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Article

Equipping Language Teachers with the Digital Literacy to Support Student Learning in and Beyond Classrooms

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Abstract
As digital technologies continue to evolve and improve, and the range of language learning resources available continues to expand, it becomes more important that language teachers possess both the digital literacy to effectively incorporate these technologies into their teaching practices to facilitate language learning within and beyond the classroom. However, evidence suggests that teacher training programmes do not uniformly provide satisfactory levels of training on Computer Assisted Language Learning (CALL), resulting in teachers lacking the digital literacy, and consequently, the inclination, to make CALL a meaningful part of their classroom activities, and research is needed on how to remedy this issue. The main aim of this study was to design, implement, and evaluate a CALL intervention among a cohort of Teaching English to Speakers of Other Languages (TESOL) students. This involved a questionnaire to determine initial CALL knowledge and practices, and then a 4-week intervention, which was evaluated through thematic analysis of semi-structured interviews. Analysis revealed that while integration of CALL is limited through lack of knowledge and training, students increasingly see CALL literacy as a central professional responsibility, and they reported that the intervention had improved both their knowledge of CALL and their ability to find and evaluate resources. These findings indicate that short-term CALL literacy interventions can be effective in equipping language teachers with the resources to support their own learners in employing CALL both inside and outside the classroom.

Keywords
Computer-assisted language learning, digital intervention, TESOL education, learning beyond the classroom, Digital Literacy

1 Introduction

The rapid advancement of digital technology has had a profound impact on all aspects of education, with language teaching and learning being no exception. The range of apps and other online resources and platforms that, depending on how they are used, can either support or hinder learning, continues

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to expand, making it imperative for educators to familiarise themselves with these resources, so that they may appropriately employ them to enhance learning. For language teachers, it is no less essential that their own digital competences are sufficiently advanced to develop these literacies among their own learners to facilitate learning both within and beyond the classroom. In the 21st century, the ability to navigate, select, and effectively harness digital resources such as websites and smartphone apps is becoming an increasingly important skill for language learners, and therefore, language teachers.

Yet, there remains a need to explore pre-service teachers' beliefs on integrating technology into their teaching (Moon et al., 2022). A review of the literature by Zhou et al. (2024) reported that various factors can shape or change the beliefs of teachers, including collaborative practice, institutional ethos, and prior experience using technology, and as they note, 'Teachers' beliefs profoundly influence pre-service teachers' future technology integration practice' (p. 4). However, language teacher education programmes do not do a uniformly efficient job of equipping future educators with the combination of knowledge and pedagogical know-how to critically evaluate and integrate them into their pedagogical practices (Iskandar et al., 2022), and it is important 'to identify areas that, although at present do not feature in teachers' perceptions of critical digital literacies, […] need to be integrated into future policy-making agendas' (Gouseti et al., 2023, p. 1752), so that the decisions of teachers, and consequently students, will be underpinned by critical awareness and agency (Ávila, 2021). It is this gap in teacher perceptions of the importance of digital literacies that this study seeks to fill.

2 Literature Review

The integration of technology in language education has gained significant attention in recent years, particularly in light of the increasing demand for educators to be digitally literate. For language teacher education programmes, this concept is crucial as it influences how teachers engage with technology and affects how they prepare their students for language learning in a rapidly evolving digital landscape.

2.1 Defining digital literacy

Digital literacy has been conceptualised in many overlapping ways, with one recent definition suggesting that these 'literacies can range from the functional to the critical, and from the personal to the professional. They can be taught formally in the language classroom or learned through autonomous practice' (Darvin & Hafner, 2022, p. 868). While this and many other definitions of digital literacy encompass skills that facilitate broader participation in society and digital citizenship, for the purposes of this paper, concerning the digital literacy of student teachers, it is defined as 'proficiency in applying technology to education accompanied with awareness of and decisions on the implications of teaching and learning' (Nguyen & Habók, 2024, p.309). Developing these digital technology skills can lead to the professional development and empowerment of teachers, building their confidence in using these resources effectively, and in turn, improving the standard of their teaching, (Pérez-Escoda et al., 2019). Moreover, there is a focus on equipping student teachers to help learners develop the skills to harness digital resources not only inside the classroom, but also autonomously outside the classroom, in the *digital wilds* (Sauro & Zourou, 2019).

The effective use of digital tools in language learning contexts hinges on the digital literacy of educators (Graham et al., 2019). Language teachers are expected to navigate a wide range of digital resources, from language learning apps to online platforms that offer authentic language exposure. However, many educators lack the training to select appropriate digital tools and integrate them effectively into their teaching (Pegrum et al., 2022). Similarly, a recent study by Hughes et al. (2023), which explored digital competence and confidence among 30 pre-service language teachers, reported that while their participants were positively disposed towards ICT, 'they feel additional specific and in-

depth preparation is required within their initial training' (2023, p. 1). They consequently suggest a need 'to develop new training resources and measure their effectiveness'. Exploring the potential of one such digital intervention as part of pre-service training is one aim of this study.

2.2 Frameworks for evaluating teacher digital literacy

Various theoretical approaches have been developed to explore these educator literacies, including the SAMR (Substitution Augmentation Modification Redefinition) model (Puentedura, 2006), the CDL (Critical Digital Literacy) framework (Hinrichsen & Coombs, 2014), and the TDC (Teacher Digital Competence) framework (Falloon, 2020). One early but influential framework is the Technological Pedagogical Content Knowledge (TPACK) framework, which highlights the importance of knowledge of technology, pedagogy, and content, and how these competences can intersect within a particular context to support the effective integration of technology into teaching (Koehler & Mishra, 2005).

A more recent framework developed to advance these competences is DigCompEdu: the European Framework for the Digital Competence of Educators, which acknowledges the ubiquity of digital technologies and that 'the duty to help students become digitally competent requires educators to develop their own digital competence' (Redecker 2017, p.4), and aims to standardise language, logic, and frames of reference across European member states. Compared to TPACK, DigCompEdu is 'a better-operationalised conceptualization of TDC [Teacher Digital Competence] which encompasses the professional expertise of teachers and also their professional development' (Horváth et al., 2024, p.5).

Regardless of the framework adopted, the growing body of literature emphasises the need for teacher education programmes to incorporate digital literacy training that aligns with current technological advancements. For instance, Murray et al. (2020) argue that digital literacy should be embedded in language teacher education curricula to ensure that future educators are equipped to utilise technology effectively. Moreover, Mullen et al. (2023) indicate that the integration of technology in language education not only enhances student engagement but also fosters independent language learning. Therefore, the development of digital literacy in student teachers is not just an added benefit but a necessity in preparing them for modern teaching environments.

2.3 Previous digital literacy interventions

Given the continuous developments in learning technologies, and the shortfalls in teacher training already mentioned, it is inevitable that interventions take place to address this gap. Within the field of language learning, there have been interventions aimed at raising awareness of the role that technologies can play in supporting learning, and these have been conducted with both language learners (see, for example, Göktürk (2017), who explored the use of video recordings, and Avci and Adiguzel (2017), who reported on mobile-based collaborative learning) and, more relevant to the focus of this study, pre- or in-service language teachers.

One such intervention explored how smartphones could be used to help raise awareness of different accents, highlighting the power of technologies to help teachers become more familiar with and tolerant of various accents (Bozoglan & Gok, 2016). Hautemo and van der Merwe (2022) reported on a study involving the collaborative use of Wikipedia by pre-service teachers, noting the increased quality of their communication skills. Koltovskaia (2023) examined the use of Grammarly to supplement the feedback of both in-service and pre-service teachers, finding that, while limited, it did provide some support for their provision of feedback. A study of pre-service teachers in Portugal found that the use of Virtual Exchange was helpful in improving intercultural awareness and communication skills (Rets et al., 2023). Yu and Wang (2025) experimented with digital storytelling to promote digital collaboration among pre-service English teachers, reporting improvements in both their own level of English and their proficiency with digital storytelling. This study seeks to add to this body of literature on digital interventions.

2.4 Language Learning Beyond the Classroom

An emerging theme in language education is the notion of supporting language learning beyond the traditional classroom setting. While *learning beyond the classroom* can encompass informal learning, structured out-of-class learning activities, or self-directed learning, for the purpose of this study, the scope is limited to the role language teachers can play in helping their students to develop their language learning skills 'to enable them to continue to learn without the help of a teacher' (Reinders, 2020, p. 63).

Integrating technology into language learning can lead to increased learner autonomy, enabling students to take charge of their language acquisition process (Kukulska-Hulme, 2013). The proliferation of digital tools has transformed how and where language learning occurs, or, at least, where it can occur, with many learners now engaging with language through various online platforms, mobile applications, and social media (Godwin-Jones, 2020), allowing learners to practice skills at their own pace and on their own schedule. Through the process of familiarising themselves with these tools, student teachers can better guide their future students in utilising them effectively, thereby enhancing their overall language proficiency (Mullen et al., 2023). Harnessing such resources nurtures learners' language skills and builds their confidence in using the language in real-world scenarios, thus reinforcing their motivation to engage with the language outside the classroom.

To summarise, the literature reviewed has emphasised the critical importance of enhancing student teachers' digital literacy, the relevance of technology to language learning both in and beyond the classroom, but also the failure of teacher education curricula to consistently focus on this crucial aspect of language teaching. Thus, there is a need to explore ways in which these skills and capabilities can be fostered among student teachers, and how future iterations of teacher-training programmes can be enhanced. This is one of the aims of the project described in this study.

3. Methodology

3.1 The aim of the study

This study explores the classroom processes through which student language teachers engage with digital resources for language learning. Specifically, the paper describes and examines the outcomes of a structured intervention on a one-year full time postgraduate TESOL programme at a Scottish university in which 21 student teachers experimented with, and then individually and collectively evaluated and reflected on various websites and smartphone applications. It asks the following research questions:

1. What are the current uses of technology and levels of CALL literacy of a cohort of student teachers of TESOL?
2. How do student teachers perceive the effectiveness of a CALL intervention aimed at increasing levels of CALL literacy?

To achieve these aims this study employed a mixed method approach combining quantitative survey data and qualitative data from a semi-structured interview. This article describes how the intervention informed their evolving understanding of both language and digital pedagogy, and built their repertoire of digital resources to support learning both within and beyond the language classroom. Additionally, the study aims to assess the impact of the digital intervention in fostering a more confident attitude towards future use of various technologies.

3.2 Participants

As Table 1 shows, the cohort was primarily international in nature, with Pakistan and China having the most students. Typically, Pakistani students had more teaching experience than their peers, and also had a

relevant qualification, while Chinese students had comparatively less experience, and most did not have any specific teaching qualification, instead having undergraduate degrees in subjects such as Language and Linguistics. The cohort could be roughly divided into two profiles: those already qualified and working as teachers, and those without either a job or a prior qualification, who were looking for a first teaching position, though not every student fit neatly into either profile.

Table 1
Profile of Participants

	Nationality	Gender	Years of teaching experience	Prior educational qualifications
P1	Pakistani	Female	8	Primary education
P2	Pakistani	Female	6	Primary education
P3	Pakistani	Female	7	Primary education
P4	Pakistani	Female	11	Primary education
P5	Pakistani	Female	3	Primary education
P6	Pakistani	Female	3	Primary education
P7	Pakistani	Female	7	Primary education
P8	Pakistani	Female	5	Primary education
P9	Indian	Female	3	Secondary Education
P10	Ghanaian	Female	4	Secondary Education
P11	Bangladeshi	Male	2	Secondary Education
P12	Kurdish	Male	0	None
P13	Czech	Female	0	None
P14	Chinese	Female	0	None
P15	Chinese	Male	4	Secondary education
P16	Chinese	Female	0	None
P17	Chinese	Female	0	None
P18	Tunisian	Female	4	Primary Education
P19	Scottish	Male	0	None
P20	Thai	Female	3	Secondary Education
P21	Spanish	Female	18	Primary Education

3.3 Design and procedure

The overarching aim of the research project was to guide student teachers in developing a critical understanding of how to incorporate digital tools into their teaching practices to enhance the quality of language teaching and learning. This digital intervention comprised three components: firstly, an initial questionnaire to determine the cohort's existing levels of use and comfort with digital resources, and subsequently, a four-week intervention during which students experimented with, evaluated, and reflected on their experiences with various digital resources. Finally, the intervention was followed by semi-structured interviews of 13 of the 21 students on the MEd TESOL programme, the transcripts of which were thematically analysed following the six-step process outlined by Braun and Clarke (2006). Ethical approved was received from the university's ethical research committee.

3.3.1 Initial Questionnaire

Questionnaires are a frequently-used tool in educational research, and are valued for their time efficiency as well as their ability to capture data on attitudes and behaviours (Cohen et al., 2018). The questionnaire was designed on the Microsoft Forms platform, and the link was shared with students via their institutional email and also shared on the university's Learning Management System. Students were informed that their completion of the survey was entirely voluntary, anonymous, and the data would be treated confidentially.

The short questionnaire functioned as a diagnostic tool to inform some of the specific resources to be introduced during the intervention phase, as well to produce descriptive quantitative data to complement the qualitative data collected from the interviews. Through a series of closed, typically multiple-choice items, it explored the cohort's existing uses of technology in their teaching practices, and their levels of comfort with various technologies.

Although a post-intervention survey was considered to offer a contrast with the pre-intervention data, the small number of participants surveyed meant that statistical analysis was not possible, and would not have allowed quantitative measurement of any improvement. Thus, one limitation of this study is that it is limited to primarily qualitative analysis of the data collected.

3.3.2 Interviews and thematic analysis

To allow further exploration of the survey data, semi-structured interviews were conducted as these different methods of data collection can enhance each other 'by capitalizing on their complementary strengths and differences' (Plano-Clark, 2016, p. 305).

The interviews were subsequently subjected to inductive thematic analysis, which is a qualitative research method that involves identifying, analysing, and interpreting patterns (or themes) within a dataset. It is widely used in qualitative research due to its flexibility and ease of use, and is frequently used with interview data (Gray, 2018).

The process of thematic analysis in this study followed the six steps outlined by Braun and Clarke (2006). Although grounded theory was considered as an alternative, the time frame available for research did not allow for the iterative cycle of data collection and analysis, and moreover, the researcher was not seeking to develop new theories based on the analysis of the collected data, which is central to grounded theory (Charmaz, 2024), but was focused on generating rich, detailed description of themes that highlighted key issues and offer insight into the essence of the participants' perspectives.

3.4 Digital intervention

The intervention took place within a TESOL module titled Theory and Practice in TESOL. The module lasts 12 weeks, with one three-hour session per week, the first six of which are seminars focusing on the fundamental elements of lesson preparation such as writing a coherent lesson plan, designing and sequencing classroom activities, effectively creating lesson materials, and classroom management techniques. The second half of the module involves the delivery of 12 hours of English language teaching to a class of ESOL learners recruited from across Scotland. Across the six weeks, each MEd TESOL student delivers at least two classes of teaching, as part of two-hour classes planned collaboratively with the other students teaching on that day.

The first three classes of the intervention focused weekly on three different categories of digital resource, allowing the participants to progressively build their skills in evaluating the usefulness and pedagogical potential of these tools. The process involved searching for digital resources, experimenting with them, evaluating their educational merits for learning in and out of the classroom, and reflecting on their experiences. The culmination of the four weeks was a collaborative knowledge-sharing session where students presented their findings. The following sections will detail the implementation of each of the weekly sessions.

3.4.1 Week 1: Dedicated language learning resources

In the first week, the student teachers were tasked with identifying and experimenting with dedicated language learning resources, such as websites or mobile apps that are explicitly designed to improve language skills. This included platforms such as Duolingo, Memrise, and Babbel, which offer structured lessons and interactive exercises targeted at improving English skills.

The primary goal of this week was for the student teachers to explore how these dedicated resources could be used in and/or beyond the classroom to support language learning. They examined key aspects of each resource, including:

Pedagogical Design: Does the resource align with current language teaching methodologies? For example, does it incorporate communicative language teaching principles or elements of task-based learning?

User Engagement: Is the tool engaging for learners? Does it provide opportunities for interactive and immersive learning, or is it limited to repetitive, drill-based tasks?

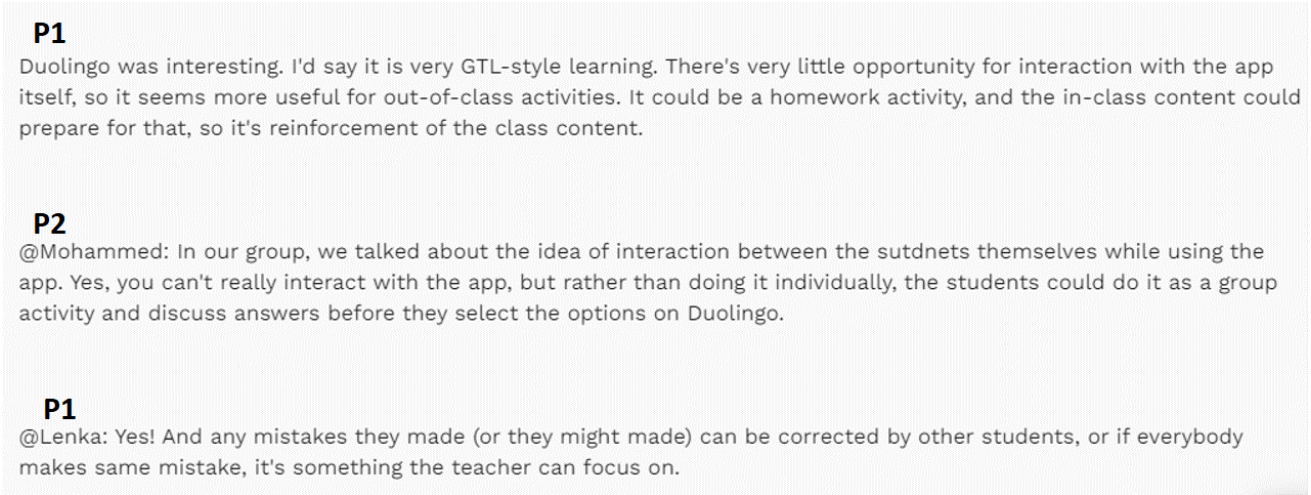
Skill Development: How many skills does the resource target, and how effectively?

After experimenting with the selected resources, the student teachers reflected on their experiences through guided discussions and written evaluations. They were encouraged to think critically about not only the potential of these tools for fostering meaningful language use, but also their limitations. For instance, while apps like Duolingo are considered engaging due to their gamified nature, some student teachers pointed out that these resources often lack depth in terms of promoting productive language use, such as writing or speaking in context.

The reflections also highlighted important considerations about how these dedicated resources might be used in different teaching contexts. While they can be effective supplementary tools, student teachers recognised the need to use them in conjunction with teacher-led activities that promote interaction and real-world language use. Additionally, they considered how these resources could support learners in developing their language skills beyond the classroom, offering opportunities for autonomous practice and reinforcement of in-class learning.

One such resource experimented with was the Duolingo app. An example of this interactive, reflective discussion is presented in Figure 1 below. In this exchange, P1 firstly evaluates Duolingo as having limited value as a classroom resource, but P2 shares the fact that her discussions identified a different, more collaborative and classroom-friendly use of Duolingo, which P1 responds to by further considering ways that the resource could be used in class.

Figure 1
Reflective Discussion of the In-class Merits of Duolingo



This interaction serves as an example of the way in which resources were evaluated, and then reflexively re-evaluated based on discussion with peers, enhancing both individual and group understanding of the potential pedagogical applications and limitations of resources such as the Duolingo app.

3.4.2 Week 2: Exploration of authentic resources

In the second week, the focus shifted from dedicated language learning tools to authentic language sources of language. These include digital tools, websites, or apps not specifically designed for language learning, but which provide exposure to authentic language use and opportunities for language practice. Examples include video streaming sites like YouTube, social media platforms such as Twitter/X, news websites, podcasts, and online communities such as Reddit.

The aim of this week was for student teachers to explore how these authentic resources can provide learners with exposure to real-world language use, often within a certain social or cultural context. Authentic resources are highly valuable in language learning because they offer language in context, which is often more complex and less predictable than the structured exercises in language-specific tools (Gilmore, 2007). Such exposure and experimentation helps learners develop the ability to understand and produce language in more natural settings, preparing them for interactions beyond the classroom.

Student teachers were encouraged to consider the following aspects when evaluating authentic resources:

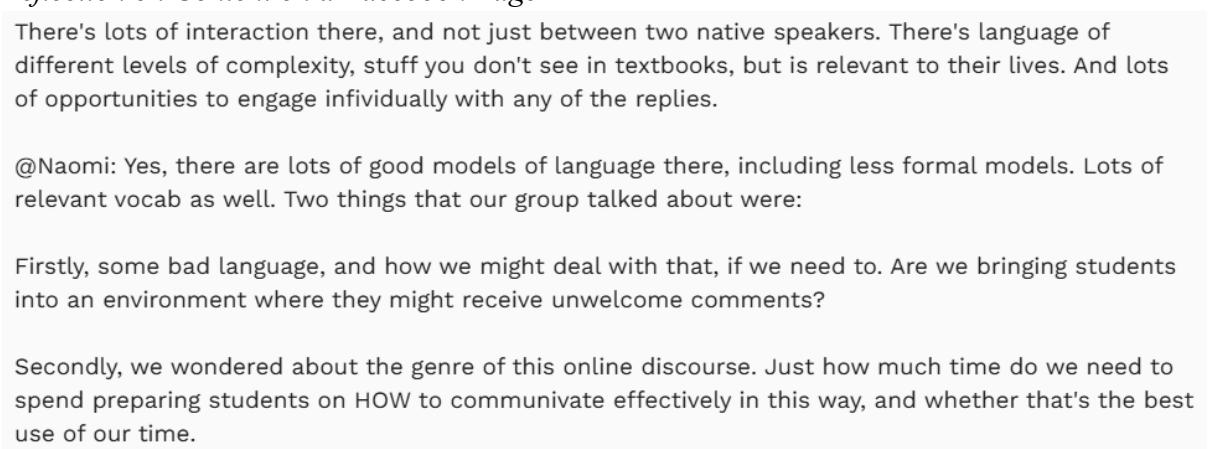
Language Authenticity: Does the resource expose learners to real, unmodified language as it is used in a particular community?

Language Skills Development: Which language skills can be developed through the resource? For example, reading comprehension can be enhanced through news articles, while listening skills can be improved through podcasts or videos.

Potential for language production: Does the venue offer an opportunity for learners to produce their own comments and engage with people or a community? For instance, Facebook groups discussing a particular music group, or a football team, offer opportunities to interact with members of those communities.

The student teachers explored a variety of non-dedicated resources, including using video streaming sites to enhance listening skills, reading news sites for vocabulary expansion, and following social media accounts for exposure to and interaction with authentic content on areas of interest. They discussed their experimentations with these resources, and one insight that emerged was a particular focus on informal registers or subject-specific language that might not be covered in textbooks or traditional classroom activities.

Figure 2
Reflection on Content on a Facebook Page



Another insight from the week two experiments was, as Figure 2 shows, the recognition that learners need guidance on how to use some of these resources effectively, echoing Godwin-Jones (2016, p. 6) who emphasises not just the importance of students building skills to harness the learning potential of online resources, but also 'the essential role of the teacher in that process'. Resources with opportunities for interaction can be daunting for learners to engage with, and a more structured examination of the nature of these online interactions would be essential to help learners build the understanding to communicate with confidence.

3.4.3 Week 3: Evaluating generative AI for language learning

The third week of the intervention explored a recent development in language learning: the potential role of generative AI in supporting language education. Generative AI tools, such as ChatGPT or other AI platforms, have been gaining attention for their ability to compete tasks such as generating human-like text, and the 'the promises held by this technology are vast: personalised content, instantaneous feedback, immersive, interactive learning experiences, and content creations' (Creely, 2023, p.10.) However, as Teng (2024) notes, developing a critical understanding of Generative AI is essential, both to ensure accuracy of information and to avoid an over-reliance on such technologies.

This week's focus was on critically evaluating how AI tools can support, rather than replace, essential language learning processes. The student teachers were tasked with experimenting with generative AI in various ways, such as a focus on writing, by exploring how AI might help learners to enhance their writing skills through immediate, automated feedback on written work. They could also examine the potential to support reading practice, evaluating the ability of AI to generate useful pieces of text for reading comprehension practice, as well as considering how well AI could be used to explain grammar rules or provide vocabulary activities.

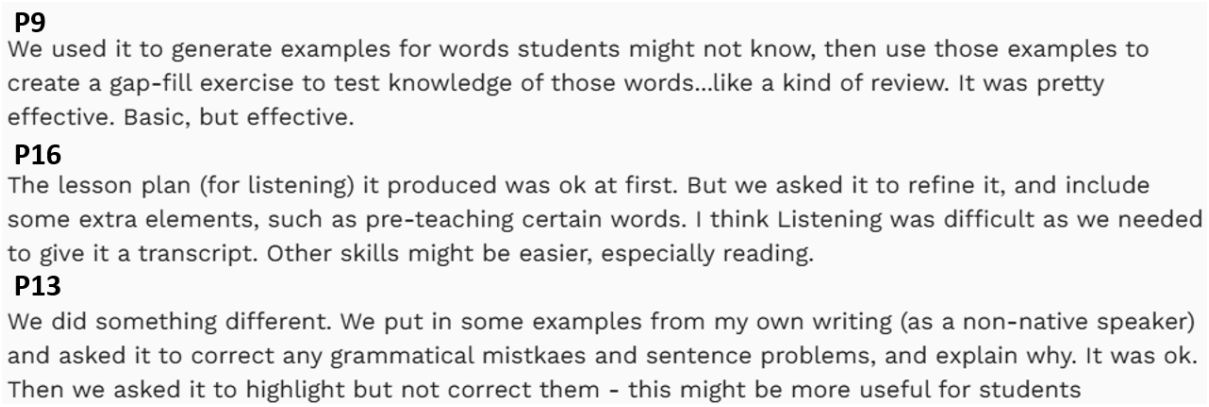
The evaluation criteria for this week included the following elements:

Pedagogical value of output: How valuable are the materials generated by AI? Do they provide useful resources for teachers or learners, or are there inaccuracies or limitations that could potentially limit learning?

Quality of AI-generated feedback: How does AI perform when asked to correct or provide feedback on a piece of writing?

The student teachers reported generally positive results. In all cases, ChatGPT was the AI used, and it was employed for a variety of tasks, including generation of content, generation of activities, and to provide feedback on written work.

Figure 3
Reflection on AI-Generated Content

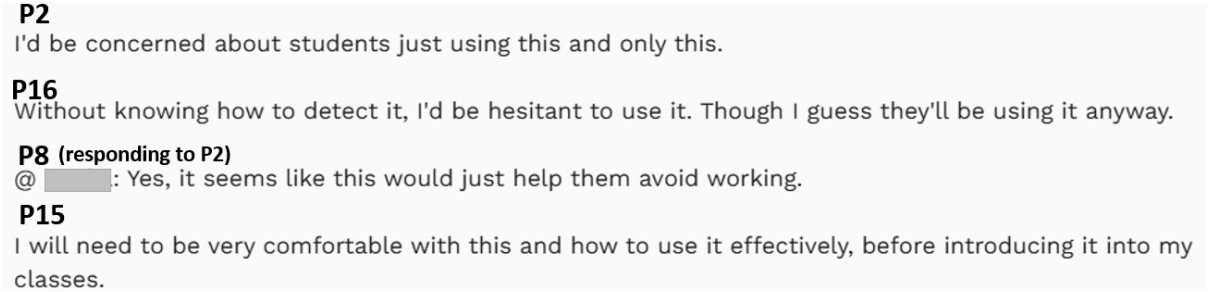


As Figure 3 indicates, the output was not considered of the highest quality, but rather, was 'basic, but effective', with P7 later commenting that 'I could make the same thing just as well, but it'd take me 20 minutes, not 20 seconds.' This theme of Gen AI output being most useful as a time-saving activity, with tasks being initially generated through AI, and then refined as needed by teachers, and thereby saving them from having to create the whole resource from scratch, was the most commonly expressed sentiment about the value of Gen AI in terms of content creation.

One group used ChatGPT as a feedback generator on written content. The first asked the AI to simply correct the piece of writing, and later improved upon this by asking the AI to highlight but not correct any errors, which they felt more useful in terms of supporting student development of writing skills.

Despite these mildly positive assessments, the less beneficial, or less ethical, potential uses of Gen AI were immediately apparent to them, as Figure 4 shows.

Figure 4
Concerns Over Negative Aspects of Generative AI



The participants to realise that Gen AI could be used as a tool to replace learning, rather than support or enhance it. Echoing Fuchs' (2023) discussion on whether Gen AI was a blessing or a curse, the general sentiment among participants was that given their lack of confidence regarding effectively harnessing Gen AI as a resource, or their own ability to distinguish such content from student-produced content, there was hesitance about using Gen AI as a resource for students to use, although, as P16 noted, 'they'll be using it anyway.'

3.4.4 Week 4: Presentation: Reflections and microlesson plan

In the final week of the intervention, participants presented their evaluative conclusions from the previous weeks' experiments in the form of a short pair presentation. Participants had to focus on two key elements in their presentations:

A reflection on the resources they had experimented with in terms of their potential to support language teaching inside or outside the classroom

The design of a 30-minute lesson plan which would utilise any one of those resources to facilitate language learning in the ways mentioned above (based on the principles of lesson design already covered in the non-intervention content of the module).

The participants chose a variety of resources, but the lesson plans were generally quite similar, and resembled the process of the intervention itself, in that the plans typically introduced students to resources, had them experiment with the resources, and then reflect on the potential of that resource to support learning in or beyond the classroom. Figure 5 contains an extract from a lesson plan that focused on use of the SKELL function of the Sketch Engine website (The free SKELL tool, which allows basic word sketches, examples, and analysis, is available here: https://skell.sketchengine.eu/#home?lang=en)

Figure 5
Extract from Lesson Plan Using Digital Technology to Support Learning

5 minutes	Student practice	Experimenting with and evaluating the resource	Have learners open SKELL (https://skell.sketchengine.eu/) on their own devices. They work in groups, doing different tasks: **Example Sentences**: 1. Ask learners to think of a word they often use or struggle with, like "refuse" or "decline." 2. Direct them to enter the word into the "Example Sentences" search bar. 3. Have them read several sentences, noting different contexts and phrases where the word appears. 4. Reflect on these examples help clarify the word's usage. **Word Sketch**: 1. Using the same words, guide learners to click on the "Word Sketch" tab. 2. Explain how this feature provides collocations: words that often appear together. 3. Have them identify two or three useful phrases they might use in writing or conversation.	S-S

Overall, while the module lecturer (this researcher) generally found the lesson plans to be somewhat pedestrian, they were nonetheless pedagogically sound, and represented promising output from a student cohort who, in many cases, had only recently begun to explore the concept of integrating digital technologies into their teaching practices.

In terms of their overall reflections, they were tentatively enthusiastic about the utilisation of technology as a classroom resource, though, as their lecturer is a self-professed advocate of technology, there is clear potential for bias. It was also evident from their reflections, and from the subsequent interviews, that there was a preference for resources that offered less opportunity for distraction or disruption in the classroom, such as Duolingo, rather than more, such as social media.

To conclude this section, this four-week intervention, which followed a process of experimentation, evaluation, and reflection on various digital resources and their pedagogical affordances and limitations, provided the participants with an improved understanding of how digital resources can be effectively integrated into language teaching. They developed critical digital literacy skills, enabling them to assess the pedagogical value of various tools and understand how to use them to support language learning, both in and beyond the classroom, while also considering, and exploring how best to mitigate against, the potentially negative impacts of such resources.

4 Findings

This section will offer a description and analysis of the data collected during the project, starting with the questionnaire, the key results of which are provided below, before moving on to the thematic analysis of the interview data.

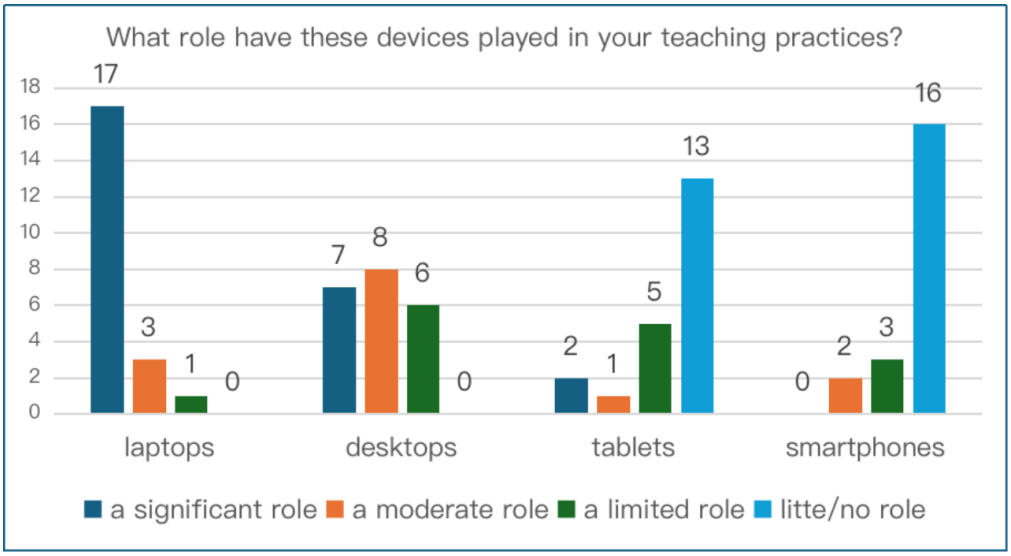
4.1 Survey data

As they survey served primarily to gain initial insights into their existing familiarity with and uses of various technologies, only some key extracts from the survey data are provided here. See Appendix 1 for the full set of questions.

As Figure 6 indicates, the clear majority had significant experience with laptops in their teaching practice, and to a lesser extent, they were familiar with desktop computers. However, there was much

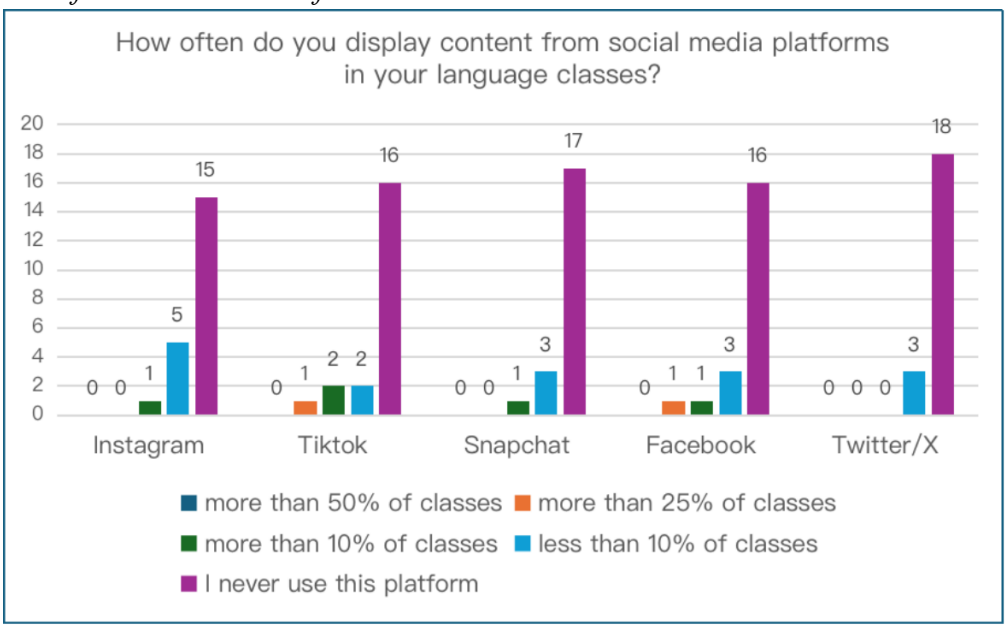
less use of tablets as a teaching resource, and unsurprisingly, use of smartphones was extremely limited. This echoes previous findings regarding both the supremacy of laptops as the primary teaching device in classrooms (Nikopoulou, 2021), and the infrequent use of smartphones (Metruk, 2020).

Figure 6
Existing Use of Technologies



The extent to which the cohort employed social media platforms as part of their classroom practice was explored. As Figure 7 reveals, there was extremely limited exposure to any social media platform as part of their teaching repertoire with most reporting never using any platform.

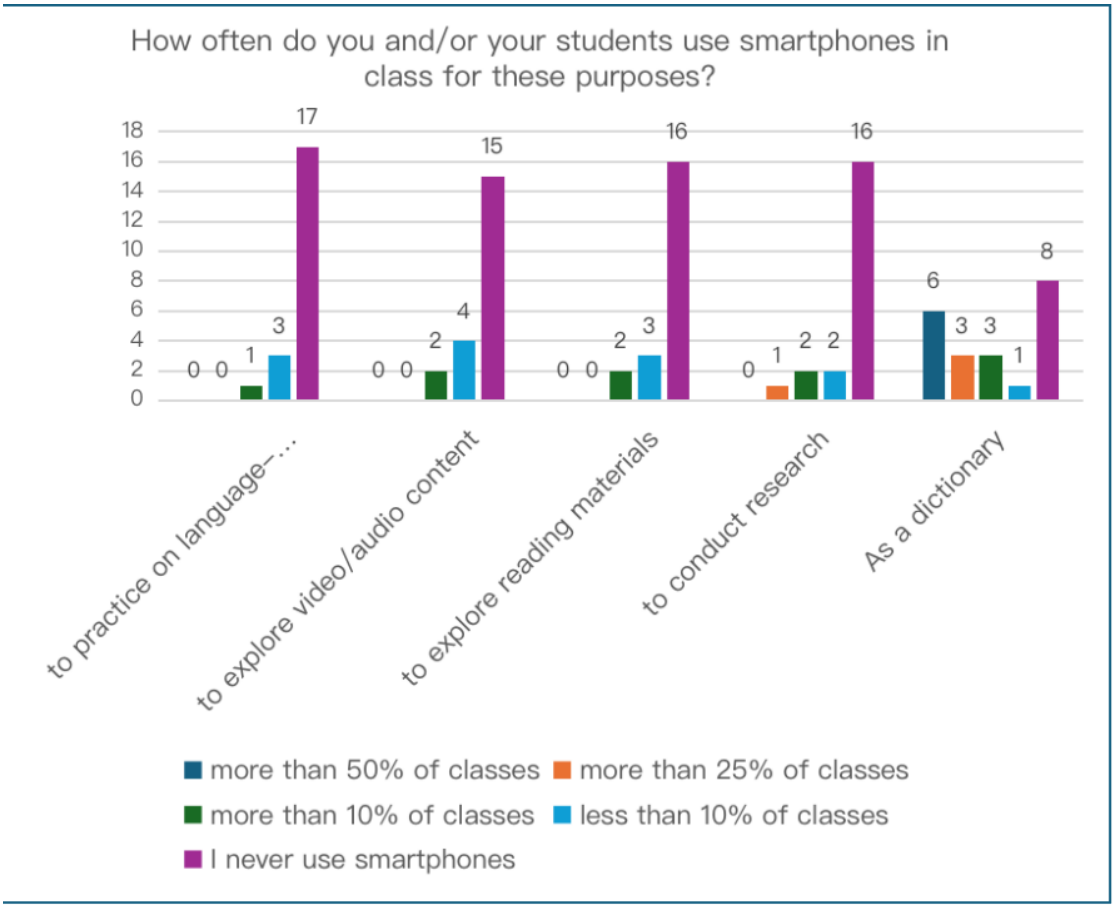
Figure 7
Use of Social Media Platforms as a Classroom Resource



This supports Barrot's (2021) review of the literature which reported that despite established benefits to the use of social media, its use in classrooms tends to be exploratory at best.

The questionnaire also focused specially on the use of smartphones in class, as Figure 8 reveals.

Figure 8
Use of Smartphones in Class



The data indicate that except for using a smartphone to look up words, which was widespread, other uses were extremely limited. Even for this function, usage was limited as some teachers have either a personal or institutional rule that smartphones are not to be used under any circumstances, or they work in schools where children are too young to own the devices. Beyond this, the most frequently employed function of smartphones was to help students conduct research, but even this was not common. These findings echo those of Mullen (2021), whose participants rarely used their devices for language learning, whether in or outside class, for anything other than dictionary purposes.

4.2 Interview data

As mentioned earlier, subsequent to the digital intervention, interviews took place. A full set of interview questions are available in Appendix 2. All of the 21 participants initially agreed to be interviewed. However, for no other reason than busy study schedules, only 13 interviews took place. These 13 engaged in semi-structured interviews which were subjected to thematic analysis to further probe the data in both the survey and the intervention itself. This deductive thematic analysis produced four main themes: positive disposition towards technologies, negative disposition towards technologies, their professional responsibility to become digitally literate, and the effectiveness of the digital intervention, which will be discussed, supported by exemplary quotes, in the following paragraphs. As indicated earlier, the cohort was diverse in terms of their nationality, their qualifications, their teaching experience, and the technology available to them, and these differences occasionally resulted in different opinions within the cohort, which will also be discussed.

4.2.1 Positive disposition towards technologies

All 13 of the student teachers interviewed expressed some positive sentiments about the use of technologies as part of their teaching practices. A commonly expressed opinion was that technology offered engaging content and engaging activities for students, with videos and podcasts being frequently cited. The use of video from sites such as YouTube was repeatedly mentioned as a resource that would engage students, exemplified by one comment that "These videos are another voice in the classroom as well as mine, and I can show them things from the UK or America, let them hear the real language that they are learning."

Social media was also mentioned as a source of engaging and authentic content. Echoing Godwin-Jones (2020), one student teacher commenting that the intervention had "opened my eyes about what kind of things we can use in the classroom, what kind of language we can share with the students", while another noted that some media offered valuable examples of authentic online interactions.

While concerns were expressed about some aspects of Generative AI, student teachers also valued its potential as a resource for making teaching materials, as it could generate tailored content very quickly for either grammar or reading comprehension tasks. It was noteworthy that those who taught at primary level were more enthusiastic about Generative AI as a resource for making materials, perhaps because of the nature of content and tasks at that level, exemplified by one student teacher who noted that "At the level I teach at, we need simple materials so authentic stuff isn't always the best. Using ChatGPT to make a very specific gap fill exercise or whatever, will be really helpful."

Overall, the student teachers mentioned a range of technologies that they had become familiar with through the digital intervention, and similar to Pérez-Escoda et al. (2019), felt these resources would improve their standard of teaching, expressing intentions to use them in both lesson preparation and delivery.

4.2.2 Negative disposition towards technologies

Notwithstanding the sentiments of the previous section, the majority of student teachers also expressed at least one, and sometimes multiple, concerns over the use of technology, for a range of reasons related to factors including age and distraction.

As some of the cohort work in primary schools, use of smartphones is prohibited, though they did mention the possibility of getting students to practice with apps such as Duolingo outside class. In general, the student teachers were less positive about smartphones than other technologies, as there were potential issues with what one student teacher described as "smartphone envy" with not all children owning phones, and some being more expensive than others, raising concerns over equity.

Linked to, but not limited to smartphone use, was the wider issue of internet access causing issues. Similar to Wang et al. (2022), who reported distraction as an outcome of smartphone use in class, student teachers were very aware of the potential for this when it came to smartphones, with widespread opinion being represented by one comment that "After two minutes of work, then they stay, stay on the internet." Distraction was also mentioned in relation to social media, as examination of relevant content could possibly result in a less useful discussion, with one student teacher noting that "If I showed them a social media discussion about football, they wouldn't shut up for ages afterwards", while another commented that "It's just not something I'd be comfortable with. Not sure I could control the class."

In general, the concerns over distraction were greatest when talking about authentic content or authentic interaction, as tasks using such resources or activities could easily transform into something less structured. There was a preference among the cohort for technology-based activities or resources in which this was less of a threat. The use of SKELL (the free function of Sketch Engine) was cited as an example of a resource that would allow the teacher to maintain control over their class. Similarly, Duolingo was mentioned as a resource which did not offer much chance of the students being diverted towards unhelpful tangents in class.

Overall, the negative opinions expressed related primarily to age, distraction, and a lack of training. This factor has not been mentioned here as it is actually a criticism of the training they receive in how to use technology, rather than technologies themselves, and this issue is discussed below.

4.2.3 Digital literacy as a teaching responsibility

Notably, compared to how students of previous cohorts viewed the implementation of technology in the language classroom, there was an evident shift in perception among student teachers regarding the development of their own digital literacy being a central responsibility as a teacher, rather than an optional skillset to develop.

There was a recognition among the student teachers that in environments where technology use is ubiquitous, all teachers should be digitally literate, and have this responsibility to their students. One exemplary comment was "Probably, they'll just get more and more common and from a younger age in the future, so it's something I'll need to learn, to be able to help them [the students]." Similarly, another student teacher commented that "Yeah, I think they're something I should know more about. I should know what good sites or apps are, as part of my job."

There was general consensus that part of being a good teacher was being able to use technologies effectively and appropriately, and this feeling also resulted in frustrations over a lack of effective training. Although the cohort was made up of people from a range of countries, among those with previous teacher-training experience, there was near-universal criticism of the quality of that training, both in general, and specific to technology. One student teacher commented that "So they tell us, ok from now on it needs to be communicative, or we need to use technology, or this or that, but they don't train us in any of that. The training stays the same."

The same sentiments were expressed by both Chinese and Pakistani student teachers in the cohort, who reported that curriculum changes are often simply lip service, and that factors such as University entrance exams, or other prestigious exams, remain a core element of their responsibility as teachers, and a barrier to meaningful change in their language teaching practices.

Similar to the findings of Hughes et al. (2023), the lack of prior training reported by the participants made them painfully aware of their lack of expertise when it came to technologies, and understandably made them hesitant to experiment in the classroom, as they were concerned about using them ineffectively or even creating damaging experiences for their students. One student teacher commented that technologies "could be useful in class, but only if I knew how to use them. Use them properly I mean", with another saying that "you really need to know how to use them well, before you feel comfortable with them, and I don't feel like that".

In particular, the use of Generative AI was challenging, with participants expressing polarised views, similar to Fuchs (2023), regarding the values of its affordances and limitations. Moreover, echoing the findings of Toncelli and Kostka (2024), whose participants expressed concerns about the nature of education in an AI-enhanced world, students in this study, and particularly those teaching at secondary schools, were similarly apprehensive about the broader issue of integrity of student output and authorship.

The ever-changing nature of technology was also cited as an issue, with some teachers sharing their experiences of investing time and effort into learning about a particular resource, only for it to change to a pay-to-learn model, or change how it operated, or simply disappear. This led to a form of burn out, with teachers become disillusioned about keeping up to speed with the available technologies. As one teacher commented, "'I don't know which resources now are any good or not, or even still available. It all changes so quickly."

While Šabić et al. (2022) found that both gender and age had an impact on digital self-efficacy among teachers, reporting that older female teachers were least confident. among this cohort, the primary factor impact on digital literacy was the length of teaching experience, with those who had teaching experience

of five years or longer being less apprehensive about digital experimentation in the classroom, perhaps as they had already developed more confidence as language teachers in general.

Overall, while there a welcome sentiment that being digitally literate enough to effectively integrate technology into their teaching practices was seen as part of their role as teachers, the lack of high-quality training they had received, and their perception that they were not sufficiently knowledgeable, skilful, or up-to-date, meant that a majority of the participants remained hesitant to use technology as much as they wished, even when such opportunities were possible.

4.2.4 Effectiveness of the digital intervention

All 13 interviewees made positive comments about the impact that the intervention had had on their understanding of technologies for language teaching, and these comments were categorised into two main areas – improved knowledge of resources, and improved comfort with the integration of technologies.

Concerning the improved knowledge of technologies, it was clear that student teachers initially had a limited range of resources at their disposal. Some were only aware of dictionary websites, and sites like Youtube and British Council, as well as websites for sharing teaching materials. When asked in the interviews if, before the intervention, they would feel confident about recommending a language learning app, most were unfamiliar with any app beyond Duolingo, and when similarly asked about websites for finding English content in different levels of difficulty (such as https://www.englishinlevels.com/), most were unable to name any resource.

After the intervention, they reported that their stock of online resources had increased significantly, and the guided process of searching for and evaluating resources had given them an improved confidence in their ability to examine a particular resource in terms of suitability for their learners' needs. One student teacher commented that "It's not just knowing about new resources. I mean, that great, but it's also that I feel like I'll be able to find them more easily if I need them, good ones I mean."

Moreover, the participants conveyed that they now felt that the type of resource they considered classroom-friendly had changed. As already mentioned, one student teacher reported that the 4-week process had "opened my eyes" about how technology could be used as a resource, and others expressed similar sentiments. Another comment was that "It made me think a lot more broadly about technology, especially technology that isn't, like, designed for language teaching", which represents a widely-held view that the intervention broadened the participants' perceptions of what kind of online resources could be used, and how they could be employed.

Regarding a greater degree of comfort using technologies, the participants consistently reported improved confidence about future integration of various technologies into their teaching practices. One student teacher comment that "Now that I've practiced with them myself, and seen how they can work, yeah, I'll be using some of them a lot more than before." As well as the comfort of having more resources to choose from to enhance their existing teaching strategies, the intervention made them more comfortable using technologies in ways they had not previously considered. One student teacher noted that while they had previously thought that online resources would help mainly for listening and reading, they now saw a role for technologies in more aspects of language teaching, commenting that "finding sites like HiNative and making the mini-lesson about it has made me think about how I could get really good writing practice online for [my students], so I'll definitely be using that."

Overall, the student teachers reported that the intervention had had clear benefits in terms of the range of resources now at their disposal, and their levels of comfort in actually implementing them in the classroom for a wider range of activities than before, and focusing on more language skills than before, meaning that they felt much more likely to integrate them into their teaching practices than before the intervention.

One potentially limiting factor on this classroom implementation, however, was the resources available to them in their current or future teaching environment. Participants from countries such as Ghana, Pakistan, and Bangladesh, while valuing the intervention, noted that their classroom environments, in which access to internet connections and digital devices was by no means guaranteed, would potentially restrict the extent to which they could integrate the resources and activities they had practised with.

5 Discussion

5.1 Implications for teacher education

Similar to previous studies on digital interventions with language teachers, such as Rets et al. (2023), and Yu and Wang (2025), this study reports success on equipping student teachers with digital skills and digital confidence. Thus, supporting the findings of Pérez-Escoda et al. (2019), improving the quality of their teaching.

The findings from this study hold significant implications for teacher education programmes. Firstly, there is a clear need to prioritise the development of digital literacy within teacher education curricula. Pre-service training of future teachers must be designed to better prepare language teachers for effective use of technologies. This involves not only improving their technical proficiency but also developing a greater understanding of the pedagogical principles that underpin the use of technologies in language learning contexts. As noted by Bax in his influential 2011 work, use of technology cannot simply be for its own sake, and 'at the expense of a pedagogical rationale' (p. 248).

Thus, such training does not simply mean developing in teachers a discrete set of skills or resources, but also, and more importantly, involves equipping them with the skills to critically assess and integrate digital resources effectively, which, echoing Gouseti et al. (2023, p. 1751), will support 'their role in developing students' critical digital literacies.' The relative success of this intervention means that meaningful progress can be achieved in a short time frame if the intervention or training programme is designed and implemented effectively.

Such training can be supplemented by useful in-service training to ensure that teachers remain up to date with developments in various technologies, and related developments in pedagogical approaches. Considering the ever-changing nature of technologies, and consequently, the evolving role that they can play both inside and beyond the classroom, this will help to avoid the 'technology burn out' mentioned above, where teachers lose track of what resources are available to them.

4.2 Theoretical implications

The study also holds theoretical implications. The successful nature of this short-term intervention reinforces Cognitive Load Theory – the notion that smaller, more manageable content chunks may better facilitate learning and retention, especially for adult learners, which can have implications for teacher education programmes, similar to the recommendations of Murray et al. (2020) mentioned earlier.

Moreover, as the intervention included peer interaction and collaborative digital tasks, the findings draw on the tenets of social constructivism, in that development of digital literacy should not be considered from purely cognitive or technical perspectives—it is also social and contextual, and such collaborative, interactive task could become even more a feature in the education of language teachers.

Finally, the study aligns with Bandura's theory of self-efficacy (1977), or in this case, digital self-efficacy. As has been shown in this study, participant confidence in their own digital abilities can be increased during a short-term intervention. The kind of activities used in the intervention could serve as a model for future training programmes, incrementally improving digital literacy, and with it, building confidence and willingness to experiment.

5.3 Limitations of the study

This study has potential limitations in relation to the small number of participants, the possibility of bias, and time constraints. Firstly, a sample of just 21 participants, even though it represented the entire cohort, is an insufficient number with which to conduct statistical analyses. Consequently, success of the intervention could only be determined through the qualitative analysis of the interview data. Moreover, as only 13 of the 21 participants were interviewed, this further impacts on the generalisability of the findings, though they should be of interest to other researchers in similar educational fiends. Future studies conducting such statistical analysis to strengthen reliability and validity would be welcome.

Secondly, as the researcher was also the lecturer for the module, there was a clear potential for bias. To mitigate against this, various steps were taken. Firstly, the participants were assured that a lack of participation would not have any negative impact on their module grade, and indeed, eight of the cohort opted out of the interview, suggesting that these assurances were convincing. Secondly, to avoid any other power dynamics during the interviews, a neutral gatekeeper conducted the semi-structured interviews, and the process thematic analysis adhered strictly to the steps laid out by Braun and Clarke (2006).

Finally, there were time constraints which limited the length of the intervention. As the module had other content related to English language teaching that needed to be covered, the intervention was shorter than ideal, and did not explore all aspects of CALL that the researcher wished. In future, a longer, more comprehensive study would shed welcome light on student teachers' attitudes towards and literacy with CALL tools.

6 Conclusion

This paper has described the implementation and analysis of a digital literacy intervention conducted with TESOL student-teachers at a Scottish university. The findings from the digital literacy intervention firstly highlight that by engaging student teachers in the search, evaluation, and experimentation with digital resources, their preparedness for integrating technology into their future teaching practices can be enhanced.

Secondly, they indicate a welcome change in perspective among future teachers about the importance and centrality of developing their own digital literacy as part of their professional responsibility to their students.

This change in perspective can only be effectively harnessed and supported through training at both pre-service and in-service level that equips future teachers with the skills and knowledge to critically analyse and effectively implement technologies into their teaching practices. The insights gained from this research emphasise the need for teacher education programmes to evolve in response to the changing landscape of language learning, ensuring that future educators are equipped to meet the needs of their learners both in and beyond the classroom.

Appendix 1: Survey questions

Nationality:

Gender: Female/Male/Other/Prefer not to say

Years of teaching experience:

Prior educational qualifications:

None /Primary teaching qualifications/Secondary teaching qualification/Other

Teacher Training:

1. In my prior teacher training, I received sufficient training on the use of technology for language learning.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

2. In my prior teacher training, I received sufficient training on helping learners learn outside the classroom.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

3. In my prior teacher training, I received sufficient training on helping learners to reflect on their learning.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

Current responsibilities

4. In my current teaching position, there are suitable digital resources.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

5. In my current teaching position, I feel confident in my use of technology.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

6. In my current teaching position, there is an emphasis on learner-centred classes.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

7. In my current teaching position, there is an emphasis on supporting learning outside the classroom.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

8. In my current teaching position, I am expected to use computers in the classroom.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

9. In my current teaching position, I am expected to be knowledgeable about digital technologies.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

10. In my current teaching position, I am expected to be knowledgeable about learning beyond the classroom.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

11. In my current teaching position, I am expected to be knowledgeable about the impact of reflection on learning.

Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

Current digital practices

12. What role have these devices played in your teaching practices?

	A significant role	A moderate role	A limited role	Little/no role
Laptops				
Desktops				
Tablets				
Smartphones				

13. How often do you display content from social media platforms in your language classes?
Always Regularly Occasionally Rarely Never

14. How often do you display content from social media platforms in your language classes?
Always Regularly Occasionally Rarely Never

Current digital knowledge

15. I confidently use computers in my classroom.
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

16. I confidently use tablet computers in my classroom
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

17. I confidently use smartphones in my classroom.
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

18. I have a good knowledge of useful language-learning websites.
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

19. I have a good knowledge of language-learning apps.
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

20. I have a good knowledge of the strengths and limitations of Generative AI.
Strongly Agree Agree Neither agree/disagree Disagree Strongly Disagree

Appendix 2: Interview Questions

Let's start with your prior **teacher training experience**. Can you talk to me about how much that training focused on technology, from what perspectives, and how valuable you felt it was?

Follow up (if applicable):

- What specific technologies/resources did you focus on?
- What language skills did you focus on?
- Since you started teaching, what kind of extra training have you received?

(If applicable) In your current **teaching position**, can you tell me about the range of technological resources available to you?

(If applicable) Again, in your current **teaching position**, can you tell me about how you use these resources?

Follow up (if applicable):

- Are there rules about what you can or can't use?
- Are there specific resources provided to you in your role?
- What resources do you tend to use most often, and in what way?
- In terms of your core responsibilities as a teacher, where do you position your own digital literacy?

In terms of feeling comfortable with different technologies, and confident using them in the classroom, which technologies do you feel most and least comfortable with?

Follow up (if applicable):

- Can you tell me about any barriers you face regarding integrating technology into your teaching?
- Before the intervention with your lecturer, how confident would you have been recommending some language learning apps to your students?
- Before the intervention with your lecturer, how confident would you have been recommending some websites to your students which present content in different levels?
- Before the intervention with your lecturer, how confident would you have been using Generative AI as a resource for planning and delivery of lesson content?

Concerning the intervention you participated, can you comment on your overall impressions of it?

Follow up (if applicable):

- In what areas/aspects do you feel you benefitted from the intervention?
- What areas/aspects would you have liked to practice more on?

Do you have any **final comments** about the intervention or about technology in the classroom?

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