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Technology in ESP Pedagogy

The article aims at giving a brief overview of the use of technology in ESP pedagogy. Its first part provides a historical perspective on computer-assisted language learning (CALL), its three distinct phases, and subsequent developments in information technology (IT). The sections that follow focus on the use of technology as tool for supporting traditional forms of language learning and for creating various contexts for communicating. The article closes with suggestions for further research into the use of technology in ESP pedagogy, its impact on the multiple roles of the ESP teacher mentioned in the literature of the subjects, and the resultant implications for specific training programmes for teaching practitioners.

Key words: ESP, CALL, technology, ESP teacher, ESP teacher training

1. Introduction

English for Specific Purposes (ESP) refers to the teaching and learning of English as a second/foreign language which, in contrast to other pedagogical approaches, bases the course contents and objectives on the specific needs of target learners. Thus it is frequently contended that ESP is an umbrella term which covers a range of diverse teaching contexts. They are broadly defined as English for Academic Purposes (EAP), English for Occupational

Purposes (EOP) and English for Professional Purposes (EPP). Since in each area of ESP teaching, it is customary to distinguish between general and specific purposes, its main branches are further subdivided. Accordingly, in EAP, it is possible to differentiate between English for General Academic Purposes (EGAP), e.g. English for academic reading, and English for Specific Academic Purposes (ESAP), e.g. English for medical studies (Basturkmen, 2010).

According to Dudley-Evans & St. John (2009), the study of languages for specific purposes is centuries old. Its modern origins, however, go back to the early 1960s and are associated with J. M. Swales' *Episodes in ESP*. During the early phase of ESP evolution, research focused on English for Science and Technology (EST) in academic settings (Hutchinson, Waters, 2010) and involved statistical grammatical counts within written discourse (Johns, 2013).

By the 1980s, new technologies had found their application in ESP research, and investigations focused on analysis of large corpora. Likewise, ESP pedagogy has been significantly influenced by the use of technology. Following the example set by B.F. Skinner (1958) and his teaching machines, computers have been implemented in language teaching since the 1960s. With the development of CD-ROM, more interactive activities and practice than paper-based materials were offered to language learners. The turn of the 20th century witnessed further changes in the shape of the foreign language classroom. Since then the Internet has had an enormous impact on the process of foreign language learning and teaching, and the development of a range of technological applications has offered tools for language learning and for creating a communicative space (Bloch, 2013).

The objective of the present article is to give a brief overview of the use of technology in ESP pedagogy. It consists of two main parts, *Introduction* briefly depicting the impact of new technologies on ESP pedagogy, and a section with *Conclusions*. The first part of the article provides a historical perspective on computer-assisted language learning (CALL), its three distinct phases, and subsequent developments in information technology. The sections that follow focus on the use of technology as tool for supporting traditional forms of language learning and for creating various contexts for communicating. The article closes with suggestions for further research into the use of technology in ESP pedagogy, its impact on the multiple roles of the ESP teacher mentioned in the literature of the subjects, and the resultant implications for specific training programmes for teaching practitioners.

2. Technology in ESP pedagogy

2.1. Historical overview

Technology has long played an important role in the teaching of ESP and its affordances have turned out to be extremely useful in ESP pedagogy, given its clearly defined focus on needs assessment, materials creation/adaptation, ongoing course and/or materials evaluation, and methodology that draws on target situations and disciplines. As technology entered ESP classrooms, teaching practitioners made use of interactive multimedia packages, Internet resources, and various tools designed to create specialized materials with a view to promoting learners' engagement with relevant target situations (Arnó-Macía, 2012).

It is contended that the relationship between information technology (IT) and ESP remains under a strong influence of the evolution of computer-assisted language learning (CALL) alongside developments in applied linguistics and language teaching (Arnó-Macía, 2012). As pointed out by Garrett (2009: 719), CALL, which refers to "the full integration of technology into language learning", should be based on the interrelation of such elements as pedagogy, theory and technology. Looking at its rapid development from the perspective of underlying theories and avalaible technology, Warschauer (1996), Warschauer & Healey (1998) distinguish three distinct phases of CALL.

In the *behaviorist* phase, conceived in the 1950s and implemented in the 1960s and 1970s, the computer was used as a vehicle for delivering instructional materials to students by means of different tutoring systems. The PLATO system, for instance, provided vocabulary drills, brief grammar explanations and drills, as well as translation tests. In keeping with the then-prevailing behaviorist theories of language learning, programmes like the PLATO system entailed repetitive language drills for the sake of practice.

The *communicative* phase of CALL, frequently distinguished from behaviorist CALL not by the kind of software used, but by the purpose to which a given computer programme is put (Warschauer, 1996), was based on the communicative approach to language teaching that predominated in the 1970s and 1980s. Its basic tenets emphasized the focus on using forms rather than the forms themselves, implicit grammar teaching, creating a natural environment for the target language use, etc. (for more details see Underwood, 1984). Accordingly, during

that period several computer programmes were developed and used to provide skill practice in a non-drill format (which was an extension of the *computer as a tutor* model), to stimulate discussion or writing (the *computer as a stimulus* model used for communicative activities), and/or to empower learners to use or understand language (the *computer as tool* model) (Warschauer, 1996).

Reassessments of the communicative approach and the resultant more integrative teaching of various aspects of language dovetailed with advances of computer technology. Integrative approaches to CALL were based on two important technological developments – multimedia technology allowing access to a wide variety of media (text, graphics, sound, animation and video) and the Internet, a medium of global communication and a source of innumerable authentic materials (Warschauer, 1996).

Further developments in IT and language teaching have brought about such concepts as *network-based language teaching* (NBLT), which in contrast to CALL, traditionally associated with self-contained, programmed applications such as tutorials, drills, simulations, etc, involves human-to-human communication and collaboration (Kern & Warschauer, 2000), and a *second wave of online learning*, which expanding its focus beyond language learning, places emphasis on culture (i.e., intercultural competence, cultural learning, cultural literacy) and social discourses (Kern, Ware and Warschauer, 2004). Observing mobile technology moving at a dizzying pace, one cannot but agree with Arnó-Macía (2012) that the very concept of CALL needs to be extended to include the latest mobile devices.

The Internet has given rise to significant changes in language learning. The acronym ALIVE standing for the concepts of *authenticity*, *literacy*, *interaction*, *vitality*, and *empowerment* best captures the nature of these developments (Warschauer, Shetzer, and Meloni, 2000). These concepts are of particular importance to ESP learners, who aspire to join target discourse communities. Owing to limitless Internet resources, they are provided with a wide range of authentic materials, as well as opportunities to actively interact with members of these communities through e-mails, forums, blogs, etc. The use of various Web 2.0 applications can considerably contribute to learners' empowerment, and help them gain control over their learning. Also, the ubiquitous presence of IT in our lives makes it necessary for language teaching to consider computer-mediated communication (CMC) skills in addition to traditional skills, such as writing and speaking (Chapelle, 2003; Garrett, 2009). This entails the expansion of traditional notions of literacy and communicative competence by including

online communication, collaborative writing, and dealing with hypertext and multimedia (Shetzer and Warschauer, 2000).

2.2. Technology as tool for language learning

Technology has been exploited in ESP pedagogy since the very introduction of stand-alone computer into the classroom, through the development of local-area networks (LAN), wide-area networks (WAN), the Internet and World Wide Web to the invention of mobile technologies. Not only has it made possible to access authentic texts, and analyze them by means of software designed for such analysis, but has also played an important role in ESP teaching, being used as a tool for helping with traditional types of language learning (Bloch, 2013). Thus it has been most frequently used as a repository for ESP authentic materials available in the form of newspapers, magazines, scientific journals, news broadcasts, lectures, all of which represent different written and oral texts.

Owing to the growth of open-access university courses, ESP teachers have been able to freely exploit authentic discipline-specific materials in the classroom and thus bring relevant language experiences from outside the classroom. Some news organizations like the British Broadcasting Company (**www.bbc.co.uk**) or National Public Radio (**www.npr.org**) have offered open access to their programmes stored in the form of podcasts. Also, some universities like Yale (**http://oyc.yale.edu**) and The University of California, Berkley (**http://webcast.berkley.edu**) have provided both audio and visual copies of lectures that can be used for language practice in the classroom or by students learning on their own.

Moreover, video-hosting sites, the largest and most popular of which is YouTube, have provided a wide selection of authentic discipline-specific materials. There are closed captioning on many of these videos, which gives lower proficiency students a chance to follow the videos at their own pace and clarify some difficult parts consulting the captions.

With free programmes like Audacity, teachers have been able to create their own podcasts (Kern, 2013) and encourage students to do so. These can be stored for free online (e.g. at **www.youtube.com**), and shared with an unlimited audience. Sites for storing videos are of great importance for ESP learners. Not only do they expand the audience for students' work,

but they also make them consider how the relationships between them and their audiences are affected by their use of language (Bloch, 2013).

Another technology that has enabled ESP teachers to incorporate authentic forms of language into their lessons is concordancers[1] and concordancing sites. The former allow for searches of the occurrence of particular words or structures or combination of words, and help generate word frequency lists and key word in context (KWIC) concordance lines. The latter provide examples of technical vocabulary use and syntactic structures from authentic texts in specific areas of discourse, and can be used in the classroom with a view to enabling learners to develop language awareness in addition to structural knowledge of sets of meanings.

As an alternative to ready-made corpora[2] that are in the public domain, ESP teachers can as well develop their own corpora to meet specific needs of their learners resulting from the narrowly defined teaching objectives, especially when the existing corpora do not appropriately reflect disciple-specific types of texts (Tribble, 1997). Corpora – whether small teacher-developed or large like the Corpus of Contemporary American English (COCA) (at **http://corpus.byu.edu/coca/**) – can be accessed by anyone, at any time, for any purpose, depending on the use of web-based interfaces, e.g. the VIEW (Variations in English Words and Phrases) in the British National Corpus (BNC) (at **http://corpus.byu.edu/bnc/**), which allows the user to search for a word or phrase or patterns including synonyms.

Corpora can also be used to compare expert texts with learner-produced texts to juxtapose the features used in target texts with the characteristics of learners' production (i.e. their overuse of certain structures, inappropriate use of markers, etc). Apart from providing information to researchers, materials writers and teachers, corpora can be easily incorporated in the classroom on condition that they are accompanied by appropriate activities (Flowerdew, 1998).

The proliferation of technological resources that support ESP teaching and learning dovetails with resources for online learning. The latter can facilitate real-life communication and engagement with genuine situations (Belcher, 2004). Owing to advances of technology,

[1] Concordancers are software tools that provide access to any electronic text, i.e. a text available on the computer or from a CD-ROM based corpus or database or the Internet

[2] As defined by Sinclair (2004), a corpus refers to "a collection of pieces of language text in electronic form, selected according to external criteria to represent, as far as possible, a language or language variety as a source of data for linguistic research".

online communication, which constitutes part of everyday communication in academic and professional settings, has become not only a means for language learning, but also a goal to be reached by ESP students, who have to learn to cope with various digital genres, or *cybergenres* (Shepherd and Watters, 1998 in Arnó-Macía, 2012). This communication can be asynchronous ("different time, different place"), e.g. email, listservs, blogs, discussion boards, social networking sites like Twitter or Facebook, where users can interact using any of these modes of discourse. It can as well include synchronous modes of discourse ("same time, different place"), such as chats, video conferencing, e-learning systems or virtual learning environments, where participants interact in the same time frame.

Taking part in online forums, Facebook, Twitter, as well as in other digital media, ESP learners are provided with an opportunity to engage in authentic discursive practices related to their areas of study or work. As emphasized in the literature of the subject, students' motivation increases if they participate in authentic purposeful communication through meaningful tasks as well as projects that involve simulations of real-life interactions (cf. Grosse and Voght, 1991; Dudley-Evans and St John, 2009; Hutchinson and Waters, 2010).

With such a proliferation of *cybergenres*, ESP teachers are confronted with unprecedented challenges related to the integration of these "new digital literacies" (Bloch, 2013: 434) into classroom activities. Since synchronous and asynchronous modes of communication have different discourse features (Sotillo, 2000), it is important to take into account various issues before incorporating a particular technology in the classroom. The variables most often include the character of the *cybergenre*,and the type of authorship that is best supported by a particular technology (Bloch, 2013). Synchronous modes of CMC tend to produce short forms of informal discourse. Depending on the target audience, the language of email can be either formal or informal, with its length being usually related to the communicative goal that is to be reached by the writer. Owing to the delayed nature of asynchronous modes of communication, ESP learners required to produce any of this type of digital genres are given more opportunities to produce syntactically complex language (Sotillo, 2000). Accordingly, listservs[3] and discussion boards can make students use more formal forms of language and

[3] The term 'listserv' refers to electronic mailing software.

engage them in in-depth discussions. Blogs[4], in turn, can help them express or develop their ideas alongside various rhetorical strategies (Bloch, 2007). Blogs can as well be integrated with other forms of discourse to create new forms of multimodal texts (Bloch, 2013). It thus goes without saying that synchronic and asynchronic modes of communication can be exploited for different pedagogical purposes. Both can be used as tools to enhance language learning by encouraging interaction among participants, the formation of electronic communities of learners, as well as collaborative text creation (as in the case of Wikis[5], blogs and social bookmarking[6]) (Sotillo, 2000; Sykes, Oskoz, Thorne, 2008; Bloch, 2013).

The growing importance of working collaboratively, often in different physical spaces, has given rise to cloud computing, which is defined as a type of computing that relies on sharing computer resources rather than having local servers or personal devices to handle applications. Since in cloud computing, the word "cloud" is used metaphorically to refer to the Internet, cloud computing signifies Internet-based computing, where different services (servers, storage, applications) can be accessed simultaneously from different locations. Cloud sites, e.g. Google Docs (at **https://www.google.pl/intl/pl/docs/about/**) contain a set of appropriate programmes that facilitate such cooperation when creating a document, spreadsheet, presentation, etc. by means of Web-based software.

Technology also offers various visualization tools that can be used in language learning (Krajka, 2015). One of them is Mindmup (at **https://www.mindmup.com**), a free mind mapping application that enables users to store maps on several cloud storage providers, such as Google Drive, and collaborate in real time with other users. It is particularly useful in education owing to anonymous access and the lack of requirement for account signup to use cloud services. When it comes to ESP pedagogy, it can be employed to visualize content, topics, as well as the elements of lexis. Another interesting free online service is Tagxedo (**http://www.tagxedo.com/**), which allows to turn various texts, e.g. speeches, news articles,

[4] Blogs (short for 'Web logs') refer to online journals that can be set up and run by anyone. They are "continuously updated with one's words, ideas and thoughts, links to websites visited, personal and professional news, announcements, multimedia, etc." (Krajka, 2007: 98)

[5] Wikis refer to "a freely expandable collection of interlinked webpages, 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 & Cunningham, 2001: 14).

[6] Social bookmarking is an online service which enables users to add, annotate, edit, and share bookmarks of web documents.

presentations, reviews, slogans, etc. into visually stunning word clouds, and to display words appropriately sized, and with the frequencies of their occurrence highlighted within the body of text or compared texts.

2.3. Technology as a communicative space

Technology has had an enormous impact on ESP pedagogy, not only by expanding ESP teachers' ability to design new materials and share them with other Internet users. It has also given rise to new forms of multimodal discourse combining texts, podcasts, images or video. The changes brought about by the Internet imply that the technologies discussed above as tools for language learning can also be used as spaces where students are given various opportunities to create and disseminate their texts across the Web (Bloch, 2013).

Apart from the already-mentioned forms of digital literacies, there are several alternative approaches to presenting information online, such as PowerPoint Online extending Microsoft PowerPoint to the web browser (at **https://office.live.com/start/PowerPoint.aspx?omkt=pl-PL**) or Prezi, a cloud-based (SaaS) presentation software and storytelling tool for presenting ideas on a virtual canvas (at **www.prezi.com**). There are also various meeting platforms that allow for incorporations of these presentations online.

Technological development has also provided various opportunities for immersion in real-life situations, which are becoming more and more realistic. In addition to numerous online simulations[7], i.e. goal-directed activities in which learners are required to use the target language to perform authentic tasks in a communicative setting (Krajka, 2007), ESP teachers can make use of various ask-an-expert tasks in which learners turn to an expert with a request to dispel their doubts about a certain issue[8] or WebQuests (WQ)[9], inquiry-oriented Web-based activities that involve students in using web-based resources and tools to transform their learning into meaningful understandings and real-world projects (Dodge, 1995). Also, several

[7] One of the best known is a virtual adaptation of a professional simulation "hotel". Detailed instruction concerning its realization can be found at http://home.sandiego.edu/~mmagnin/simulation.html.

[8] Detailed instruction and a list of useful links can be found at http://eduscapes.com/tap/topic14.htm.

[9] Detailed instruction and a list of useful links can be found at Detailed instruction and a list of useful links can be found at http://eduscapes.com/tap/topic4.htm.

attempts have been made to produce discipline-specific Web-based ESP materials that reproduce authentic work and/or study situations. Owing to the collaboration of different European universities with maritime experts, the Web-based Maritime English Learning Tool (*MarEng*) was designed (López de Vergara Méndez, 2006). Addressed to maritime students, teachers and professionals that may need a thorough command of maritime English, the objective of MarEng was to produce an on-line high quality, low cost, language learning tool that might be accessed via the Internet. It is based on nine topic areas, each of which covers part of the daily situations aboard the virtual ship MS Marina. Another application of IT to ESP teaching includes two interactive online workshops designed by Hussin (2006) in Australia – one aimed at developing the communicative skills of ESL Nursing students, and the other one focusing on academic writing of ESL Business students. Still another example of ESP Web-based materials includes the online game *It's a Deal*, which was created as a learning tool for the teaching of intercultural business communication between Spaniards and Britons in business settings in which English is used as the *lingua franca* (Guillén-Nieto, 2009).

The environments designed to recreate real-life situations have been classified into three distinct types of 3-dimentional virtual environments, such as open social virtualities (e.g. *Second Life* and *There*), massively multiplayer online games (MMOGs) (e.g., *World of Warcraft*, *Everquest*), and synthetic immersive environments (SIEs, i.e., "visually rendered spaces which combine aspects of open social virtualities with goal-directed gaming models to address specific learning objectives") (Sykes et al., 2008: 528). As pointed out by Thorne et al. (2009), these environments for language learning provide students with the opportunities for socialization and real communication practice. Owing to their immersive, multimodal, and realistic nature, they increase language learning benefits by positively affecting learners' motivation, their participation in real-life tasks, collaboration, negotiation of meaning, intercultural and pragmatic competence, as well as the development of speaking skills. Sykes et al. (2008: 534) contend that different types of visually rendered virtual spaces present "distinct possibilities for language development based on the affordances, constraints, and unique interactional opportunities of the space itself". SIEs, for instance, combine many of the benefits of online gaming to produce "explicit, educationally related outcomes in simulated, relevant interactional contexts" (Sykes et al., 2008: 536). Thus they have great potential for language learning as they allow their designers to target specific skills and educational

objectives, creating at the same time "a meaningful collaborative space in which learners themselves are at the center of their own learning" (Sykes et al., 2008: 536).

The development of programmes and materials for distance learning has been accompanied by the design of online ESP courses incorporating discipline specific materials and tasks. Online courses – whether in a distance or blended learning formula – appear to be particularly well-suited for ESP. Not only do they help overcome distance and time constraints, but also allow for the customization of learning, and provision of discipline-specific materials and tasks. The tradition to develop online ESP courses is quite long (Luzón, 2009), and most probably results from the need to design materials adapted to specific needs of ESP learners, which also include their time and place constraints (Arnó-Macía, 2012). The most frequently selected is the blended learning formula, which is a logical consequence of the eclectic approach to language teaching (Claypole, 2003) as instruction is provided both in class and online. Since the term was first used in 2003 (Claypole, 2003), several ESP courses based on the formula have been designed. As characterized by Allen and Seaman (2010), this format of learning represents the best of both worlds, i.e. it provides the learner with all the conveniences of online learning, maintaining at the same time an important face-to-face (F2F) link related to the classroom experience. The selected studies depicted below illustrate a range of ESP teaching contexts to which blended learning approach has been applied.

Thus Mungra (2009) developed a blended learning course for medical students in Italy, which was aimed at developing writing skills related to simulated practice that provided relevant context for meaningful work. Beagle and Davies (2013) describe two blended learning ESP courses developed by RMIT English Worldwide (REW), an English language centre owned by RMIT University in Melbourne, Australia – one for pilots and the other for air traffic controllers. Referred to as *Beyond Level 4* (*BL4*), the courses were targeted at practising aviation professionals working in international airspace, and focused on extending English language speaking and listening skills in aviation contexts. Whittaker (2013) describes blended learning ESP courses that were developed and managed by the British Council's Military English Support Project (MESP) that formed part of the wider Peacekeeping English Project. The courses provided English language training to military personnel (mainly officers) in the armed forces of Bosnia and Herzegovina (AFBiH) primarily to enable them to partake in peace support operations. Lesiak-Bielawska (2014) developed a blended learning course for instrumentalists that focused on English language speaking and listening skills required by learners in three distinct situations: the conductor-orchestra interactions during

rehearsals, interactions between the members of small ensembles (e.g. quartets, quintets) during rehearsals, and instrument teacher-learner interactions in class.

The affordances of technology also offer various computer-based testing tools, which can be extremely useful in the process of needs analysis and/or course evaluation. To define target learners' expectations and/or preferences, as well as their opinions about the course, ESP teachers can make use of generally accessible solutions to conduct appropriate surveys, such as SurveyMonkey (at https://www.surveymonkey.com/) or GoogleForms (at https://www.google.pl/intl/pl/forms/about/), and select the kind of tool that best matches their teaching and/or research objectives, i.e. either a tool with a simple interface or with the possibility of importing the collected data to statistical software, such as IBM SPSS Statistics.

With regard to test development, there is a variety of course management and test development software. Different e-learning platforms, such as Moodle or Blackboard Learn, offer tools for assessing the effects of teaching, e.g. the quiz and the test manager modules in Moodle and Blackboard Learn, respectively. Such tools allow teachers to design tests that can be based on questions of various kinds, both open and closed. Tests created by means of these tools can be either homogenous or heterogeneous, i.e. consist of one form of testing or a variety of forms, such as sentence/phrase/word completion, multiple-choice, short answer, selecting the right picture, etc.; the questions can as well be supported by various multimedia elements .(Krajka, 2015). Worthy of note is also QuestionMark (at https://www.questionmark.com/) that specializes in developing, supplying and supporting an assessment platform, software, systems and services for computerizing education and training-related assessments. Its assessment tools enable institutions to measure knowledge, skills and attitudes. They are claimed to empower learning and testing professionals with collaborative authoring instruments, accommodate participant needs with blended and multilingual delivery, and inform stakeholders about test results through meaningful analytics.

Attention should also be paid to various ways of test assessment accessible to ESP teachers using e-learning platforms, such as sum of grades, mean of grades, weighted mean of grades, mean of grades with extra credits, lowest/highest grade in Moodle, etc. Last but not least is alternative forms of testing available online, such as computerized adaptive testing (CAT), or tailored testing, in which computer software adapts the choice of successive questions depending on what is known about the testee from previous questions for the purpose of

maximizing the precision of the exam or test. As an option to traditional testing, it gives a test taker an opportunity to only deal with challenging questions appropriately adapted to the individual proficiency level (Krajka, 2015). One of the platforms allowing for adaptive testing is WebClass (at http://webclass.co/), a distance education and assessment system designed by Malec (2013; 2014).

Despite access to a range of course management and test development software, it has been noted that currently available assessment testing tools can be employed to develop fairly basic multiple-choice and blank-filling tasks, which allow for the incorporation of video, audio, and graphics as part of their input. As such, they sometimes seem to fail to satisfy the needs of ESP testers for highly authentic assignments, which require more sophisticated input and response features (Douglas, 2013). As for test delivery, technology offers language test developers a series of options for enhancing the authenticity of test input and test response alike. They include full motion video, coordination of text and sound, and colour graphics that provide multimodal opportunities for context-rich tests (Chapelle & Douglas, 2006). Thus the use computers and the Internet allows for more realistic simulations of different workplace, professional and academic situations than paper-based tests. However, as pointed out by Douglas (2013), mere delivery of tests by computer does not automatically guarantee authenticity since in some situations paper-based input is a medium that replicates the target language use situations best.

3. Conclusions

It has been pointed out that research into the uses of technology for pedagogical purposes is both inconsistent (Bloch, 2013) and scarce (Blake, 2013). On the one hand, there are studies reporting large gaps between the usefulness with which technology was perceived and its actual usage in the classroom (Jarvis, 2004) or describing the use of technology with language learners as 'thin" (Lee & Swales, 2006). On the other, some research findings point to the success in applying technology to ESP instruction (Lesiak-Bielawska, 2013; 2014). In view of such contradictory research findings, it is difficult to draw an unequivocal conclusion related to the beneficial use of technology in the ESP classroom. All the more so that since some of the research was published, technologies and their availability have evolved and some of the earlier findings may no longer apply. Also, little research has been conducted to determine

whether all students equally benefit from online learning (Blake, 2013), and almost none into the impact of personality and various cognitive factors on student outcomes in an online learning environment.

These questions need to be addressed by future investigations into the impact of technologies on ESP instruction. Another major problem that has to be researched more is how to implement new technologies that are constantly being introduced (Bloch, 2013). As shown above, technology can no doubt be found useful when determining the specific needs of learners. However, the choice of the most appropriate technology in the ESP classroom depends on many different factors, the most important of them being the problem the teacher wants to address, and/or the learning goal that needs to be reached, which in many cases involves a recognition that learning to use the technology itself can fulfil the needs of the learner (Bloch, 2013).

Advances in technology and the development of the knowledge economy have put great emphasis on the ability to use new technologies. However, as pointed out by Bloch (2013), the explosion in new technologies raises several questions. The first one pertains to the sustainability of these technologies, many of which (e.g. email or blogging) are being gradually superseded by new ones (e.g. Twitter or Facebook). As new technological tools are being continually released, ESP teachers are provided with more and more opportunities for classroom use. They may as well be often confused by a vast range of resources available, which – given the fact that many of them consider themselves to be *digital immigrants*, i.e. newcomers to the latest technologies (Prensky, 2001), – can make the choice even more difficult.

As shown above, the choice of technology, either as a tool or communicative space, is never neutral, and the technology-conversant ESP teacher needs to consider various issues before making a final decision about the use of the appropriate tool. As pointed out by Bloch (2013), they relate to the kinds of language being produced, the kinds of social relationships being affected by the tool, and the value attached to certain tools in a given educational context, and/or a particular society. There are also various issues pertaining to the economic nature of technology that have to be considered like the once-free technology begins to charge high fees or the push for more mobile forms of computing or cloud computing.

The application of IT in ESP pedagogy has transformed the multiple roles of the ESP teacher mentioned in the literature of the subject (cf. Dudley-Evans & St John, 2009). Accordingly, the scope of ESP practice has been expanded beyond the traditional ESP classroom to incorporate various affordances of technology (Arnó-Macía, 2012; Gajewska & Sowa, 2014; Lesiak-Bielawska, 2015). As a needs analyst, the ESP teacher is not only provided with instruments to analyze linguistic data, but also with various online tools to investigate learners' subjective needs. Many ESP teachers will certainly find the use of technology useful at the stage of course design since it enables them to overcome learner-and/or-sponsor imposed limitations related to the content, time and place of the course. As shown above, IT and the Internet are of great significance when selecting authentic materials, i.e. samples of professional discourse, and deciding on the right tool and/or space to encourage online communication. ESP teacher might as well make use of various IT tools, i.e. special programmes like Hot Potatoes, Mindmup, etc., to create and/or adapt appropriate learning activities. Technology considerably aids the ESP practitioner in the process of course and materials evaluation since it provides appropriate tools and space for conducting questionnaires, surveys, as well as various forms of testing. Also, the ESP teacher's research work is inseparable from the use of technology, both at the phase of needs analysis and when assessing the effectiveness of the course. Last but not least is the role of the ESP teacher as a collaborator, which is crucial in such a multidisciplinary field like ESP (Dudley-Evans & St John, 2009; Arnó-Macía, 2012). According to Arnó et al. (2006), collaboration among language teachers and between teachers and subject specialists is one of the driving forces for the integration of IT in ESP in order to advance and adapt to a changing context.

To perform these roles, ESP teachers need to competently integrate various skills – in the technological, pedagogical, organizational, and affective dimensions. This very fact implies that more research is needed in the area of ESP teacher needs (Basturkmen, 2014), with implications for specific training programmes (cf. Compton, 2009; Murphy, Shelley and Baumnann, 2010; Arnó-Macía, 2012). In many cases, this kind of training has been restricted to various, sometimes *ad hoc* organized, in-house sessions. With the development of the Internet, ESP teachers have also been given an opportunity to participate in global networks of teachers and draw on each other's experiences. Irrespective of the value of the experience of other teachers, it seems that the overreliance on online discussions pertaining to the use of technology for continual training is not enough. Since the success or failure of a technology in the ESP classroom is largely dependent on the degree of training the teacher has received, not

on the technology itself (Bloch, 2013), it appears extremely important that ESP teachers are given a chance to participate in specific training programmes preparing them to respond to continual advances in technology. This kind of teacher training programmes will undoubtedly help many of them adopt a perspective of a "critical, technologically-informed pragmatism" (Chapelle, 2003: 9) to the use of technology in the classroom. They might as well enable many *technophobe teachers* (Arnó et al., 2006) to keep pace with all the dizzying changes, as well as a new generation of *digital natives* (Prensky, 2001), i.e. individuals surrounded by technology which is fully integrated in their everyday lives.

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www.npr.org

http://oyc.yale.edu

http://webcast.berkley.edu

www.youtube.com

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