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THE USE OF TECHNOLOGY IN ENGLISH FOR SPECIFIC PURPOSES (ESP) INSTRUCTION: A LITERATURE REVIEW

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Abstract. *The application and integration of technology in English for Specific Purposes (ESP) contexts may pose challenges and create opportunities which might be different from the ones in English as a Foreign Language (EFL) contexts. This review was conducted to examine the effectiveness and quantity of previous research studies on the use of technology in ESP instruction. A total of 55 research studies were analyzed using the technology typology developed by Golonka, Bowles, Frank, Richardson, and Freynik (2014). The findings indicated that research findings on the use of technology in ESP instruction are different from the ones identified in the literature of using technology in EFL instruction. The results only confirmed the evidence for learning outcomes and efficacy of the use of course/learning management systems, corpora, and wikis in ESP instruction. Course/learning management systems can promote the quality of ESP instruction and promote students' listening comprehension. The use of corpora can foster students' academic vocabulary, word combination learning and communicative ability. The use of wikis can help ESP students to learn academic writing more efficiently. Moreover, many reports of the benefits of the use of chatting and blogs are available in ESP instruction even though their efficacy and learning outcomes for ESP instruction are not obvious and supported by experimental studies. Finally, there is a dearth of research and empirical evidence on the use of a wide range of technologies in ESP instruction. The findings can have implications for ESP decision-makers, researchers, materials developers, teachers, and students.*

Key words*: ESP, technologies, EFL, efficacy, learning outcomes*

1. INTRODUCTION

The application of technology in the realm of English for Specific Purposes (ESP) has gained tremendous popularity among English as a Foreign Language (EFL) researchers and scholars (Arno, 2012; Butler-Pascoe, 2009; Jarvis, 2009; Plastina, 2003). ESP courses are commonly developed for adults who have a short period of time for learning in heterogeneous courses and are associated with students' specialist studies. More specifically, ESP instruction is goal-oriented and based on the specific needs of students (Robinson, 2003). Dudley-Evans and St. John (1998) note that English for Academic Purposes (EAP) and English for Occupational Purposes (EOP) are the two branches of ESP instruction. EAP is defined as "the teaching of English with the specific aim of helping learners to study, conduct research or teach in that language" (Flowerdew & Peacock, 2001, p. 8), and EOP is defined as "English for professional purposes in administration, medicine, law and business, and vocational purposes for non-professionals in work or pre-work situations" (Dudley-Evans & St. John,1998, p,7). In

this paper ESP has been considered as an umbrella term under which EAP and EOP can be categorized. Bulter-Pascoe and Wiburg (2003, cited in Butler-Pascoe, 2009) suggest that the use of technology in the ESP curriculum can provide students with a plethora of learning opportunities and advantages. The specific merits of using technology in ESP instruction comprise providing interactive and communicative activities related to professions, majors, or specific purposes of students, appreciating the socio-cultural dimensions of the language and the specific content, nourishing students with adequate specific input related to students' needs which can foster their language production, equipping students with strategies that they need to learn languages for specific purposes, facilitating the integration of task-based instruction in ESP instruction, using authentic learning materials related to students' specific needs and content area, providing access to international academic discourse communities, promoting critical thinking and cognitive abilities in ESP students, encouraging collaborative and group learning, making it possible to learn language skills more easily, creating learner-centered and needs-specific learning environments, adapting teaching to students' learning styles and preferences and affective aspects of learning, and providing appropriate tools for giving feedback and assessing students' language knowledge and knowledge of the specific content.

The affordances and benefits that technology provides for ESP instruction has encouraged ESP practitioners and educational directors to integrate computer-assisted language learning (CALL) aspects in their ESP curricula. Moreover, the use of technology in ESP instruction has revolutionized the ways ESP materials developers and course designers produce learning materials for ESP instruction (Butler-Pascoe, 2009). Dudley-Evans and St. John (1998) suggest that ESP is an independent and a separate activity and has its own ESP research agenda within the field of applied linguistics. Furthermore, ESP instruction has its own methodology and its research is interdisciplinary. Therefore, it is a fallacy to generalize the findings of the use of technology in EFL contexts to the field of ESP instruction. As a result, it is paramount to be cautious about the implications of CALL research in general language learning contexts to ESP instruction. Bearing this issue in mind, this study was conducted to examine the findings of previous research on the use of technology in ESP instruction. Even though a plethora of studies have been undertaken to assess the use of technology in ESP instruction, there is a dearth of a well-established literature review study on the use of technology in ESP instruction. A comprehensive literature review study can provide beneficial implications and insights for ESP decision-makers, teachers, researchers, and students across the world.

2. AIMS AND SCOPE OF THIS LITERATURE REVIEW STUDY

This study aimed to review previous research on the use of various technologies in ESP instruction. Research on EOP and EAP were also considered and included in the literature review. To increase the validity of the findings and objectivity of the literature review, only empirical studies which were based on solid research foundations published in peer reviewed journals and books were included in the review. In addition, research reported in PhD and MA/MS theses related to technology and ESP were considered in the literature review. Conceptual papers, conference papers, literature reviews, and technology descriptions were not included in the literature review.

The technology typology which was considered by Golonka, et al. (2014) for CALL literature review was considered appropriate for the purposes and aims of this study. Adopting the same technologies reviewed by Golonka et al. (2014) provided the opportunity for readers to compare and contrast the type of technologies which was commonly researched in the fields of EFL and ESP. The only technology that was added to Golonka et al.'s (2014) technologies was plagiarism detection software tools which are commonly utilized in the field of ESP instruction. Technologies which are somewhat normalized in the teaching contexts such as DVDs, televisions, CDs, emails, and PowerPoint, were excluded from the literature review. These technologies were also excluded from Golonka et al.'s (2014) study. Moreover, a single study which was focused on the use of various and multiple technologies in ESP instruction was excluded from the data analysis to enhance the objectivity and validity of the findings. A total of 55 studies related to the use of technology in ESP instruction were identified and reviewed. The evidence for the efficacy of the use of technology in ESP instruction was supposed to be established when an experimental study using control and experimental groups were used to examine the learning outcomes of a specific technology. In cases of research on technology use without any experimental designs, the efficacy of that technology was considered to be unsupported and insufficient. However, the existence of non-experimental studies could show the benefits of the technology, but did not confirm its efficacy and learning outcomes for ESP instruction. In order to facilitate the interpretation of the results, the studies and their publication type (book chapter, thesis, or journal article) were included in the tables.

3. Reviewed studies- Schoolhouse or classroom-based technologies

3.1. Course/learning management system (CMS/LMS)

Even though there is a paucity of research on the use of CMS/LMS in general EFL instruction (Golonka et al., 2014), several studies have been undertaken to examine the use of LMS/CMS in ESP instruction. Golonka et al. (2014) identified one study related to LMSs and EFL instruction, while this study reported the results of eight studies on the use of LMS/CMS in ESP instruction (Table 1). This issue can suggest that ESP course designers and practitioners are more interested in the inclusion of CMS/LMS in the ESP curriculum. All the studies have reported positive effects of LMS/CMS on students' perceptions of ESP learning and ESP learning in general. Previous studies used both qualitative and quantitative methodologies using single-method and mixed-methods designs. In general, positive attitudes towards the use of LMS/CMS have been reported in previous research (Crnjac Milic, Martinovic, & Fercec, 2009; Hirata & Hirata, 2012; Kučírková, Kučera, &Vydrová, 2014; Maulan & Ibrahim, 2012; Perea-Barbera & Bocanegra-Valle, 2013). There is adequate qualitative and quantitative evidence which illustrates that integrating CMS/LMS in ESP instruction would increase student engagement and participation in the classroom (Al-Mazeedi, 2011; Mamakou & Grigoriadou, 2008; Maulan & Ibrahim, 2012). The use of LMS can also improve student autonomy and independence (Crnjac Milic, Martinovic, & Fercec, 2009; Kuzmina & Golechkova, 2012; Mamakou & Grigoriadou, 2008). Only one study which is experimental using control and experimental groups has reported learning outcomes of

the use of CMS/LMS in ESP instruction (Kučírková, Kučera, & Vydrová, 2014). This study indicated that the use of CMS/LMS can enhance ESP students' listening comprehension ability.

Table 1. Summary of previous studies on the use of CMS/LMS in ESP instruction.

Study	Instruments/Design	Publication type
Al-Mazeedi (2011)	Mixed- methods design (interviews and questionnaire and observations)	Book Chapter
Findings: The study presented a series of interactive activities in the ESP course. The Blackboard learning system was used in this course. The students perceived that they had more opportunities for collaboration and participation in the classroom.		
Crnjac Milic, Martinovic, Fercec (2009)	Questionnaire, observation, test	Technical Gazette
Findings: The distance learning ESP course, using an LMS, was a significant aid for learning. The LMS created the opportunity for providing learning materials between the institutions and students. The LMS also improved independent learning in students. In general, positive attitudes from teachers and students were reported in this study.		
Hirata & Hirata (2012)	Test and post study questionnaires	Book Chapter
Findings: The study examined the effectiveness of GOALS, a learning management system, in ESP instruction. The results showed that the students had positive attitudes towards the course and use of LMS. The students who attended the LMSESP course had significantly more positive attitudes than those who did not.		
Kučírková, Kučera, & Vydrová (2014)	Experimental study (pretest-post-test, control group, experimental group) and post study questionnaires	Journal on Efficiency and Responsibility in Education and Science
Findings: the study explored the use of a Moodle learning management system (LMS) in business English instruction. The results depicted that students in the online ESP course had an improvement in their listening comprehension. The students held positive attitudes towards the online course and the LMS.		
Kuzmina & Golechkova (2012)	Evaluation of completing a project work	Procedia- Social and Behavioral Sciences
Findings: The study sought the perceptions of ESP students of blended ESP course using LMS. The students adopted positive attitudes towards the ESP course. The LMS increased student engagement.		
Perea-Barbera & Bocanegra-Valle (2013)	Mixed- methods study (questionnaires and Interviews)	Book Chapter
Findings: The use of Moodle, a management system, improved students' learning of specialized vocabulary. The students had generally positive attitudes towards the ESP course. The use of multimedia to learn vocabulary was perceived useful.		

3.2. Interactive white board (IWB)

Golonka et al. (2014) noted that the majority of studies related to the use of IWBs in EFL instruction are of a qualitative nature. It appears that in both EFL and ESP contexts there is a lack of research on the efficacy of IWBs and that research in this field is chiefly qualitative. In ESP instruction literature, only one qualitative study on the use of IWBs in ESP is available and because of its qualitative nature, no generalizations can be made on the efficacy of IWBs for ESP contexts. As Table 2 depicts, the results of this study indicated that training is required for efficient use of IWBs in ESP instruction and that the use of IWBs may not be fully normalized in the ESP class (CurtimScmid, 2009). However, the evidence for the efficacy of IWBs in ESP instruction is still lacking and caution should be exercised when using this technology in the ESP classroom.

Table 2. Summary of previous studies on the use of IWBs in ESP instruction.

Study	Instruments/Design	Publication type
Curtim Schmid (2009)	Qualitative study (video recording and field notes)	Book Chapter
Findings: The results of this study indicated that IWB was not fully normalized in the ESP classroom. Furthermore, both ESP teachers and students needed training to use this technology more effectively.		

3.2.1. ePortfolio

The search for studies on the use of ePortfolios in ESP instruction indicated that no well-documented study has been carried out in this regard. Similarly, Golonka et al. (2014) identified a small number of qualitative studies on the use of ePortfolios in EFL instruction. Therefore, no claims of efficacy can be made about the use of ePortfolios in ESP instruction.

4.. INDIVIDUAL STUDY TOOLS

4.1. Corpus

Table 3 shows that both qualitative and quantitative studies have been undertaken to assess the use of corpus in ESP instruction. The search for the use of corpus in ESP instruction resulted in identifying seven studies (Table 3). Golonka et al. (2014) argued that the majority of studies on corpus and EFL instruction are qualitative ones. Two experimental studies suggested that using corpus in ESP instruction can yield learning outcomes. The findings of these indicated that the use of corpus can improve students' academic vocabulary knowledge and knowledge of technical word combinations and collocations (Fuentes, 2007). Fuentes (2003) also reported that the use of the corpus fostered EAP students' communicative ability. Other research studies also have suggested the corpus-instruction can have benefits for academic vocabulary learning and syntactic knowledge improvement in ESP instruction (Hou, 2014; Pérez-Llantada, 2009;Yoon, 2008). The use of corpora has also been reported to promote ESP students'

academic writing proficiency (Lee & Swales, 2006; Yoon, 2008). In a mixed-methods study, Balunda (2009) asserted that the students had difficulty working with the corpus and that they needed training for the efficient use of corpora in ESP instruction.

Table 3. Summary of previous studies on the use of corpus in ESP instruction.

Study Instruments	Design	Publication type
Balunda (2009)	Mixed- methods study (interviews and questionnaires)	MA Thesis
Findings: The students reported that working with a corpus is more useful then working with a dictionary to learn vocabulary. Furthermore, some students perceived that working with a corpus is somewhat complicated.		
Fuentes (2007)	Test and Questionnaire (control and experimental group)	Scripta Manent
Findings: Two groups used corpus to improve their vocabulary knowledge. One group used traditional corpus and the other one used the corpus through electronic resources. The second group outperformed the first group in vocabulary learning. In general, the electronic corpus-based work could improve academic vocabulary knowledge.		
Fuentes (2003)	Qualitative study (oral tasks) and experimental study (control and experimental groups)	ReCall
Findings: The use of corpora helped business students produce more technical combinations and collocations in their discussions. Also, the use of the corpora enhanced students' communicative ability and efficiency.		
Hou (2014)	Experimental study (pre-test, post- test)	English Language Teaching
Findings: The introduction of a corpus-based course enhanced EAP students' content, language, and vocabulary knowledge.		
Pérez-Llantada (2009)	Survey, teachers' ongoing assessment of students' work, corpus- based tasks	Language Learning & Technology
Findings: Bhatia's multi-perspective model for discourse analysis was used for corpus-based instruction in this study. The results showed improvements in ESP students' production of accurate and appropriate grammatical structures and enhanced students' awareness about the social, contextual, and generic aspects of using grammar. The corpus-based instruction also provided authentic grammar learning for students.		
Yoon (2008)	Qualitative case study	Language Learning & Technology
Findings: the study assessed the effect of corpus technology on EAP writing. The results showed that the corpus helped students to have fewer writing mistakes and problems and enhanced their lexico-grammar perceptions and language awareness. The corpus also made students independent writers who took the responsibility for their learning. In general, the use of the corpus was believed to foster academic writing proficiency in EAP students.		

4.2. Electronic (academic, general) dictionary and electronic glosses/annotation

Even though several studies have been directed towards the use of electronic dictionaries, and electronic glosses/annotations in general EFL instruction (Golonka et al., 2014), this line of research has remained somewhat uninvestigated in ESP instruction. There is no well-documented study on the use of electronic dictionaries for ESP instruction, while a small number of qualitative studies exist on the use of electronic glosses/annotations in ESP instruction. Due to the qualitative nature of these studies, no judgment on the efficacy and learning outcomes of these technologies for ESP instruction can be made. Specifically, three studies have been carried out in relation to the use of electronic glosses/annotations in ESP instruction. According to Table 4, two studies, one qualitative and one quantitative, has indicated the positive effect of electronic glosses on ESP students' vocabulary learning (Lenders, 2008; Poole, 2011). However, Sakar and Ecretin (2004) concluded that although ESP students have positive attitudes towards hypermedia annotations for reading comprehension, there exists a negative correlation between using annotations and improvement in reading comprehension proficiency. In general, no conclusive result can be drawn from these studies since they are of a limited number and are qualitative in nature.

Table 4. Summary of previous studies on the use of electronic (academic, general) dictionaries and electronic glosses/annotations in ESP instruction.

Study Instruments	Design	Publication type
Lenders (2008)	Longitudinal qualitative study (observations, questionnaires and interviews)	Computer assisted language learning
Findings: The EAP students believed that electronic glosses were useful and effective for their vocabulary learning. The learners were also more motivated to use the glosses if the glosses were related to their future jobs. Authentic texts should be combined with learning tasks to increase the efficiency of glossing vocabulary learning.		
Poole (2011)	Test, questionnaires and interviews	MA Thesis
Findings: The use of concordance-based glossing improved academic vocabulary learning and vocabulary production. The students held positive attitudes towards concordance-based glossing.		
Sakar & Ercetin (2004)	Tracking tool, reading test, questionnaire and interview	Computer assisted language learning
Findings: The study sought whether EAP students are positive about hypermedia annotations and their effect on reading comprehension. The results indicated that the EAP students had positive attitudes towards visual annotations rather than textual and audio ones. However, a negative correlation between annotations and reading comprehension was reported.		

4.3. Intelligent tutoring system (ITS)

Research on the use of ITSs in ESP instruction is limited even though there are some studies in the EFL instruction literature (Golonka et al., 2014). The only study which assessed the use of an ITS for ESP instruction is Gonçalves, Aluisio, de Oliveira, and Oliveira (2004). The findings of this study revealed that using ITSs in ESP is a staunch testing instrument and makes students aware of a great number of learning strategies (Table 5). There is no experimental study in this regard to assess the learning outcomes of ITS in ESP instruction.

Table 5. Summary of previous studies on the use of intelligent tutoring systems (ITSs) in ESP instruction.

Study Instruments	Design	Publication type
Gonçalves, Aluisio, de Oliveira, & Oliveira (2004)	Tests	Book Chapter
Findings: CALEAP-Web which integrated an adaptive testing system and task-based environment was introduced to an EAP context. The ITS was robust and effective and the students believed that the system was functional and efficient. In general, the ITS was useful for testing purposes and helped students with a large number of learning strategies.		

4.4. Grammar checker, automatic speech recognition and computer-assisted pronunciation training (CAPT)

Unlike EFL instruction in which a plethora of studies have been undertaken on grammar checkers, automatic speech recognition, and CAPT (Golonka et al., 2014), very limited attention has been directed towards these technologies in the ESP instruction literature. There is no previous study on the use of grammar checkers in ESP instruction. However, as Table 6 shows, there is one qualitative study on the use of CAPT in ESP instruction which indicated that CAPT is mostly useful for weaker ESP students (Hincks, 2009). Overall, evidence of learning outcome of these technologies is very limited.

Table 6. Summary of previous studies on the use of grammar checkers, automatic speech recognition and CAPT in ESP instruction.

Study Instrument	Design	Publication Type
Hincks (2005)	Students' pronunciation error analysis	PhD Thesis
Findings: The results of this study showed although weaker ESP students may benefit from computer-assisted pronunciation training (CAPT), the more advanced students did not improve using the speech software.		

4.5. Plagiarism detection software

Previous research in ESP instruction has also been focused on the use of plagiarism detection software tools to learn ESP. However, this technology was not included in Golonka et al. (2014). Previous research on plagiarism detection software is mostly qualitative and there is a lack of experimental studies in this research strand (Table 7). Results of these studies are inconclusive. While Bikowski (2012) and Davis (2007) pointed out that the use of plagiarism detection software tools can improve students' academic writing proficiency and their awareness of plagiarism, Hunt and Tompkins (2014) reported that not all plagiarism detection tools are reliable ones and they cannot detect plagiarism efficiently. They demanded that teachers raise students' awareness about the shortcomings of plagiarism detection tools. Bikowski (2012) also argued that students need training for the efficient use of plagiarism detection tools. However, no conclusions about the learning outcomes of the use of plagiarism detection tools can be drawn based on the results of previous research.

Table 7. Summary of previous studies on the use of plagiarism detection software tools in ESP instruction.

Study Instruments	Design	Publication Type
Bikowski (2012)	Questionnaire and Semi-structured interview	Book Chapter
Findings: ESP students who studied business frequently use plagiarism detection software tools to check their academic writing and are generally satisfied with these tools. The students need training for the use of these software tools. It was shown that the software helped ESP students avoid plagiarism.		
Davis (2007)	Evaluation of written tasks and post- study questionnaires	Brookes e-Journal of Teaching and Learning
Findings: The study revealed that the use of Turnitin improved EAP students' academic writing proficiency in general. More specifically, using the plagiarism detection software enabled students to enhance their citation skills, avoid plagiarism, and paraphrase appropriately. The use of the software improved the students' academic literacy.		
Hunt & Tompkins (2014)	Analysis of sudents' texts	The Journal of the Virginia Community Colleges
Findings: The study compared the use of SafeAssign and Turnitin for academic writing. It was reported that no significant difference was found between SafeAssign and Turnitin and both of these software tools were not that reliable for detecting plagiarism. The study suggested that students and teachers should be aware of the shortcomings of these software tools.		

5. NETWORK-BASED SOCIAL COMPUTING TECHNOLOGIES: SYNCHRONOUS COMPUTER-MEDIATED COMMUNICATION (CMC)

5.1. Virtual world/ Serious game

Similar to the results of previous studies in EFL instruction, there is no evidence for the efficacy or learning outcomes of the use of virtual world/serious games in ESP instruction (Golonka et al., 2014). The only case study which has been conducted is Chen (2014). The results of this study showed that ESP students accepted the virtual reality learning environment moderately (Table 8).

Table 8. Summary of previous studies on the use of virtual world/serious games in ESP instruction.

Study Instruments	Design	Publication Type
Chen (2014)	Case Study (questionnaire)	Journal of Computers
Findings: The study aimed to assess ESP students' acceptance and self-efficacy of a virtual reality learning environment. The students perceived moderate self-efficacy and acceptance of the learning environment.		

5.2. Chat and conferencing

A total of six well-documented studies were conducted on the use of chat in ESP instruction based on the literature review. The studies are mostly qualitative with two mixed-methods studies. There is a lack of experimental studies on the use of chat in ESP instruction. Golonka et al. (2014) identified studies which reported on the learning outcomes and efficacy of chatting in EFL instruction. As Table 9 illustrates, all the studies indicated that chatting and synchronous conferencing can have benefits for ESP learning. Some studies were indicative of the benefit of chatting for fostering students' academic writing skills (Cheng, 2007; Leppänen, 1995; Lin & Kuo, 2011). Two studies reported that the use of chat promoted students' oral proficiency (Shamsudin & Nesi, 2006; Vetter & Chanier, 2006). Moreover, the results of previous studies show that chatting improved student collaboration and participation in discussions (Cheng, 2006; Lin & Kuo, 2011; Jackson, 2011; Vetter & Chanier, 2006) (Table 9)

Table 9. Summary of previous studies on the use of chat in ESP instruction

Study Instruments	Design	Publication Type
Cheng (2007)	Mixed- methods study	PhD study
Findings: The results indicated that EAP students used a wide range of language function in order to communicate with the discourse community during online discussions via synchronous CMC chatting. In online discussion students provided scaffolding for each other which helped them foster their academic literacy. In general, online discussions helped students to enhance their academic writing skills.		
Jackson (2011)	Qualitative (learner interaction analysis)	TESL- EJ

Findings: The study showed that the use of certain tasks can improve students' interaction in synchronous CMS environments in ESP contexts. It was concluded that different tasks should be considered for different purposes in synchronous CMS environments.

Leppänen (1995)	Qualitative study (interaction Analysis)	ELT Journal

Findings: The EAP students were supposed to use computer conferencing for discussions and talk about academic writing process. The computer conferencing increased students' participation in discussions. Computer conferencing also improved collaboration between the students and the teacher. Both student-provided and teacher-provided feedback was exchanged during online discussions.

Lin & Kuo (2011)	Analysis and questionnaires	The JALT CALL Journal

Findings: This study illustrated that advanced EAP students are able to use various strategies during synchronous CMC conferencing. The students are also highly collaborative in online discussions. Synchronous CMC peer-conferencing was considered as a suitable pre-writing consciousness-raising task for learning rhetorical aspects of academic writing.

Shamsudin & Nesi (2006)	Oral assessment and project work	Computer assisted Language Learning

Findings: The results showed that synchronous CMC can improve students' oral proficiency in ESP courses. Also, the students who worked with synchronous CMC achieved higher scores in a computer science project.

Vetter & Chanier (2006)	Mixed- methods study	ReCall

Findings: The study investigated analyzed students' interactions in a multimodal synchronous audio conferencing environment in an EAP context. The results of this study showed that in audio-synchronous environments supported by multimedia even weak learners can have active oral participation. It was also revealed that false beginners can have professional conversations at different complexity levels in the study.

6. NETWORK-BASED SOCIAL COMPUTING TECHNOLOGIES: WEB 2.0 TOOLS AND ASYNCHRONOUS COMMUNICATION

6.1. Wiki

The studies on the use of wikis for ESP/EAP instruction have used both qualitative and quantitative methodologies. Except one study (Kavaliauskienė, 2010) which was based on a descriptive design, i.e. post-study questionnaires, the other studies indicated generally positive effects of wikis for ESP/EAP instruction. Sun & Qiu (2014) conducted a very comprehensive study using an experimental design with control and experimental groups. The results showed that the use of wikis in ESP instruction can improve students' academic writing skills. This study clearly revealed the positive learning outcome and efficacy of the use of wikis in ESP instruction (Table 10).

Some studies have revealed that the use of wikis for ESP/EAP instruction can engage students in collaborative learning, acquisition of social skills, and increase in their motivation to collaborate in the classroom (Bradley, 2010; Sun & Qiu, 2014; Wang, 2014).The results of previous research also show that the use of wikis in ESP/EAP instruction can improve students' academic writing proficiency (Dashtestani, 2014; Kavaliauskienė, 2010; Kuteeva, 2011; Papadima-Sophocleous & Yerou, 2013; Sun & Qiu, 2014; Wang, 2014). The students further expressed positive attitudes towards the use of wikis for ESP/EAP instruction in other studies (Dashtestani, 2014; Papadima-Sophocleous & Yerou, 2013; Sun & Qiu, 2014). The use of wikis in EAP/ESP instruction improved and increased student participation in the classroom and learning (Felea & Stanca, 2014; Rodríguez-Arancón & Calle-Martínez, 2014). Finally, two studies reported that students perceived that the use of wikis enhanced their computer literacy (Dashtestani, 2014; Papadima-Sophocleous & Yerou, 2013).

Table 10. Summary of previous studies on the use of wikis in ESP instruction

Study Instruments	**Design**	**Publication Type**
Bradley (2010)	Design- based case study (interaction analysis)	ReCall
Findings: The use of wikis was a positive experience in general and led to various collaborative learning patterns. The use of the wiki had benefits for students from a socio-cultural perspective.		
Dashtestani (2014)	Mixed methods study (questionnaires and interviews)	Book Chapter
Findings: Students' positive attitudes towards using Wikipedia for learning academic writing, reading comprehension, academic vocabulary, and improving their computer literacy.		
Felea & Stanca (2014)	Quantification of students' page views and edit statistics	Book Chapter
Findings: The wiki-based course was a successful learning experience and enhanced students' participation.		
Kavaliauskienė (2010)	Post-study questionnaires	English for Specific World
Findings: students' negative attitudes towards using wikis for collaborative learning of academic writing skills.		
Kuteeva (2011)	Mixed-methods case study English for Specific Purposes (questionnaires, participant observations, text analysis)	English for Specific Purposes
Findings: Using wikis for academic writing increased students' grammatical accuracy and structural cohesion. Moreover, the students analyzed their audience more effectively after the use of the wiki.		
Popadima-Sophocleous & Yerou (2013)	Questionnaires and students' reflective journals	Teaching English with Technology
Findings: The students had overall positive attitudes towards wikis for learning academic English. The use of wikis enhanced their computer literacy, social skills, and academic English.		
Rodriguez- Arancon & Calle-Martinez (2014)	Students' self- reports	Book Chapter
Findings: The students' had active participation in the wiki-based activities and were highly motivated. Wiki-based activities created a learner-centered environment in which students learned based on their needs and interests.		

Sun & Oiu (2014)	Experimental study (pre-tests and post- tests) (control and experimental groups)	International Journal of Information Technology and Management
Findings: The experimental group who received wiki-based instruction outperformed the control group in academic writing. The students had a rather positive attitude towards wikis and their effect on their collaborative learning experiences and motivation to learn.		
Wang (2014)	Writing tests and Computer assisted language learning	
Findings: the collaborative writing tasks were very interesting for many learners and improved their academic writing proficiency. Improvements in language learning, collaborative learning, and professional writing were reported.		

6.2. Blog

Similar to wikis, blogs have been widely researched in the field of ESP. Nearly all the studies support the notion that using blogs in ESP/EAP instruction can have beneficial results for academic English learning. As Table 11 indicates, the majority of the studies are mostly both qualitative and quantitative. Creating a sense of community learning is a finding which has emphatically been echoed in previous research (Asoodar, Atai, Vaezi & Marandi, 2014; Fola-Adebayo, 2014; Kelly, 2008; Montero-Fleta & Pérez-Sabater, 2014; Sun & Chang, 2012). Also, opportunities for reflection on learning and self-discovery learning were the other benefits of using blogs which were reflected in the results of two studies (Blackstone, Spiri, & Naganuma, 2007; Murray, Hourigan, & Jeanneau, 2007). Finally, the opportunity to have collaboration in the classroom was mentioned in the results of two studies (Chong, 2009; Nicolaou & Constantinou, 2014).

Table 11. Summary of previous studies on the use of blogs in ESP instruction.

Study Instruments	**Design**	**Publication Type**
Asoodar, Atai, Vaezi & Marandi (2014)	Mixed- methods study (questionnaires, interviews, participant observation)	Computers & Education
Findings: there exists a significant difference between students who have a strong sense of community and those who have a low sense of community in using blogs. This study emphasizes that students should be considered as members of a community of learning and using blogs can help to achieve this aim.		
Blackstone, Spiri & Naganuma (2007)	Post- study questionnaire	Reflections on English Language Teaching
Findings: blogging enabled students to experience autonomous learning. Blogs also encourage students to have more authentic communication. Also, students will have more opportunities for reflection and interaction during academic writing tasks. Overall, blogs assisted students to improve their academic writing proficiency.		

Chong (2009)	Students' blog discourse analysis and a survey	Computers & Education
Findings: Blogging can initiate students into academic research. Students can be encouraged to conduct academic research in a collaborative environment.		
Fola-Adebayo (2014)	Content analysis and questionnaires	Journal of Language and Literature
Findings: the results of this study show that using blogs in EAP instruction can activate students' higher-order thinking levels and create online language learning communities.		
Montero- Fleta & Perez-Sabater (2014)	Mixed- methods study (questionnaires and interviews)	Procedia- Social and Behavioral Sciences
Findings: blogging motivated students to feel as the members of a learning community and gear their writing to the demands of the community. Blogging also enhanced students' participation and engagement.		
Murray, Hourigan & Jenneau (2007)	Analysis of students' reflections	IBERICA
Findings: the use of blogs enabled students to pay attention to their learning process in academic writing. The use of blogs also encouraged students to have self-analysis and self-discovery on the strategies they used and the blog was considered as a valid assessment tool for teachers.		
Nicolaou & Constantinou (2014)	Questionnaires	Book Chapter
Findings: students showed positive attitudes towards using blogs in EAP. The students perceived that using blogs increased their collaboration in the class.		
Shih (2012)	Mixed- methods study (interviews, questionnaires and feedback analysis)	Turkish Journal of Educational Technology
Findings: the study indicates that factors such as free access, type of materials, and easy revision affect students' perceptions of the blog. Furthermore, the use of blogs in the EAP course was a satisfactory and successful experience for learners.		
Sun & Chang (2012)	Qualitative case study (content analysis and open-coding)	Language Learning and Technology
Findings: blogging enabled students to be involved in knowledge sharing and generation and focus on their learning process. The students also found new identities as authors and members of an authorship community.		

6.3. Social networking

Research on social networking sites and their effect on ESP instruction seems to be in its infancy. There is an obvious paucity of research in this area of research. There are only two studies which reported the positive effects of using Twitter and Line on ESP students' vocabulary learning and collaborative learning (Pérez-Sabater & Montero-Fleta, 2015; Van De Bogart & Wichadee, 2015). However, the evidence for the effect of social

networking on ESP learning is very limited and no conclusive results can be drawn from previous research (Table 12).

Table 12. Summary of previous studies on the use social networking in ESP instruction

Study Instruments	Design	Publication Type
Van de Bogart & Wichadee (2015)	Questionnaires	The International Review of Research Open and Distributed Learning
Findings: the use of LINE can enhance collaborative learning. Students felt that LINE is easy to be used and had positive attitudes towards that.		
Perez- Sabater & Montero-Fleta (2015)	Tests, questionnaires, interaction analysis	IBERICA
Findings: the use of Twitter encouraged students to use specialized vocabulary in authentic contexts. Twitter created a sense of learning community and increased student participation.		

6.4. Internet forum and discussion/message board

The research related to the use of Internet forums and discussion boards in ESP instruction is chiefly qualitative. Therefore, it can be concluded that there is a lack of quantitative research on this area of research. More specifically, all studies have been directed towards online discussion forums. According to Table 13, previous research shows that the use of online discussion forums in ESP instruction enhanced students' participation, interaction, and communication quality (Bensoussan, Avinor, Ben-Israel, & Bogdanov, 2006; Tajeddin & Alemi, 2012; Yang, Hwang, & Yang, 2013).

Table 13. Summary of previous studies on the use of Internet forum and discussion/message boards in ESP instruction.

Study Instruments	Design	Publication type
Bensoussan, Avinor, Ben-Israel & Bogdanov (2006)	Questionnaires, written tasks and comprehension questions	Language @ Internet
Findings: computer-mediated communication which occurred in a forum improved both the quality and quantity of participation. The forum created a motivating environment for students to participate in language learning and discussions. In general, the use of the Forum had benefits for learning and students had positive attitudes towards it.		
Tajeddin & Alemi (2012)	Analysis of sudents' issues in language teaching comments	
Findings: the use of online discussion forums motivates ESP students to use interactional meta-discourse markers. Also, it was shown that meta-discourse markers were an integral part of online discussion genres.		

Yang & Hwang (2013)	Tests, log file analysis	Educational Technology & Soviety
Findings: the use of online discussion forums improved students' intercultural communication and language awareness in the learning community In general, the online forum fostered online intercultural interaction among ESP students.		

7. MOBILE/PORTABLE NETWORKABLE DEVICES

7.1. Tablet PC and PDA, iPods and cell phone/smart phone

Even though an extensive search was conducted, no well-documented study published in peer review journals or books on the use of tablet PCs, PDAs, or iPods in ESP instruction was identified. However, there was a study published in the proceedings of a conference (Papadima-Sophocleous, Georgiadou, & Mallouris, 2010) which investigated the effect of using iPods on ESP students' oral reading proficiency. It was revealed that the use of iPods out of the classroom helped students improve their reading fluency and automaticity. Unfortunately, this paper was not well reported and discussed, therefore it was decided not to include it in the literature review. There was another conference paper (Schcolnik, Kol, & Oren, 2007) which explored the effectiveness of handhelds in academic reading. They reported that there was not a significant difference between the use of handhelds and desktops for academic reading. Generally, students had positive attitudes towards using handhelds for academic reading. Also, reading strategies which are used for printed materials can be transferred to digital reading environments. However, this study was in form of a conference paper and was excluded from the data analysis. A well-documented study which explored the effectiveness of language learning materials on mobile devices in business English instruction is Yamada et al. (2011). Although the type of mobile device was not stipulated in this study, the results revealed that the use of mobile learning materials had a positive effect on students listening comprehension and motivation to learn (Table 14).

Table 14. Summary of previous studies on the use of tablet PCs and PDAs, iPods, and cell phones/smart phones in ESP instruction

Study Instruments	**Design**	**Publication Home**
Yamada et al. (2011)	Tests and questionnaires	CALICO
Findings: regarding the effectiveness of language learning materials through mobile devices in ESP business English instruction, the findings showed an increase in students' motivation, and listening comprehension scores.		

8. CONCLUSION

This study was conducted to explore the focus and aims of previous research studies on the topic of technology use in ESP instruction. A total of 55 well-documented research studies were analyzed and the efficacy of technologies used in ESP courses was examined and reported. Even though research on ESP instruction and technology has

thrived in recent years, many claims related to the use of technology in ESP instruction have not been supported by adequate and sound empirical evidence. This study indicated that there is clear empirical evidence for the efficacy of the use of course/learning management systems, corpora, and wikis in ESP instruction. Course/learning management systems were reported to increase the quality of ESP instruction and promote students' listening comprehension. The use of corpora in ESP instruction can foster students' knowledge of specialized vocabulary and collocations, and academic communicative abilities. Finally, the use of wikis can enhance ESP students' knowledge of academic writing.

The use of chat and blogs has widely been researched and reports of the benefits are available even though their efficacy for ESP instruction and learning outcomes has not been researched and clarified. There is a significant body of research on a wide range of other technologies, including IWBs, ePortfolios, electronic (academic, general) dictionaries and electronic glosses/annotations, ITSs, grammar checkers, automatic speech recognition and CAPT, plagiarism detection software tools, virtual world/serious games, social networking, Internet forum and discussion/message boards, and mobile devices. Future research should be directed towards investigating the use of these technologies in ESP instruction. Without a clear understanding of the benefits and shortcomings of each technology, its integration in ESP instruction would not be a wise strategy. Even though there are similarities between EFL instruction and ESP instruction, ESP is an independent approach to learning which owns its research methodologies and specifications. Unfortunately, extending the results and findings of research of general EFL instruction to ESP instruction is rather common and popular among a number of language teaching researchers and practitioners. What seems necessary is to exercise caution when generalizing the results of general EFL research to the specific contexts and demands of ESP instruction. Since ESP instruction is closely associated with the acquisition of academic literacy and being socialized into larger and more complicated academic discourse communities, it is paramount that any aspects of new technologies be examined and researched under the specific conditions of ESP contexts in order to ensure that ESP teachers, institutions, and students can integrate those technologies in their educational practices.

As this literature review indicated, there were a plethora of differences and discrepancy between the findings of previous research on EFL and technology, and ESP and technology. This difference is obvious when comparing the quantity of studies in ESP and EFL fields and their research methodologies. The study depicted that the majority of studies linked to the use of technology in ESP instruction are of a qualitative type. Definitely, ESP researchers and scholars should strive to conduct further quantitative and experimental studies which can examine the efficacy of different technologies for ESP instruction. In a large number of studies reviewed in this study, no specific treatment was applied and due to this shortcoming, no conclusive implications could be drawn from those studies. ESP researchers are advised to explore the possible benefits and drawbacks of various types of technology in different contexts and cultures. It is essential that both ESP teachers and content specific teachers undertake collaborative research studies to identify the potential benefits of technologies for both language and content teaching and learning.

As the literature review revealed, research on technology and ESP instruction seems to be in its infancy. The use of a wide range of topics and technologies in ESP instruction

has not been empirically researched and examined by ESP researchers. It is crucial that innovative applications of technology in ESP instruction be topics for further investigation. Unlike EFL teachers, ESP teachers should be able to pave the way for students' language learning and at the same time take the specific learning content into consideration. Therefore, technology inclusion in ESP instruction may pose more considerable challenges for ESP teachers and researchers since they should bear in mind that both language and content should be considered in any condition of technology use in ESP instruction. In addition, since ESP instruction is based on learner-centered and needs-based approaches to learning, the use of any type of technology in ESP instruction should be based on students' needs, preferences, and learning styles. Therefore, it is recommended that ESP teachers make attempts to use a wide range of technologies in their ESP courses in order to maximize student participation and engagement in language learning.

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