Integrating Technology in ESP: Pedagogical Principles and Practice

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Abstract Integrating technology into education has been an important agenda for educational reform all over the world, and English language teaching has been heavily influenced by this move. Despite the benefits of technology in language learning and teachers' positive attitudes towards technology, ESP teachers have demonstrated slow adoption in using new technologies for various reasons, including lack of awareness and deficient computer literacy and ICT pedagogy, despite the benefits technology can offer to languages for specific purposes (LSP). In this chapter, I review the literature in both computer-assisted language learning and ESP to draw principles for integrating technology and to offer some exemplary practice in both English for academic purposes (EAP) and English for occupational purposes (EOP) contexts, covering four types of technological tools: corpora, web-based materials, computer-mediated communication (CMC) and wikis. These principles can be used as guidelines to assist teachers to integrate technology into teaching and as directions for teacher education in integrating technology.

1 Introduction

Research in technology use in second- and foreign-language classrooms has flourished since 2000 (e.g., Chapelle 2003). Despite the positive attitudes towards using technologies in teaching among language teachers globally (e.g., Baek et al. 2008; Li and Walsh 2011), teachers still demonstrate difficulties and concerns in integrating technology. This is especially true with English for specific purposes (ESP) teachers due to lack of awareness, more comfort with text environments, deficient

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computer literacy and contentedness that technology does not deliver educational success (Virkus 2008). The general observation is that apart from realizing the benefits of technologies and getting tips on how to integrate technology in teaching, teachers need to be aware of the principles of using technology in teaching. This chapter aims to outline the principles and practice of technology use in ESP contexts. It is worth noting that although these principles are used in ESP contexts, they are also applicable for the contexts of learning English for general purposes.

The goal of this chapter is to introduce principles of technology integration in ESP instruction and to provide guidance for making it more practical in language classrooms than it has previously been. First, I will discuss the characteristics of ESP and the benefits of technology in language learning. Then I will outline five general principles for integrating technology in teaching ESP, with some examples in English for academic purposes (EAP) contexts and English for occupational purposes (EOP) contexts, such as English for business purposes. Finally, I will provide a brief discussion of the principles and practice and the role of teacher training in cultivating the area further.

2 ESP and Its Characteristics

English for specific purposes has a long history and is becoming increasingly popular as globalization necessitates communication within and across their disciplines internationally. The popularity of ESP has also resulted in the evolution of the definition and an increasing number of different definitions. Again, this is partially due to differences between disciplines and the variety of situations where English is used. The evolution of the definition has also seen shifts in ESP pedagogy from specialised vocabulary acquisition to language use in context. Currently, ESP has developed towards a learner-centred pedagogy that emphases the importance of needs analysis. ESP learners need to understand authentic texts and how to communicate effectively in the situations they encounter in their discipline rather than master field-specific terminology (Smoak 2003). However, vocabulary is still an important learning element for ESP for at least two reasons: First, there is a widely shared belief that students would be able to understand concepts and phenomena in their disciplines better if they incorporated specialist language and terminology in their academic work (Woodward-Kron 2008), and, second, students need to have specialized discourse competence to succeed in their studies and engage in group activities (Hyland and Tse 2007).

As discussed above, defining ESP is not an easy task, since the requirements for English are different for different disciplines. For example, the kinds of communication skills and language genres in the contexts of business and medicine are completely different, since the purpose of communication is different. In a business setting, people use language to market their products or negotiate deals, which require establishing shared understanding and giving information and skills of negotiation and discussion, whereas in a medical setting, understanding, listening

with empathy and giving instructions are more frequent, and it is very rare to see doctors and patients need to negotiate. Despite the different needs for language, Arnó et al. (2006) argue that Dudley-Evans and St. John's (1998) extended and flexible definition can serve as a framework that can encompass various ESP contexts.

Absolute Characteristics

- ESP is defined to meet specific needs of the learners.
- ESP makes use of the underlying methodology and activities of the discipline it serves.
- ESP is centred on the language (grammar, lexis and register), study skills, discourse and genre appropriate for these activities.

Variable Characteristics

- ESP may be related to, or designed for, specific disciplines.
- ESP may use, in specific teaching situations, a different methodology from that of general English.
- ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation; it could, however, be for learners at the secondary school level.
- ESP is generally designed for intermediate or advanced students; most ESP courses assume some basic knowledge of the language systems. (Dudley-Evans and St. John 1998, pp. 4–5)

This framework outlines the basic and fundamental characteristics of ESP. In order to understand how ESP instructions can benefit from technology affordances, it is important to unpack these characteristics. First and foremost, ESP is designed for learners with specific needs, which means a needs analysis is the most important step in teaching ESP. This point is emphasised by Belcher (2004) in her latest historic review of ESP:

> Unlike other pedagogical approaches, which may be less specific needs based and more theory driven, ESP pedagogy places heavy demands on its practitioners to collect empirical needs-assessment data, to create or adapt materials to meet specific needs identified, and to cope with often unfamiliar subject matter and even language use. (p. 166)

So, broadly speaking, ESP concerns what learners need to know in their professional contexts. In other words, given the particular context in which English is used, the variant of English will change. Therefore, for ESP, the ultimate goal is to tailor language instruction to meet the needs of learners in specific contexts. Addressing learners' needs is referred as the commitment to the purposes of the learners (Belcher 2009) and is shared by all branches of ESP, and it does not only include learners' needs at the language level, but also from material and teacher aspects. According to Belcher (2009):

> What the commitment entails is, (1) first and foremost (before, during, and even after instruction), finding out what learners' needs are, then (2) developing or adapting materials and methods to enable needs-responsive instruction while concurrently (3) acquiring the expertise to function as needs-knowledgeable instructors. (p. 3)

Second, authenticity is a key feature of ESP. Here, authenticity refers to authentic language materials and tasks. For ESP practitioners, much attention is given to developing authentic materials based on the discourse in the taught discipline. This is also referred as target genre students' need to engage in the real-life work situations.

Third, closely related to authenticity and learners' needs is the teaching methodology. ESP adopts a learner-based approach; thus, all aspects of learning and teaching are about addressing learners' needs. However it is important to note that learners' needs vary according to the situations they are in, their disciplines and the context in which they work. Their needs are also very much influenced by local culture, their existing knowledge and their desire and motivation to learn.

Finally, it is worth noting that ESP mainly deals with adult learners who are at intermediate or advanced levels. It is assumed that ESP learners have achieved a certain level of English and are relatively mature; therefore, learners' cognitive and linguistic levels are critical in ESP course design, material development and pedagogical considerations. This is why needs analysis, discourse genre, corpora, situational practice, cross-cultural issues, context and authenticity of communication and materials are important aspects of teaching ESP (Johns and Dudley-Evans 1991; Hewings 2002).

3   Affordances of Technology in ESP Instruction

Technology affordances can be simply defined as potential benefits that technology can bring to the process of teaching and learning. Affordances of technology are well documented in the literature, with different theoretical perspectives focusing on different aspects. Generally speaking, the role of technology has shifted from being a tutor to being tool to communicate due to shifts in pedagogical theoretical position from behaviourism to socio-constructivism in recent years. Technology has been used by ESP teachers for different purposes. For example, technological tools are used to create suitable materials or relevant contexts for language learning (Arnó-Macià 2012), to address learners' needs and to achieve positive psychological impact (Arnó et al. 2006). The fast-growing Internet provides ESP teachers with a new tool to engage students in real-life communication, to bridge the intercultural gap, to collaborate in their professional community and to access up-to-date information relevant to their discipline. I have discussed the general benefits of technology in language learning elsewhere (e.g., Li 2015), and here I will explicitly focus on the multiple roles of technology in ESP teaching and learning.

3.1 Technology Enhances Language Learning

Macaro et al. (2012), in their review, provided some evidence that technology facilitates the acquisition of linguistic knowledge and the development of language skills. Research suggests that multimedia presentation, including graphics and video clips, has a positive effect on vocabulary acquisition (e.g., Kim and Gilman 2008; Silverman and Hines 2009). For example, Rusanganwa (2013) investigated whether the use of multimedia can facilitate technical vocabulary acquisition in physics undergraduates in Rwanda, and the results suggest that multimedia has a large effect on the recall of the concepts taught. Apart from vocabulary learning, technology has also been reported to have improved writing (e.g., Mak and Coniam 2008), listening comprehension and grammar accuracy.

Closely related to linguistic acquisition is the development of communication skills. Developing communicative competence is the key purpose of learning English and one very important aspect in real-life situations. For example, email is becoming more important for communication than other methods, and being able to communicate successfully and appropriately is considered an important communication skill. Computer-mediated communication (CMC), such as online forums and synchronous and asynchronous communication tools, has become popular in efforts to improve second-language learners' communicative competence. The use of CMC technologies such as emails, online forums and Skype has benefited learners in real-life communication. Research suggests that email exchange encourages students to recognize that L2 is more than just learning vocabulary and grammar but a powerful medium for communication (Warschauer 2000, 2003). Of course, facilitating knowledge acquisition does not only stay at the linguistic level; research studies show value of technology for development of intercultural awareness (Mueller-Hartmann 2000; Ware 2005), especially with CMC and network-based learning (Kern and Warshauer 2000). Web 2.0 technologies develop opportunities to communicate and collaborate even further for people from the same profession from different contexts. Blogs and wikis do not just provide learners a tool to communicate but a space to work together and publish their work.

3.2 Technology Facilitates in Creating Authentic Materials

It is very likely that in many contexts where teachers are teaching those digital natives (Palfrey and Gasser 2008). The development of digital and web materials has enriched learners' experience in the sense that they can gain more authentic input and see how language is used in particular contexts. This is especially useful for ESP, as ESP learners need to learn the authentic language that they can apply in real-life contexts. In language learning, the authenticity of language materials and tasks is emphasised by various researchers, and the use of authentic language materials is encouraged whenever possible. As such, students are not only able to learn

the kind of language they need but also how it is used. The underpinning theory is to experience rather than acquire the language. Designing materials for students' needs is perhaps the very first thing faced by many ESP teachers, in which case teachers are not simply teachers but also material developers, due to the unavailability of the materials they need or the lack of authenticity of the textbook. This task is very challenging for many teachers, and the Internet is believed to serve well the authenticity of the text and the authorship of the language user—the two aspects of communicative language learning (Kramsch et al. 2000). As such, the Internet is considered an authentic resource for natural, context-rich and culturally specific materials (Herron et al. 2002). These materials do not stay at the textual level but also provide rich audio and visual materials that provide learners with multimodal learning experiences (e.g., YouTube). The availability of up-to-date information and tasks in different discourse communities provides both the teacher with authentic language materials and the students with access to the information they need to complete their tasks and projects. As I mentioned before, corpora have been used by ESP teachers to develop suitable materials for their learners. The availability of academic and occupational corpora enables both ESP teachers and learners access to the authentic language used in their targeted context, and, by analysing corpora, what learners need can be addressed.

3.3 Technology Mediates Thinking

Technology can also be used as a mediational tool (Li 2014), especially in network-based learning and computer-supported collaborative learning. Mediation is how people use 'culturally constructed artefacts, concepts and activities to regulate the material world or their own and each other's social and mental activity' (Lantolf and Thorne 2006, p. 79). Language is widely accepted as the primary mediational tool, but nowadays the use of technologies is a new psychological tool that can mediate interaction between humans and the environment around them. The multimodality of technology materials can mediate ideas, thoughts and thinking processes through images, sound and videos. Even in text-based chat rooms, the use of emoticons can help express thoughts and emotions. The mediational role that technology plays in network-based learning is vitally important. Students from different cultures and backgrounds can take advantage of computer tools to represent their thoughts and to bridge the gap in intercultural communication.

3.4 Technology Provides a Learning Environment for Interaction

Interaction lies at the heart of language learning, and technology can provide learners with an environment where they can engage in authentic interaction. In ESP teaching, interaction between learners can be promoted through the use of a particular technological tool, for example, a forum or an online discussion board. The kind of interaction in which students engage in such a learning environment resembles the real-life situation, as the task is genuine and the language is authentic. With the development of network-based learning, project-based CALL (computer assisted language learning) is also popular in assisting students to develop their interactional competence. For example, in a German as a foreign language context, Chun (1994) has argued that the use of network-based activity facilitates interactive competence as learners 'generate and initiate different kinds of discourse, which in turn enhances their ability to express a greater variety of functions in different contexts as well as to play a greater role in managing the discourse' (p. 18).

3.5 Technology Facilitates Self-Directed Learning

In order for learners to become autonomous, they need to engage in self-directed learning. Self-directed learning is also one of the key features of ESP courses (Carter 1983). For Carter, 'ESP is concerned with turning learners into users' (Carter 1983, p. 134). In order for self-direction to occur, the learners must have a certain degree of control over when, what and how they study. Technology in this sense offers a great opportunity to realise self-direction. For example, in a self-access learning environment, students are able to access the learning materials and direct their own learning at their own pace. This not only involves students developing strategies to learn the materials and gain competence in language skills (e.g., listening), but also provides students an opportunity to control their own learning. In this context, technology can 'support self-paced instruction and … support self-paced review of concepts' (Roblyer 2006, p. 48).

3.6 Technology Motivates and Engages Learners

Technology can be used as an effective tool to engage, motivate and regulate learners. In particular, motivation has been core to discussions about technology in language learning in general (Braine 2004; Schwienhorst 2007). Teachers also widely believe that the use of technology enhances student motivation (e.g., Li 2008).

4 Five Principles for Integrating Technology in ESP

Based on the above discussion of benefits of technology, I propose five basic principles in integrating technology in ESP.

4.1 Principle 1: Understanding the Benefits and Roles of Technology

In order to successfully and effectively integrate technology in ESP teaching, teachers need to be aware of the benefits of technological tools for language learning. Technology in general has a positive impact on language learning, but technology cannot be simply added on to teaching or replace the teacher. Teachers need to critically evaluate the role of technology, as different tools have different functions. For example, some tools are more appropriate for developing collaborative learning (e.g., the use of wikis, blogs and other Web 2.0 technologies), whereas other tools are more suitable to help students develop their linguistic knowledge and skills on their own (e.g., the use of software, videos and corpora). Some tools are more useful to help students to engage in real discourse communities (e.g., online discussion forums and social networks), and others are good for identifying students' needs (e.g., corpora). Knowing the affordances of different technological tools helps the teacher to select the best options to achieve their pedagogical goals.

4.2 Principle 2: Linking Technology to Learners' Needs

ESP adopts a learner-centred approach, and learners' need lies at the heart of designing and teaching ESP. In understanding learners' needs, there are three things teachers need to do (Westerfield 2010). Frist, teachers need to understand the learning objectives and the affordances of technology. That is, teachers need to know exactly what the learners need to be able to do in the target language and how technology can help to achieve this. Table 1 provides an example to illustrate how to link technology to learners' future needs.

Second, teachers need to understand the current learners' language levels and expectations. This means that the teacher needs to have a good knowledge about what the learners can do now and what they want from the course. The current knowledge can be assessed through comparing student work and the existing academic or professional work.

Third, teachers need to know the learning environment, including what technological environment they have (e.g., one-computer classroom, network-based classroom, self-access centre or distance learning), available resources (e.g., access to

Table 1 An example of linking technology to learners' needs (Li 2017, p. 142)

What learners need	How technology can help (examples)
Communication skills	CMC tools (e.g., online discussion boards, emails and videoconferencing) can be used to engage students in real-life discourse
Academic writing skills	Corpus analysis of published academic work to identify how to use linking words, reporting verbs and tenses
Collaborative experience	Wikis, project-based CALL
Engagement and participation in a professional community	The use of social networking

computers, Internet and software), students' computer literacy level and their experience in using technology in learning.

4.3 Principle 3: Integrating Rather Than Adding Technology in Teaching

Technology needs to be integrated as part of pedagogy rather than an 'add-on' to the existing teaching. 'Integration' puts the emphasis on pedagogy, which means technology is used to achieve pedagogical goals and teachers need to be aware of their pedagogical beliefs, and research suggests that teachers use technology according to their underlying beliefs about teaching and learning (see Table 2 for an example of writing tasks using technology). Only by understanding their own beliefs can teachers 'integrate' technology into their teaching rather than adding it as a supplementary tool.

'Integration' also means that technology is integrated in assessment. For example, for each pedagogical goal, teachers need to have a reliable, measurable and clear assessment method. Mueller (2010) calls for authentic assessment, which means real-life tasks that demonstrate meaningful application of essential knowledge and skills. For example, email tasks with different purposes could be used to develop students' (internal and external) communication skills.

4.4 Principle 4: Considering the Role of the Teacher

When technology is integrated in teaching and learning, the role of the teacher will be transformed as a consequence. Clearly, one of the factors influencing teachers' use of technology innovatively is the understanding of the teacher's role. Teachers need to be aware of different roles they perform when different kinds of technology-supported activities are implemented. The challenge for teachers is to give control to learners and explore their agency in learning. Technological tools in many situations can be used to assist learning, and the teacher needs to realise the supportive

Table 2 An example of teachers' pedagogical beliefs and the use of technology (Li 2017, p. 143)

Teacher's pedagogical beliefs	Main technology use
Writing is a means of reinforcing speech patterns (product based)	Doing grammar and vocabulary exercises on a website
	Using feedback tools (e.g., marking or track changes in Microsoft Word) for peer reviewing, focusing on local feedback, such as tense, spelling and grammar.
Writing is a process of constructing personal meaning (process based)	Accessing Web database
	Composing with the word processor
	Using mindmap tools
	Participating in collaborative web-based writing projects
	Using prompted writing and grammar software in small groups
Writing is an important academic and professional skill (content based)	Using corpus to analyse academic and professional discourse
	Using academic and professional websites
	Using online referencing sites (e.g., dictionaries and libraries)
Writing is a text understood by individual readers.	Using blogs and wikis
	Participating in online discussion (e.g., wikis, blogs)
	Participating in email exchange

Table 3 Teachers' Roles (Adapted from Li 2017)

Teacher role	Activity	Technology
Organiser	Students work together on a collaborative writing project	Wikis
Audience/reader	Students presents their views and opinions about topics in their field	Blogs
Guide	Students develop a vocabulary project for their discipline	Corpus
Participant/facilitator	Students initiate and participate in discussion	Online forum
Evaluator	Students produce oral and written work (with multimodal materials)	Digital recording software and Microsoft Office package

role of technological tools. In this learning situation, teachers needs to explore how they support and facilitate this learning process rather than trying to be the controller of this process and the absolute knowledge provider, as in traditional knowledge-transmission classrooms. Table 3 presents examples of different roles teachers might perform in different activities when various technological applications and tools are used.

These are just some examples of roles and possible technological tools in teaching and learning. Of course, teacher's roles cannot be restricted to those mentioned above and can change depending on the students' situations and tasks.

4.5 Enhancing Authenticity of Both Language and Task

Technology must be brought into the process of teaching and learning to address authenticity—both at the language and task aspects. Teachers can use technology as a tool to access authentic materials to prepare teaching so that students experience and learn the authentic discourse they are expected to encounter in their profession. Teachers should also use technology to increase the authenticity in learning tasks. These tasks should resemble the kinds of tasks students are expected to carry out in a real-life work environment, for example, discussing a project with a senior colleague or solving a problem with colleagues. Technology can give students an authentic environment to some extent; for example, in Second Life, law students can have a virtual courtroom and business students can do virtual business.

5 Integrating Technology in Teaching

In this section, I present some ideas for using technological applications in teaching English for specific purposes. These ideas can be approached from perspectives of the disciplines, the learners and teachers, language skills and technological tools. Since these ideas can be applied across disciplines and involve different language skills, I chose four different kinds of technological tools to explore how they can be integrated into teaching and learning.

5.1 Corpus

In many academic writing contexts, vocabulary acquisition and grammatical structure appear to be important features, and many investigations have been carried out in these areas to assist learning English for academic purposes. In recent years, data-driven learning (DDL) has become popular. DDL is an approach which is rooted in corpus linguistics. Friginal (2013) suggests that the 'future direction of teaching writing for specific purposes will include corpus-based textbooks, materials and data' (p. 209).

A corpus can be defined as 'a collection of texts, written or spoken, which is stored on a computer' (O'Keeffe et al. 2007, p. 35). Two basic functions can be identified with a corpus:

Fig. 1 An illustration of using concordancing for EAP

- Concordancing: The most basic and commonly used function of a corpus data-base is the 'key word in context' feature, which shows how a searched word is used in the corpus. For example, the verb *suggest* is searched using Corpus Concordance English (v 6.5)[1] with AA Academic Abstracts, which contains the-sis and dissertation abstracts at the master's and doctoral levels written by English native speakers (174,000 words). The results show how *suggest* is used for aca-demic purposes (Fig. 1).
- Bar graph display: This provides the frequency a word is used.

There are various free corpora available on the Internet for use, and these data-bases provide searchable text samples of writing across academic disciplines and registers. For example:

- British National Corpus (BNC)[2] (100 million words).
- Corpus of Contemporary American English (COCA)[3] (410 million words).
- Michigan Corpus of Academic Spoken English[4] (1.8 million words).
- Michigan corpus of upper-level student papers (MICUSP)[5] (16 disciplines at 4 levels of 7 paper types with 8 textual features).
- Hong Kong Engineering Corpus[6] (9.2 million words).

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[1] www.lextutor.ca/concordancers/concord_e.html

[2] http://www.natcorp.ox.ac.uk

[3] http://www.americancorpus.org

[4] http://quod.lib.umich.edu/cgi/c/corpus/corpus?page=home;c=micase;cc=micase

[5] http://search-micusp.elicorpora.info/simple/

[6] http://rcpce.engl.polyu.edu.hk/HKEC/

Yoon (2011) suggests that a corpus has two functions that assist in writing: as a research and a reference tool. EAP teachers can use a corpus to search for vocabulary usage as demonstrated in Fig. 1. A corpus can also be utilised as a reference tool for students to solve writing and language problems. This can be done through concordancing for linguistic reference in terms of collocations and lexico-grammar and for revisions of their writing, particularly self-correction of errors. Students can compare their essays with a corpus to do revision after a teacher has highlighted the problems (e.g., Gilmore 2009).

The corpus can be used to assist academic writing. For example, Friginal (2013) investigated the use of corpora to develop the research report-writing skills of college-level students enrolled in a professional forestry programme in the United States, in particular focusing on a set of selected linguistic features: linking adverbials, reporting verbs, verb tenses and passive sentence structures. Students' work was compared with published forestry articles to find differences in these areas and subsequent treatment was offered to students to improve in these areas. The study showed the positive impact of using corpora to address students' writing problems, including the use of linking words and reporting verbs. Students can identify the linking words and reporting verbs from their own writing and check how they are used in the academic writing corpus. This can be done either in class or outside class. A similar study was carried out by Hafner and Candlin (2007), who made use of a corpus of about 800,000 words from 114 legal cases to provide online writing support for law students when they drafted their legal texts. In this way, students were able to understand how to use legal vocabulary more appropriately and accurately, hence improving writing overall.

The corpus can be used to study key vocabulary in an ESP course. For example, students can check and discuss how the top 100 key business vocabulary words[7] are used in context. This would enhance the authenticity of vocabulary acquisition. That is, students do not learn these vocabularies alone but understand them in contexts. This could be a task outside class and each student can be responsible for two to three words and present them in class. In this way, students do not just engage in independent learning but also learn from each other.

Corpora can be used by teachers to develop materials for students. Nelson (2003) pointed out in *The Guardian* that his analysis of business English suggests that

> …the use of verbs was central to communication in the materials: There were fewer verbs and a much greater concentration on nouns … This may represent a narrower base of business activities in the materials, or it may reflect the predilection of materials writers for naming aspects of business, as opposed to writing about the language needed for doing business. (p. 1)

Thus, teachers can use real corpora to design authentic materials for students that they will find later on in the real world. In another case, Evans (2012) designed email tasks for business English classrooms by analysing data from Hong Kong's service sectors, including 50 email chains comprising 406 separate emails. He rec-

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[7] The top 100 key business words can be accessed through Mike Nelson's Business English Lexis Site at: http://users.utu.fi/micnel/business_english_lexis_site.htm

ommends a simulation-based approach in designing email tasks in which students are given 'clearly defined and differentiated roles in a particular business context, and a task that stimulates collaboration and conflict, both internally and externally (p. 210).

5.2   Web-Based Materials

The Internet is a useful material site, especially in addressing learners' needs for authentic materials. There are many interesting EA/SP websites, which can be used to help teachers to prepare their ESP lessons. From these websites, the teacher can access many real-life examples; for example, Freed's ESL/EFL ESP website (http://www.eslhome.com/esl/esp/) offers a range of topics, including English used for business, medicinal, banking and finance, dentistry, engineering and science. For each category, there are several of useful links which users can explore for either getting materials for lesson or self-study. ESP on the Web is another website (http://www.unav.es/espSig/esponweb.html) that contains materials for teachers and learners in ESP. It provides different categories of ESP, including ESP associations, resources, discipline-specific sites and articles on the web. From here, teachers can guide students to explore resources in their discipline; for example, project-based learning can be implemented using these websites.

To develop autonomous learners, these websites can also be used by students for independent study, especially in revising and expanding their knowledge in the discipline. From these sites, students can also access the discourse of the community and participate in activities.

5.3   The Use of Wikis for Collaborative Writing

A wiki is defined as a 'freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information—a database, where each page is easily edited by any user with a forms-capable Web browser client' (Leuf and Cunningham 2001, p. 14). Wikis serve as powerful mediating artifacts for collaboration (Lund 2008), as wikis facilitate participants to 'collaboratively generate, mix, edit and synthesise subject-specific knowledge within a shared and openly accessible digital space' (Wheeler et al. 2008, p. 989).

A wiki can be used as a collaborative tool for an ESP project. Students can work collaboratively to create a discipline page or a project. For example, students studying law could have a wiki page about international shipping law where they do not only collaborate with their group members to co-construct knowledge but also invite people outside to contribute to their page. This kind of collaborative activity is not restricted by place and time. Wikispaces (www.wikispaces.com) is a wiki engine where teachers or learners can create their own wiki pages.

A wiki can also be used for academic writing purposes. Research suggests that writing on the wiki can contribute to raising awareness of the audience and to increasing the use of interpersonal metadiscourse (Alyousef and Picard 2011; Kuteeva 2011). When students co-construct texts, they do not only focus on what they want to write but also on understanding other members' perspectives. In this way, develop an awareness of their audience; this perfectly matches a reader-focused writing approach. For example, in English for legal purposes, students could be writing a report about human rights together.

A wiki project can also be used to help students collaboratively solve writing problems (e.g., Li and Zhu 2013). In the writing process, students can be guided to use a 'discussion' page to discuss issues they encounter and support each other to solve problems. Because students can view a 'history' page, they can see what revisions/changes have been made and critically reflect on their own writing.

5.4 CMC

Computer-mediated communication (CMC) is an interaction that takes place in real time in which users negotiate meaning through either verbal or written language. Email is an example of a CMC tool that is relevant to all disciplines. Nowadays, sending and receiving emails is an essential skill for all employees to exchange information, conduct negotiation and work collaboratively (Angouri and Harwood 2008). Studies in the ESP literature have also emphasised that email has become an integral part of organisational communication (Louhiala-Salminen 2002; Louhiala-Salminen et al. 2005). Evans (2012) indicates that

> email plays a crucial role in binding together flows of internal and external activities that are directed towards the resolution of problems, the formulation of plans or the execution of decisions. Email is thus an important means of working towards these goals, enabling professionals to exchange and discuss information and ideas quickly and conveniently with colleagues and clients. (p. 210)

In ESP teaching, email tasks can be designed for students through email analysis (see Evans 2012). For example, in a business course, email can be used to address the issue of lack of intertextuality in traditional business textbooks and to raise business students' awareness of writing as an ongoing and dialogic process (Evans 2012). By analysing emails in authentic contexts, students can identify the differences between email writing and other types of communication (e.g., letters and face-to-face conversation). Langauge teaching can focus on style and register, and, as a result, pragmatic and cultural awareness can be raised in the communication.

6   Discussion and Conclusion

Computer technologies can benefit language learning in many aspects, but these benefits depend on how teachers use them. In the process of integrating technology in ESP teaching and learning, there are five areas that merit further discussion and research.

The first issue involves teachers' pedagogical beliefs. Warschauer (2004) suggested that 'teachers will make the best use of computers in the classroom when students are encouraged to perform the most real tasks possible, taking the advantage of the power of modern ICTs to try to change the world in ways that suit students' (p. 24), and this chapter further emphases this view. It is perhaps important to enrich teachers' technology-enhanced pedagogy so that teachers feel comfortable and confident in letting students take control in learning and engage in active participation. Obviously, this requires teachers to have sufficient knowledge at the pedagogical, technological and contextual levels.

A second issue, which is closely related to this, is teacher training and learning in terms of pedagogy and technology. We must acknowledge that integrating technology does not mean that we 'add' technology whenever is possible. This requires teachers to have systematic knowledge about the role of technology and how they can match affordances of technology to their pedagogical considerations. Therefore, teacher training or development becomes a critical issue. Research suggests that a case-study approach is useful because teachers can learn from their peers in real practice about the integration of technology. Therefore, communities of learning may be a good way forward in terms of teacher learning and development.

Third, we all know that technology is developing at a rapid rate, and a large amount of free material has been produced for language learning. On the one hand, it is great for teachers to have access to various types of language materials. On the other hand, the rapid growth of online material makes it difficult for teachers to choose the right resource for their students. In this environment, almost 'all teachers need to know how to use the Web as a resource for current authentic language materials in written, audio and visual formats' (Chapelle and Hegelheimer 2004, p. 305). It has been increasingly important therefore for teachers to evaluate these materials systematically before they adopt them in classrooms. (Chapelle and Hegelheimer 2004; Fotos and Brown 2004). One aspect of teacher learning and development should therefore focus on the frameworks or approaches to effective evaluating materials. In the literature, there are existing frameworks a teacher can adopt (e.g., Chapelle 2003). Nevertheless, teachers need to take the contextual factors into consideration in evaluating e-learning materials, in particular learners' needs, characteristics, learning styles and their preferences, pedagogical purposes and ease to use (Li 2017).

The fourth issue is appropriate assessment. When considering integrating technology in ESP instructions, teachers need to reconsider how they assess and evaluate learning. For example, it is inappropriate to use the existing and traditional assessment methods to evaluate individual performance when learning focuses on collaboration, negotiation and participation. In this respect, peer assessment and

group assessment may be help and useful. Equally, assessment content may need to include digital literacy rather than just linguistic forms.

The final issue is learner training. Research has suggested that preparation of learners before using DDL is key (e.g., Hafner and Candlin 2007; Sripicharn 2010). Therefore, in implementing DDL, it may be important to train learners to compile a corpus so that they are in a position to be able to better interrogate a corpus in terms of what it can be searched for. In preparing learners for using technology in learning, researching preferred learning styles is a crucial factor influencing the effectiveness of the technological tool (e.g., the use of a corpus) (Cresswell 2007). There are of course other aspects worth exploring, but pedagogical relevance, authenticity, technology benefits, learners' needs, teachers' beliefs and teachers' roles are the most important principles that guide technology use in ESP instruction.

This chapter also considers the various benefits technology can have in language learning and outlines some suggestions and practices in how technology can be integrated in teaching ESP in general, drawing both literature review and my own practice. Of course, this chapter is only one glimpse of what technology can do and how we can use it to facilitate better learning. Many innovative ideas can be explored through working out principles for individual teachers' contexts.

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