the second phase of the first cycle, teachers are provided the opportunity to Experience the technology as learners (Hew & Brush, 2007), that is to “learn through technology”. For example, the student teachers are asked to work in small groups to write a wiki about their experiences using technology to teach English in the same way that they might ask their English language learners to work together to write a wiki on a cultural topic. In the second phase of the second cycle, teachers are provided the opportunity to Experience the technology as teachers, that is to “teach with technology”. Specifically, the student teachers are asked to design a lesson plan and deliver the lesson to their peers. In the final phase, Reflection, teachers are encouraged to evaluate and reflect on their experience using a series of prompts based on Gibbs’ (1988) model of reflection (Grosbois & Sarre, 2016). Through the final phase of the first cycle, teachers develop new understanding of SLA and language pedagogy and make new links to the affordances of technology, that is they develop new Comprehension & Connections. With this new understanding they are then encouraged to teach with the technology in the next reflective cycle and to evaluate and reflect on that experience with a view to developing further understanding and connections.

**Graphical user interface, diagram, application

Description automatically generated**

**Figure 1 PaCKed with Technology (PCK-T)**

***3.2. Method***

**Participants:** 18 of the 26 students who enrolled on the module which ran from June to August 2022 participated in the study. All students enrolled on the CALL module had already passed modules in *Educational Technology as well as modules in Applied linguistics* and *Teaching English as a Second/Foreign language for young learners*. On these modules, students study a range of SLA theories and pedagogies.

**Data collection:** Having provided their consent to participate in the study[[2]](#endnote-2), the students were asked to complete a survey. There were three parts to the survey which had been piloted with a similar cohort of trainee teachers: (1) background and demographics, (2) self-reported TPACK, and (3) familiarity with and intended use of technology. The second part comprised Bostancioglu and Handley’s (2018) ELF-TPACK survey. In the third part, for each of the technologies in Bostancioglu and Handley’s (2018) survey, the students were asked to indicate whether they were aware of the technology and had used it (including in contexts outside teaching) and, if they were aware of the technology, whether they would use it in their teaching and how and why (see supplementary materials for survey). The students then participated in the module which comprised two three-hour workshops per week (see supplementary materials for module outline). Having completed the module, the students were asked to complete the pre-intervention survey again and to participate in follow-up semi-structured qualitative interviews exploring their experiences of the training. 18 students participated in the interviews, the schedule for which was based on the TPACK and PCK-T frameworks (see supplementary materials for interview schedule). The data collection was carried out by the first author who also delivered the module. The interviews which were conducted in Arabic and English lasted for 15-20 minutes on average and were transcribed verbatim and translated into English.

**Data analysis:** The survey data was analysed as follows.To answer our first research question, we compared the frequency of trainees who reported familiarity with technologies used in language learning and teaching at pre-test with the frequency of trainees who reported familiarity with technologies used in language learning and teaching at post-test. The data related to our second question, whether the trainee teachers’ reported levels of TPACK improved as a result of the training, were first checked for internal consistency, normality and outliers (defined here as more than 3 SD above or below the group mean). The data met the assumptions of consistency (Cronbach’s α = .80 - .94) but violated assumptions of normality. We therefore ran a series of Wilcoxon signed rank tests comparing pre- and post-test levels of reported TPACK. To answer our third research question, we compared the frequency of trainees who intended to use the technologies at post-test with the frequency of trainees who intended to use the technologies at pre-test. Note that the alpha level for significance was set at 0.05 for all analyses and Plonsky and Oswald’s (2014) benchmarks were used for the interpretation of effect sizes in educational research/applied linguistics.

To answer our fourth research question and establish the extent to which the trainee teachers’ reported rationales for using technology changed over the course of the module, and in particular whether the extent to which those rationales demonstrated TPACK, we coded their reasons using a framework based on Bostancioglu and Handley’s (2018) EFL-TPACK survey and then compared their rationales before and after the intervention (see supplementary materials).

The interview data was analysed as follows. To answer our final research question and understand the trainee teachers’ experiences of the module, we coded the data using a framework based on a combination of Bostancioglu and Handley’s (2018) EFL-TPACK survey and our PCK-T model (see supplementary materials). One further code was added inductively to the framework, namely *developing trainee’s TPACK self-efficacy*. This code was used when teachers explained a change in their understanding of what it means to use technology effectively.

***4. Results and discussion***

This section explores our research questions in turn moving from quantitative insights to qualitative insights.

4***.1. Familiarity with technology***

Table 1 compares the number of trainees who were familiar with technologies used in language learning and teaching at post-test with the number that were familiar with them at pre-test. Reflecting previous research (e.g., Li, 2014; Slaouti & Barton, 2007), these data show that self-reported familiarity with all technologies increased except for technologies one might expect the trainee teachers to already be using in their daily lives, namely Word, CMC and Web 2.0. With respect to dedicated educational technologies, self-reported familiarity varied. While trainees reported a high level of familiarity with Virtual Learning Environments (VLEs), they reported a low level of familiarity with Interactive White Boards (IWBs), authorware, and linguistic software, i.e. concordancers. The trainees’ familiarity with these technologies might be explained by their experiences as students. IWBs are not common in Kuwait compared to countries such as the United Kingdom (UK). Authorware is not a technology trainees would engage with as students, and concordancers are an example of a specialized subject-specific application that students will only have encountered if they have studied linguistics.

**Table 1.** Number of trainees familiar with technologies used in language learning and teaching at pre-test and post-test.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pre-test | | Post-test |
| Word,PowerPoint and Excel | | 18 | 18 |
| Voice recorders | | 13 | 15 |
| Digital cameras | | 9 | 17 |
| Computer Mediated Communication (CMC)  Concordances  Multimedia  Virtual Learning Environment (VLEs)  Online dictionaries  Interactive white boards (IWBs)  Mobile technologies  Authorware  Web 2.0 | | 15  5  13  15  10  8  16  2  18 | 15  16  16  17  14  14  17  11  18 |

Reflecting on their technology knowledge, the trainees reported that the module not only increased their awareness of the range of technologies they might use to support language learning and teaching, but also their awareness of the range of functionalities of technologies they were already familiar with, their affordances for language learning and teaching and how they can adapt and use them to design their own activities for use in their own pedagogical contexts. For example, participants 1 and 17 reported that the training not only expanded their technological knowledge (TK) but also allowed them to match the affordances of different technologies to their planned pedagogy.

I am aware of some of them such as YouTube videos and some online dictionaries, however, others such as Voki, Prezi, Pawtoon , Hangman game website, concordance.. No, I did not know how to customise them according to my classroom’s needs. The training was really helpful and allowed me to explore the technical affordances of these websites/technologies and relate this to my teaching practice (Participant 1, 24 years old and in her 3rd academic year)

I think I am a user of technology and after the training I developed my ability to use Apps on apple store and using concordances and online games and puzzles I am confident now to design activities using different Apps the idea is not about the technology is what you add to the technology (Participant 17, 20 years old and in her 3rd academic year).

Similar findings were observed in previous studies (Anysari, 2015; Bustamante, 2020) and support Keating and Evan’s (2001, p. 1671) claim that TPACK "extends beyond proficiency with technology for personal use to an understanding of how technology can be integrated with subject matter in ways that open new avenues for student understanding of the subject matter and the technology itself.”

4***.2. Self-reported TPACK***

Table 2 presents the mean and standard deviation of ratings for each dimension of TPACK. These data show that, in contrast with most previous studies on technology professional development for teachers (e.g., see Tseng et al, 2020 for a review), the trainees’ ratings of their self-efficacy decreased for all dimensions of TPACK, and these decreases were all statistically significant and of moderate size (Plonsky & Oswald, 2014).

**Table 2.** Mean and standard deviation of self-reported TPACK

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pre-test | Post-test | Wilcoxon signed ranks test |
| **CK** 2.48 (.57) 1.69 (.43) | | | *T* = 2, *z* = -3.52 , *p* < .01,*d* = -.83 |
| **PK** 2.57 (.50) 1.69 (.43) | | | *T* = 0, *z* = -3.66 , *p* < .01,*d* = -.86 |
| **PCK** 2.78 (.49) 1.81 (.44) | | | *T* = 0, *z* = -3.73 , *p* < .01,*d* = -.88 |
| **TK** 2.70 (.51) 1.71 (.42) | | | *T* =0, *z* = -3.73, *p* < .01,*d* = -.88 |
| **TCK** 2.83 (.80) 1.28 (.34) | | | *T* =0, *z* = -3.73, *p* < .01,*d* = -.88 |
| **TPK** 2.70 (.56) 1.64 (.44) | | | *T* = 1, *z* = -3.63, *p* < .01,*d* = -.85 |
| **TPACK** 2.94 (.73) 1.75 (49) | | | *T* = 1, *z* = -3.62 , *p* < .01,*d* = -.85 |

This finding is, however, also somewhat unsurprising. Decreases in ratings of self-efficacy are commonly observed in intervention studies outside CALL teacher education as well as in some TPACK studies (Abbit, 2014), due to shifts in participants’ understanding of effective technology integration as a result of the training they have been provided (Gosselin et al., 2020). Indeed, interview data from the trainees suggests that changes in the trainees’ understanding of what it means to effectively deploy technology to suport language learning and teaching as a result of the training might explain the decreases in the trainees’ ratings of their self-efficacy for technology integration in this study and that the trainees’ understanding of how to use technology to support language learning and teaching had in fact increased. For example, reflecting the findings of Tseng et al.’s (2020) review research on TPACK, before starting the module, the trainees reported that they tended to focus on using technology to engage students with language learning by introducing fun activities such as games, while at the end of the module, they reported that they had developed their understanding of how to use technology to implement different pedagogies. For example, before completing the training participants 4 and 6 tended to use technology as a technical tool (TK) for entertainment whereas after the training they tended to use it to present content (TCK) and implement their pedagogy (PCK) reflecting the intervention’s focus on developing trainees’ understanding of how technology can be deployed to represent content in ways that support understanding and engage students in processes that are known to support learning

First before the training I had an idea that technology can make the class fun and interactive and I was looking for technologies that will help learners to enjoy the lesson but now I think my ideas have changed. Now I am thinking about technology in relation to SLA theories (participant 4, 22 years old and in her 3rd academic year).

Well before the training (…) my main aim was to have fun and entertain myself however, after the training I knew that even chatting can be used to develop language skills such as writing and accuracy (…) now after attending the training I am aware that all technologies can be used to teach English if we have a focus in mind for example if we want to teach vocabulary we can use flashcards and if we want to drill and practice vocabulary we can use quizzes or games in Quizlet(participant 6, 21 years old and in her 3rd academic year).

*4****.3. Intended use of technology***

Table 3 compares the number of trainees who intended to use the different technologies at pre-test with the number that intended to do so at post-test. Despite the decreases observed in the trainees’ levels of self-efficacy, these data show increases for all technologies, with the greatest increases for the technologies that trainees were least familiar with, namely educational technologies and linguistic software. That intended use increased from pre-test to post-test, despite lowering levels of self-efficacy, lends further support to the claim that the trainees’ self-efficacy lowered as a result of a change in their understanding of effective technology integration (see above).

**Table 3.** Number of trainees intending to use technologies used in language learning and teaching at pre-test and post-test

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pre-test | | Post-test |
| Word,PowerPoint and Excel | | 17 | 18 |
| Voice recorders | | 10 | 15 |
| Digital cameras | | 3 | 12 |
| Computer Mediated Communication (CMC)  Concordances  Multimedia  Virtual Learning Environment (VLEs)  Online dictionaries  Interactive white boards (IWBs)  Mobile technologies  Authorware  Web 2.0 | | 9  4  12  9  5  4  14  0  7 | 16  13  16  15  8  11  17  8  14 |

Supporting Margerum-Leys and Marx’s (2002) claim that knowledge about what technology is available for use in the classroom and how to use it is a prerequisite to developing TPACK, data from the interviews suggests that these increases in levels of intended use might be explained by an increase in trainees’ awareness of not only the range of technologies available to them, but also their functionalities and how they might be used to support the development of different areas of linguistic knowledge and skills. For example, participant 17 reported that she used to use Word to simply prepare her lesson plan but now she actively thinks about how Word can be used to support different writing pedagogies including process and collaborative writing.

For example, the simplest example is Word before the training my idea was limited to using it to print out my lesson in a neat way however after the training, I got many ideas I can used to practise process writing students can write few sentences then exchange computers and continue on each other drafts in this way they will be co-constructing the text together and at the same time engage in peer review.(participant 17, 20 years old and in her 3rd academic year)

Participant 13, on the other hand, became aware that she could adapt materials she found online and author her own enabling her to better align them with her own content (TCK) and pedagogy (TPK).

The training allowed me to explore new ways of teaching English in the future now I feel that authoring the online materials is better than using ready-made online exercises because you can customise it according to your content (…) also, now I can see that using online exercise is better because they provide non-judgmental and immediate feedback, they will help teachers a lot and assess learners’ performance immediately (participant 13, 20 years old in her 3rd academic year).

*4****.4. Rationales for the use of technology***

As already noted above, trainees’ reasons for using technology in their teaching changed over the course of the study, from a focus on making learning fun at the start of the study to a focus on using technology to engage learners in processes that are known to support learning and the acquisition of linguistic knowledge and skills at the end of the study. This shift, which was observed for all technologies covered in the survey (see supplementary materials), is most evident in the following trainees’ reflections:

(…) before the training I chose the websites/APP based on how fun they were to my students but now after the training I am very concerned about the suitability of a specific website for teaching language skills (participant 3, 20 years old, 3rd year).

Moreover, the trainees’ reflections suggest that training enabled them to *connect* their understanding of the affordances of technology with their understanding of how to facilitate learning and engage learners in processes which are known to support language acquisition, one of the primary aims of the PCK-T approach (see above):

(…) also, role play is very effective to teach listening and speaking and with the help of Voki and PowToon, students can practise speaking and revise and check their utterances before sharing it with others which helps them to focus on meaning and form (Participant 3).

Before the training I did not know that I can teach grammar using Prezi by using the sequence of slides to show past and present tenses (...)also, If I want to teach listening, I have to insert text with the listening materials this can be done by using subtitles function in YouTube or other videos (Participant 6).

***4.5. Perceptions of PaCKed with Technology***

Trainees’ perceptions of the training (see supplementary materials for an overview), suggest that this shift in focus towards more pedagogically grounded reasons for the use of technology to support language learning might be explained by a fuller understanding of SLA theory and language learning pedagogies, as well as support to make connections between the affordances of digital technologies and SLA theory and pedagogy. Students’ perceptions towards the training were positive as they explained that the training not only allowed them to develop their TPACK skills but also develop a better understanding of what it means to use technology.

The training helped me to understand myself and my abilities… before the training I thought we can use whatever technologies we feel comfortable with but now my understanding has changed I realised that my ideas of how technologies should be used were completely wrong and now I feel that I need a lot of training to be able to say that I am expert in using technology in my class (Participant 2)

After the training now, I feel comfortable to use Prezi, create my own educational games using Quizlet and Spelling city and to use concordance (Participant 2).

I enjoyed the training it allowed me to make a great link between what I took in SLA courses and the use of technology, now I feel confident to justify any use of technology for the benefit of my learners in relation to SLA principles (participant 7, 20 years old in her 3rd year)

In summary, this study established that pre-service teachers are aware of a range of different technologies (TK) but are uncertain about their affordances for English language teaching (TCK, TPK and TPACK). Engaging in the training not only raised their awareness of these affordances, but also challenged their understanding of what it means to effectively deploy technology to support learning and teaching. In particular, the training shifted teachers focus from support for teaching (e.g. lesson planning) and using technology to engage learners (e.g. through the use of games) to using technology to engage learners in processes known to support language acquisition (e.g. process writing and collaboration; TPK and TPACK). As such, our results support claims that PCK is a prerequisite for the development of TPACK (Chai et al., 2010; Kessler & Bikowski, 2011).

***5. Conclusion***

This paper set out to evaluate “PaCKed with Technology” a novel pedagogically-driven model of technology professional development. The evaluation, which was conducted in the context of a pre-service primary EFL teacher education program in Kuwait, explored the impact of a module based on the PCK-T framework on trainees’ self-reported TPACK, i.e. knowledge of how to deploy technology to support pedagogical goals, and reported reasons for using technology to support language learning and teaching. Interviews with the trainees’ conducted before and after completing the module suggest that the approach supported the development of the trainees’ pedagogical content knowledge and technology knowledge, and consequently their ability to make connections between them, which in turn enabled them to deploy technology effectively to support their planned pedagogy. More specifically, with respect to technology knowledge, the trainees reported that their awareness of the range of affordances of technologies to support language learning increased as well as their awareness of the range of technologies available. Findings from the survey of their self-reported levels of TPACK, however, contradicted this, with trainees’ levels of TPACK, and technological content knowledge and technological pedagogical knowledge, decreasing from pre-test to post-test, despite reported increases in familiarity with available technologies and intention to use them in their future teaching. These decreases in self-efficacy, and in particular self-efficacy to make the connections between content and pedagogy and technology, might be explained by the fact that the module changed trainees’ understanding of what it means to use technology effectively to support language learning and teaching. From a methodological point of view, it is therefore important that future studies explore reported (intention to) use of technology as well as self- reported levels of TPACK, as we have done in this study. In terms of technology professional development, the insights from the trainees’ reports of their actual use of technology suggest that “PaCKed with Technology” is an effective model of teacher professional development for teacher education and that it is critical to devote time to the introduction of the affordances technologies trainees are already familiar with as well as the range of technologies available as well as time to help trainees understand how those affordances might be exploited to facilitate learning. Technologies trainees may not have experienced as learners (e.g. authorware) and subject-specific technologies (e.g. concordances) should also receive particular attention on pre-service technology professional development programs.

**Ethical statement and competing interests (required)**

The current research complies with the ethical regulations of research work by which volunteer participants could withdraw from the study at any point in time and that their identifying data would be kept anonymous. The authors declare no competing interests.

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1. Supplementary materials are available on IRIS: <https://www.iris-database.org/> [↑](#endnote-ref-1)
2. This research has been reviewed by and received ethics clearance from the University of York Education ethics committee Ref:22/1 data protection registration no: Z4855807. [↑](#endnote-ref-2)