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Review of Research on the Use of Information and Communication Technologies (ICTs) in ELT-Related Academic Writing Classrooms

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ABSTRACT

Background. The emergence of information and communication technology and the resulting technological devices have influenced the nature and process of composition and the level of students' engagement and participation in writing activities.

Purpose. The present study reviews 50 studies published in peer-reviewed applied linguistics journals from 2000 to 2020 which have investigated the use and implications of technology for teaching and assessing writing in academic contexts.

Methods. The PRIZMA model was applied for records screening and selection and systematic qualitative content analysis was used to explore the content of these studies and identify the most relevant themes. The most relevant sections of these studies (especially, designs and findings) were selected for further analysis and synthesis.

Results and Implications. Results of this systematic thematic review are mainly categorized and discussed based on three main themes: (1) Technology Use in Teaching and Learning Academic Writing, (2) Some Technological Tools for Teaching and Assessing Academic Writing, and (3) Practical Implications of Using Technology in Academic Writing Classrooms. Results of this systematic review indicated that growth in the use of technological resources such as computers, applications, and web-based learning environments in teaching and assessing ELT-related writing in academic contexts can enhance the quality of instruction provided. Despite some practical limitations for applying these technologies in writing courses, most of the reviewed studies pointed to the fact that technology-mediated writing instruction and assessment can enhance the students' knowledge and use of new digital literacies and, in turn, can lead to improvements in their composing processes and writing competence while working on various genres.

KEYWORDS:

information and communication technology, technology-mediated writing instruction and assessment, systematic review, qualitative content analysis

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INTRODUCTION

Learning to write and gaining competency in this skill is highly essential in academic contexts and students need to receive deliberate instruction to become competent in this skill while working on various genres (Raban & Scull, 2013). Currently, many educational contexts have highlighted the need for learners to be equipped with "an array of academic writing skills that are a prerequisite for successful careers in the industry and academia, which has been evidenced in recent curriculum requirements across various higher education institutions worldwide" (Dugartsyrenova, 2020, p. 2). Previously, many students in most EFL/L2 classrooms used paper and pencil and dealt solely with print texts, but currently using multimedia frameworks and digital tools is becoming an integral part of many writing programs (Black, 2009; Mills et al., 2018). In fact, the advent of digital technologies have made drastic changes in the domain of education, in general, and teaching language skills and components, in particular. The emergence of information and communication technology and the resulting

technological devices have influenced the nature and process of composition and the level of students' engagement and participation in writing activities. In the same regard, it is maintained that in light of the resources provided by information and communication technology for teaching writing, "the definition of "writing" and the nature of writing instruction need to be reconsidered" (Williams & Beam, 2018, p. 4).

Hyland (2016) also believes that the new computer-mediated technologies have influenced "the ways we write, the genres we create, the authorial identities we assume, the form of our finished products, and the ways we engage with readers" (p. 40). Written language, by itself, has been considered as a powerful technology that can record and regulate communicative endeavors and "a means of enacting influence, control, and exclusion as well as emancipation, enrichment, and enjoyment" (Snaza, 2019, p. 56). In fact, the "emerging digital technologies facilitate expanded communicative repertoires and multiple forms of participation, collaboration, and civic engagement" (Mills & Stornaiuolo, 2018, p. 1).Technological resources have also enhanced these possibilities and, consequently, the nature of such affordances must be further scrutinized.

In the same regard, many teacher educators and educational researchers are concerned about how digital technology can be used in writing instruction and assessment and how it can support the students' writing development. As the technology has advanced, many educators and researchers are concerned about how the rapid expansion and application of technological tools can affect the leaners' writing process and outcomes (see e.g., Bikowski & Vithanage, 2016; Elola & Oskoz, 2017; Kessler, 2020; Levy & Moore, 2018; Vetter et al., 2019; Zhang et al., 2021; Zhang & Plonsky, 2020; Zheng & Warschauer, 2017). In the same vein, the present study explored and synthesized the findings of a number of scholarly articles, published in the last 20 years (2000-2020), which have targeted the use of technology in writing instruction and assessment. More specifically, the present study intended to answer the following main research question: What are the issues and implications of using technology for teaching and assessing academic writing?

METHODS

Design

The present study intended to provide a systematic review of the information and communication technology (ICT) use in teaching writing by conducting a rather comprehensive and constructive investigation of the existing scholarships in the field of academic writing from 2000 to 2020. Denyer and Tranfield (2009) maintain that systematic review "is a specific methodology that locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known" (p. 671). According to Kohnke and Moorhouse (2020), technology reviews should cover a large and growing number of resources and media such as apps, websites, digital media, digital online resources, downloadable software, and other technology tools. They further maintain that instead of describing the affordances and functionalities of these technological devices, the reviews should focus on how they can be used to enhance teaching and learning of a particular subject area or language skills and components.

Bibliographic Database and Search Strategy

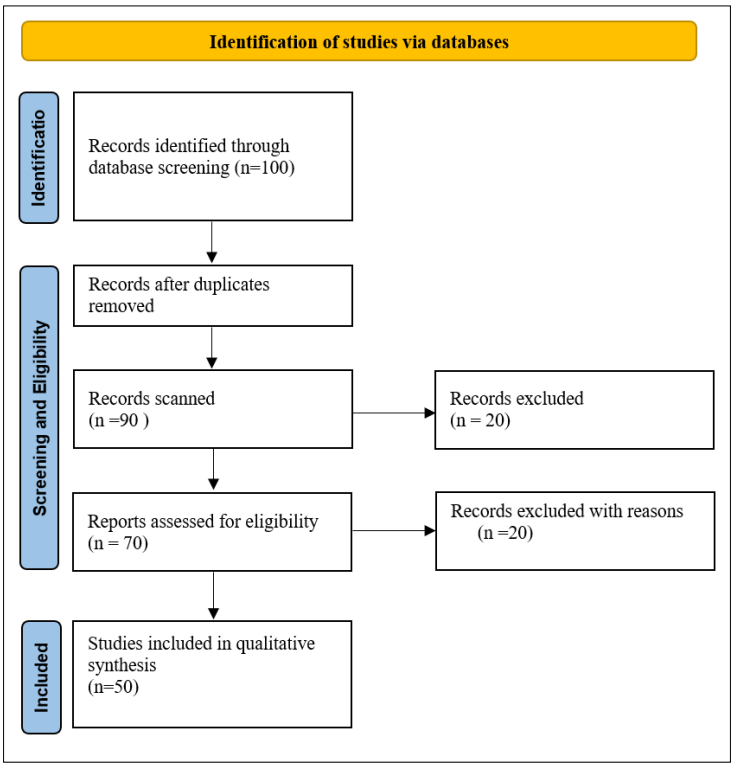
In order to identify the most relevant studies for the purpose of the present thematic review, the researcher searched for some main content terms and key words such as *technology, information and communication technology, ICT, computer-assisted language learning, CALL, writing, writing instruction, composition* and *writing assessment and evaluation* in the published peer-reviewed applied linguistics journals from 2000-2020 in electronic databases such as Google Scholar, Elsevier (most specifically *Science Direct* database) and Sage publication. As for the methodology of the present systematic review, the researcher went through the stages of literature identification, screening for inclusion, quality and eligibility assessment, and data extraction, analysis and synthesis (Xiao & Watson, 2019). The PRISMA flow diagram visually summarizes the screening process:

Inclusion and Exclusion Criteria

After finding the most relevant studies, by using a snowball search strategy, the reference list of each article was further examined to find the additional relevant studies. A total of 100 studies were found that after doing a precise screening, 50 relevant articles which have targeted the use of technology in context of academic writing instruction and assessment were selected for further inclusion and exploration. In fact, the abstract and some relevant parts in the body (especially the method and findings sections) were consulted for this selection. The main criteria for inclusion of the papers in the present review had been the use of technological resources and devices in their design and applied interventions and those which have explored the practical implications of technology use for teaching and learning of writing in academic contexts. More specifically, the designs and outcomes of these studies have been the determining factors for their inclusion and exclusion. In order to ensure the qualitative eligibility of the review, only the papers published in the peer-reviewed journals (especially those indexed in Scopus and JCR databases) having clear scholarly designs and targeting the use of ICT-based resources in teaching and assessing writing in educational settings were used in the final analyses. In addition, only the studies were included that were published form 2000-2020 and their full texts were freely available in English. The studies with weak research designs and unclear practical implications with re-

Figure 1

PRISMA 2020 Flow Diagram for New Systematic Reviews



*Note: f*rom "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," by Page, M. J.,McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hrobjartsson, A., Lalu, M. M., Li, T, Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J, Tricco, A.C., Welch, V. A., Whiting, P. & Moher, D., 2021, British Medical Journal, 89(10), p. 1-12. https://doi.org/10.1186/s13643-021-01626-4. Copyright 2021 by Creative Commons Attribution 4.0 International License.

gard to the purpose of present review were excluded from the initially-selected sample.

Data Analysis

In order to explore the use and implications of technology for instruction and assessment purposes in the context of academic writing, the selected papers were inductively analyzed by using conventional content analysis procedures. Content analysis encompasses "a family of analytic approaches ranging from impressionistic, intuitive, interpretive analyses to systematic, strict textual analyses" (Rosengren, 1981, as cited in Hsieh & Shannon, 2005, p. 1277). Qualitative content analysis is an inductive technique that attempts to analyze, identify and verify patterns occurring in a corpus of texts (Williamson et al., 2017). For the purpose of current study, the selected studies were read in their entirety to gain an overall conceptualization of the study: its purpose, procedures and key findings and implications. Subsequently, the most relevant parts which could provide the answer for the research question were identified and highlighted. More especially, the method section, which elucidated upon the technological resources/tools investigated or used for conducting the study; the key findings, and some parts of discussion and conclusion sections, which provided some insights about their significance and practical implications in teaching and learning of writing, were consulted. Finally, some significant themes emphasized in these studies were driven for further analysis and synthesis. In fact, the results of this systematic review are mainly categorized and discussed based on three main themes: (1) Technology use in teaching and learning academic writing, (2) Some technological tools for teaching and assessing academic writing, and (3) Practical implications of using technology in academic writing classrooms. These main themes are further subdivided into some sub-themes which are further elucidated in the following sections (see Table 1).

RESULTS

Technology Use in Teaching and Learning Academic Writing

The present theme intends to discuss the theoretical issues and present some key scholarly ideas regarding the application of technology in the teaching and learning of academic writing in ELT-related educational settings. This theme is further subdivided into two sub-themes: (a) Significance of Technology use in teaching and learning academic writing,

and (b) Research on the use of technology in teaching and learning academic writing.

Significance of Technology Use in Teaching and Learning Academic Writing

It is mainly conceptualized that the use of technology and interactive media in educational setting is in line with principles and implications of several educational theories including constructivist learning, situated learning, inquiry-based learning, game-based learning, and engagement theory (see e.g., Chen et al., 2019; Rahimi & Pourshahbaz, 2019). Being literate today involves knowing how to read, write, and communicate with others using digital technologies (Leu, 2002; Warschauer, 1999). Digital technologies have dramatically transformed the forms, genres and purposes of writing (Chun et al., 2016). The use of technology in teaching of writing has evolved into three directions: "as a tool for helping with traditional forms of literacy, as a rhetorical space for new forms of digital literacy, and as a new approach to teaching and learning to be literate" (Bloch, 2018, p. 1). In fact, students are continuously engaged in a variety of technology-mediated literacy practices such as text messages, emails, and chat in social network sites or even online (video) games which use various channels and modalities. These practices can also be considered as avenues for consolidating the acquired knowledge in the classrooms and facilitating the learners' meaning-making process through social and cultural practices (Zheng & Warschauer, 2017).

The introduction of technology, and more specifically personal computers, has dramatically affected the processes of planning, drafting, transcribing and revising writing. The emergence of information technology has facilitated social interaction (that is, collecting, remixing, transforming, and sharing the ideas across the Internet using multimedia resources) in forums like blogs and wikis and file-sharing programs such as Google Docs. The affordances of technology have also facilitated the instruction, scaffolding, assessment and provision of feedback for instructors. In order to learn effectively and perform with greater efficiency on the learning tasks such as writing in the increasingly complex multimedia contexts, the learners have to exert much greater efforts and try to be more self-regulated (Qin & Zhang, 2019). For doing so, the learners must be taught strategies and receive proper scaffolding and guided practice with feedback which assist them in resolving their difficulties and performing effectively in such environments.

In order to maximize students' engagement in blended writing courses, it is suggested that technology should not be used as a novelty but rather to help teachers fulfill important objectives (Gleason, 2014). Taylor (2002) presents three principles for the application of instructional technologies in blended learning environments including (a) considering and prioritizing students, (b) initiating the process in a simple manner, and (c) identifying and constructing from program principles and requirements. It is believed that the use of technology-based resources in academic contexts can facilitate the improvement of students' writing skills (McKenney & Voogt, 2009). This engagement can also improve other aspects of students' learning such as problem solving and generative skills while composing their texts (Kervin & Mantei, 2016); comprehension, interpretation, analysis and synthesis skills while researching, reading, selecting and integrating information from various ICT-based resources to compose their own research (Lawrence et al., 2009). This engagement can also mediate different processes of writing (e.g., planning, drafting, revising and editing) which in turn can lead to greater accuracy and fluency in writing (Yamac & Ulusoy, 2016).

Research on the Use of Technology in Teaching and Learning Academic Writing

In the current decades, we have observed a proliferation of research presenting ideas about how the technology can be applied for designing and developing online and blended writing courses (Gleason, 2014). Composition scholars have examined writing as it is mediated by word processing, e-mails, chat and discussion platforms, instant text-messaging, social network software and applications through visual, aural, video, performative and three-dimensional environments (Takayoshi, 2015). This body of research has studied

Table 1

Identified Themes for Systematic Review of ICT Use in Writing

Key Themes	Subthemes
(1)Technology use in teaching and learning academic writing	(A) Significance of Technology use in teaching and learning academic writing
	(B) Research on the use of technology in teaching and learning academic writing
(2) Some technological tools for teaching and assessing academic writing	(A) Tools and platforms used for teaching and learning academic writing
	(B) Tools and platforms used for assessing the writing samples in academic settings.
(3) Practical implications of using technology in academic writing classrooms	(A) Practical implications of technology use for writing instructors
	(B) Practical implications of technology use for student writers

issues such the differences between online and face-to-face writing courses (e.g., Mehlenbacher et al., 1999), students' perceptions of online and hybrid courses for their writing development (Webb Boyd, 2008), the role of collaborative writing activities in the composition classrooms and the tools used for such purposes like blogs, wikis, online word processors and social networking tools (e.g., Anderson-Inman et al., 1996; Myazoe & Anderson, 2010), the role of feedback and interactive conversation for review (e.g., Krych-Appelbaum & Musial, 2007), research and assessment issues (Matsuda et al., 2003; Wolsey, 2008), and incorporation of technology for literacy development (Lotherington & Ronda, 2014). The use of technology can create an online community of inquiry (see e.g., Hilliard & Stewart, 2019) that facilitates the orchestration of online collaborative writing tasks and various interactive practices such as search and exchange of ideas, provision of scaffolding and instructional feedback and application of various multimedia resources that can increase the learners' cognitive, behavioral, emotional and social engagement.

Prior empirical studies and systematic/meta-analytic reviews on the use of technology in writing have indicated that several online tools are being used in writing classrooms that have a positive impact on one or more process or outcome variables indicative of better writing (e.g., Little et al., 2018; Strobl et al., 2019). On the whole, this body of research has confirmed the positive effects of technological resources in enriching both the instructional programs and improving the learners' writing performance. However, a point worth-mentioning is that there might be some impediments like socio-economic status of families, students' motivation and attitudes, extent of multimedia literacy, infrastructures, internet connection, etc., that might hold back the implementation of ICT in classes (traditional or blended). In fact, the proper implementation and use of technology in the classrooms might impose extra financial expenses on the learners, their families and school/university officials and also requires extra trainings for the effective use and maintenance of technological devices. Despite these issues, due to the significance of incorporating technology in classrooms in improving the existing education systems and educating future generations, the key stakeholders (that is, learners, parents, teachers/educators, schools/universities, educational authorities, technology developers and researchers) must work together to make the implementation of technology a reality to improve the quality of teaching and learning processes.

Furthermore, Matsuda et al. (2003) call for qualitative methodologies for conducting research on L2 writing to shed more lights on the nature of computer-mediated writing: "ethnographies, longitudinal case studies, and other forms of interpretive qualitative research are thus likely to emerge as principal means of exploring the relationship of technology to second language writing" (p. 166). In the same regard, the emergence of new unobtrusive and more sophisticated data gathering techniques like keystroke logging and eye-tracking (complementing traditional methods like direct observation, observation via videotaping, and think-aloud protocols) have provided further insights into students' writing behavior, multimodal composition processes, writing strategies, self-regulatory practices and so on (Anson & Schewegler, 2012).

Technological Tools for Teaching and Assessing Writing

The present theme intends to introduce the tools and devices which are being used in academic contexts and is further subdivided into three subthemes: (a) Tools and platforms used for teaching and learning academic writing, and (b) Tools and platforms used for assessing the writing samples in academic settings.

Tools and Platforms Used for Teaching and Learning Academic Writing

In the last years, there has been a fast and impressive increase in the development of technology in the field of writing (Limpo et al., 2020). Chapelle and Sauro (2017) divided the technologies for L2 writing into three general categories: (1) Web 2.0 tools which include a variety of social media cites such as Facebook and Twitter and other synchronous and asynchronous tools such as email, course management systems, blog websites, online forums, real-time communication software, and Microsoft Word allowing for authorship and contribution of multiple users in such platforms; (2) Automated writing evaluation systems which are designed based on sophisticated natural language processing (NLP, simulating how human beings understand and manipulate language based on the principles of artificial intelligence) techniques and machine learning principles intending to analyze learners' written texts in terms of some pre-established criteria and provide them with feedback regarding the quality of their works; (3) Corpus-based tools which serve as a reference for writers interested in the strategic examination of language used for real communicative purposes (covering language productions such as spoken, fiction, popular magazines, newspapers, and academic text genres).

Technology-based platforms and assets are being used for a variety of purposes in academic contexts. The most obvious use is related to the use of Microsoft office by students for composing informational and expository texts (Doan & Bloomfield, 2014; Kervin & Mantei, 2016), creating the drafts of their paragraphs, essays and other reports and assignments (Hitchcock, Other platforms are less commonly used, 2016), preparing a range of multimodal products to present their ideas and results of their inquiry/research projects (Howell et al., 2017) and many other real-purpose social usages. They also conduct research on the Internet and related databases to find relevant ideas to organize their presentations and enrich the content they present (Doan & Bloomfield, 2014). They also receive feedback both through

in-built facilities of word processing and outside sources like their peers and instructors.

Strobl et al., (2019), in their review of digital support for academic writing, highlighted the introduction of word processors and its complementary innovations such as "formatting devices, pagination, spelling and grammar checkers, thesauri and synonym finders, search and replace, tracking and commentary functions, outline tools, and index generators as the most sustainable part of digitization of writing" (p. 2). These researchers also commented that the emergence of network and internet technologies also allowed for more communication, feedback and collaboration among writers. Corpus-based resources (e.g., Natural Language Programming Analysis) have also provided opportunities for individualized instruction and intelligent tutoring, linguistic support, automated feedback, and guidance in various genres. There are also technological tools which provide skills and strategies-based instruction and support the learners in *prewriting, planning, drafting, revising, and editing* stages of writing and help them develop their conceptual, procedural, metacognitive knowledge, and affective and social skills. Some tools are also used to offer additional visual representations or graphic elements to scaffold writing or interactions (*e.g., CohVis, C-SAW, Rationale, Open Essayist*).

A popular tool in language teaching classrooms is Google Docs; it is a free online word processor within Google Drive with an easy-to-use text editing interface which provides a unique platform for real-time collaboration for the purpose of commenting and editing the shared file by multiple users. It can also automatically save the entire composing and revising history which can further enlighten the composing behavior of individuals. There are some other platforms whose introduction and applications have enriched the quality of teaching and learning of writing: *Writing Pal* (or *W-Pal)* is an automated intelligent tutoring system (ITS) developed by the Science of Learning and Educational Technology (SoLET) Lab at Arizona State University. *W-Pal* has been developed as an online tool for teaching writing strategies, providing opportunity for extended writing practice, modularity and formative feedback (Roscoe & McNamara, 2013). It also presents some learning modules focusing upon the writing strategies learners use in planning, execution and monitoring stages of writing complemented with interactive game-based and essay-based practices to increase the level of students' motivation and engagement. This writing strategy tool also has the capacity to automatically score and evaluate students' written pieces and provide them with formative feedback by using text analysis tools such as *Coh-Metrix* which explores the cohesive features of a text. *Mi-Writer* is another learning analytic tool that has the potential to capture data in the recursive process of writing (planning, composing, reviewing, editing), plus giving feedback and recording the students' writing performance, behavior and interaction with peers and teachers in real-time which can open the possibility of facilitating automated real-time feedback that is tailored to the individual learners' performances and abilities (Clemens et al., 2013). *Criterion*, a commercial writing evaluation tool developed by Educational Testing Service (ETS), also provides holistic scores and detailed diagnostic trait feedback on the students' written texts based on level-specific models considering both the age and proficiency levels of the learners as well as some essay planning tools and reference handbooks to assist the learners in understanding and evaluating the feedback provided, which is an invaluable asset for ESL/EFL learners.

Furthermore, Flipped classrooms, as a blended learning format in which students learn content online or based on multimedia sources like videos before attending the classes and subsequently engage in more practice-oriented and problem-solving activities in the classrooms, have the potential to improve students' writing (Sarani et al., 2021). Artificial intelligence and context-aware (ubiquitous) technologies (more technically known as Internet of Things) such as augmented and virtual reality, wireless networks, mobile devices, and sensing technologies like QR codes, positioning techniques, which allow for constructive learner interactions with objects in the surrounding environments, can also create opportunities for authentic writing instruction by making academic writing closer to real-life and possibly leading to affective, linguistic, socio-cultural, and cognitive development (Lee, 2019; Lin et al., 2020).

Tools Used for Assessing the Writing Samples in Academic Settings

Another related field is development of automated essay correction softwares in the 1960s and automated writing evaluation commercial products such as Criterion (from ETS) or My Access! (from Vantage Learning) (Warschauer & Ware, 2006). They have been developed based on their potential for cost savings, providing reliable and accurate scoring mechanisms and reducing the working loads of writing instructors for having time for other activities. These programs have incorporated features such as reference materials, handbooks, template structures, editing devices, word banks and thesauri, and other beneficial tools for both writers and teachers (Cotos, 2014). Automated writing evaluation (AWE) systems by leveraging automated feedback and scoring capabilities and various learning-management functions have been associated with improvements in students' engagement and time on task, writing attitudes, motivation and self-efficacy beliefs. The scaffolding provided can also positively influence the amount of revising students completed, the content and quality of students' writing across successive drafts and their performance on exams and independent writing tasks, and thereby increasing instructional efficacy (Palermo & Wilson, 2020). Another writing strategy tool having educational models and games for teaching writing is Writing-Pal or W-Pal, which provides a platform for students' engagement and practice in various phases of the writing process from planning to the provision of feedback (Goodwin-Jones, 2018). The Online Annotator for ESL Writing is another tool incorporating a database

and an error annotation analyzer and editor that keeps track of learners' performance on various tasks (Yeh & Lo, 2009). On the whole, such software and text mining tools provide the possibility for processing large sets of written texts by using powerful analytical tools that employ sophisticated resources of artificial intelligence and thus offer valuable information and archival analyses of writing activities (Godwin-Jones, 2018). There are some other computer-based assessment tools like Vantage Learning's "My Access" incorporating "Intellimetric™," a writing technology portfolio; Pearson Knowledge Technologies' writing assessment tool "*Intelligent Essay Assessor*™"; EMO Solution's "Writer's Workbench" and "Criterion™", a web-based computer writing assessment program (produced by the Educational Testing Service (ETS)), which grades and evaluates essays, prompts students with suggestions for improving their writing, includes a pre-writing-diagramming tool for developing a writing plan, and provides feedback on various aspects and dimensions of each submitted draft (Reardon, 2015). Another technological development in the computer-based assessment of writing is taking advantage of computer adaptive testing and, more specifically, computerized dynamic assessment potentials which compared to ordinary assessment procedures "… can be simultaneously administered to large numbers of learners; individuals may be reassessed as frequently as needed; and reports of learners' performances are automatically generated' (Poehner, 2008, p. 177).

A domain related to writing assessment is the provision of feedback on the students' writing. In fact, there are some online learning environments and tools which are designed to support and improve the students' writing skills by providing them with some feedback regarding the quality of their written outputs. In the form of online tutoring, these platforms can provide feedback on the structure of sentences, choice of vocabulary and mechanics of writing such as spelling and punctuation. They can also assist the students in revising and editing the manuscripts in terms of content, layout and structure. Research has indicated that giving and receiving feedback in technology-facilitated writing environments could enhance the interaction between writers and readers, strengthen learners' awareness of audience and authorship, and also provoke learners' deep thinking and thoughtful construction in writing (e.g., Downes, 2004; Law & Bare, 2020; Zheng et al., 2015). Computer-based corrective feedback with its electronic options has considerably extended the traditional possibilities such as direct correction, metalinguistic explanation, repletion, translation, clarification, referral to reference materials and practice exercises. This avenue has provided some innovative procedures like recorded audio feedback; reference to corpus or learner corpora; electronically-delivered peer feedback and making use of tools and environments such as word processor with the comment or review function, font formatting, voice annotation, and hyperlinks, wikis, Google Docs, Moodle, web sharing services like Dropbox and so on. The provided feedback focuses on both written products (e.g., language use and appropriateness of content and structure) and provision of guidance on managing the writing process and self-monitoring skills which provide tutoring with regard to writing strategies and techniques and demands/conventions of various genres (e.g., *Research Writing Tutor*). In addition to the tools which offer previously-established feedback codes and comments on the written samples, some tools provide immediate and relevant links to other sources of information such as websites or course management systems (Strobl et al., 2019). In order to have positive effects, the provided feedback must be in line with the learner's preferences and needs and they must be willing and able to use it.

Vojak et al., (2011) studied various technology-based writing assessment programs and concluded that they have some attractive features: "quick feedback, reliability, plagiarism detection, the capacity to connect with state standards and assessment rubrics" (p. 108). They also pointed to negative aspects as well: "formulaic approaches, non-specific feedback, incorrect identification of errors, a strong emphasis on writing mechanics, such as grammar and punctuation, and a tendency to value length over content" (p.108). Nevertheless, Wang (2013) cautioned that instructor interactions with students and their pedagogical approaches are critical in the students' perceptions and their performances: writing is a social experience and without instructor feedback and critique of the quality of written samples the benefits of the technology use may be overshadowed by the negatives.

Practical Implications of Using Technology in Academic Writing Classrooms

The present theme intends to highlights the practical implications of technology use in teaching writing in academic settings and is further subdivided into two main sub-themes: (a) Practical implications of technology use for writing instructors, and (b) Practical implications of technology use for student writers.

Practical Implication of Technology Use for Writing Instructors

The discussions in scholarly journals generally believe that incorporating technology into the curriculum and pedagogical practices is both desirable and necessary (Rodrigo & Romberger, 2017). Currently, much of the students' writing in their personal and professional lives is conducted through online forums and in order to have an acceptable level of performance, they need to be equipped with writing skills and genre knowledge to apply the appropriate language register and content, and ensure the use of correct grammatical structures. Consequently, L2 teachers must assist the learners in learning the conventions of writing and teach them various writing techniques and strategies to be able to write appropriately and critically in all modalities (Chun et al., 2016). Elola and Oskoz (2017) call for a "reevaluation of literacy, writing genres, and associated instructional practices in the L2 classroom" (p. 5). In fact, recent scholarship in computer-based L2 writing advocates rethinking how L2

writing is taught and a shift away from assigning only tasks that require structured, teacher-directed writing (Zheng & Warschauer, 2017) towards incorporating informal online writing opportunities and practices in which students can express their own unique authorial voice and ideas (Smith et al., 2017). The introduction of online collaborative writing is an important avenue since it is both an essential real-world skill and is in line with principles of SLA theories that emphasize the importance of social constructivism in language learning which considers writing as a socially situated action (Godwin-Jones, 2018).

An important point here is that teachers must be competent enough in integrating technology in their classrooms and must be aware of their nuances and affordances. In fact, successful implementation of technology-based resources in writing classrooms requires increasing the teachers' competency and skills in integrating and using these resources through in-service courses. Teachers need training opportunities to enhance and build upon their knowledge of digital design and multimodality using a range of media including linguistic, visual, audio, and spatial elements, to more effectively engage in their pedagogical practices online (Dalton et al., 2011). Institutional support must also ensure the availability of technological devices such as computers and access to ICT-based resources in the classrooms. In addition, teachers must be given sufficient time and institutional support to plan and develop their technology-mediated courses and implement the activities that exploit the affordances of technology to improve their students' writing skills and meet the objectives of writing curriculum. Students must also receive practical instruction in how to integrate and use technological resources in receiving knowledge/information and producing their texts. L2 writing practitioners and researchers must also engage in investigations to identify the most effective techniques and strategies for incorporating these technological resources in the writing instruction programs to meet the specific needs of their contexts. In fact, L2 writing teachers need to critically evaluate these technologies, gain experience in using them and train their learners in how to make the most out of these assets. Chun et al., (2016) specifically listed four guidelines to support L2 teachers in integrating technology in their instructional practices: (a) learning goals for students; (b) available language, culture, and instructional resources; (c) strategies to use these resources to support the learning goals; and (d) assessment of students' effective use of these resources (p. 70). Considering these issues while designing technology-based writing programs can assist the teachers in creating fruitful learning environments.

Practical Implication of Technology Use for Student Writers

The ICT-based environments and technological tools have the potential to mediate students' leaning of new literacies (Merrill & Rodriguez, 2005) and improve the quality of their written outputs both in academic and social contexts. For example, writing with wikis encourages learners to engage in preplanning activities and pay attention to structure and organization of their texts (Yim & Warschauer, 2017); blogging cultivates a strong authorial voice while tending to maintain hierarchical identities and encourages extensive writing (Li & Storch, 2017); SMS or synchronous chat emphasizes informal language use and greater visual salience of forms (Sauro, 2009); email demands reflection and more attention to form (Schenker, 2016); digital storytelling emphasizes a personal and engaged writing style while integrating multimedia affordances (Elola & Oskaz, 2017); Facebook and Skype facilitates sharing of texts and use of voice and text chat to plan and discuss written texts (Cho, 2017) and collaborative writing environments such as Google Docs can facilitate dynamic interaction for negotiating meaning among the learners, benefiting from each other's complementary skills and knowledge and can enhance their contribution in in-process planning, rephrasing and restructuring, sharing strategies, providing feedback and making revisions, and discussing organization of the written passages (Kessler et al., 2012). Furthermore, Zheng et al., (2018) maintain that the use of computer-mediated communication (CMC) in L2 learning can provide an "apprenticeship of students into collaborative research and writing discourse communities, which are typical in most professional and academic settings" (p. 4). This possibility of building learner identities as authentic writers tends to make learners "highly motivated, deeply engaged and more thoughtful when constructing texts" (Zheng & Warschauer, 2017, p. 62).

A point worth-mentioning is that the success of technology-mediated writing instruction depends on the level of learners' engagement that it cultivates. In fact, due to learners' daily exposure to Web 2.0 technology, media tools, games and mobile apps, the technology-assisted writing instruction needs to reflect upon these experiences and be truly-learner centered. Technological experts and practitioners need to provide a delightful and fun experience by designing user-friendly interfaces and functionalities and allow the learners to be self-directed and take charge of their online actions by using customized processes and thus enhance the quality of learning and their sense of competence (Greer & Harris, 2018).The research has also demonstrated that the use of technology during writing instruction and writing-related activities had been motivating for students to be cognitively and affectively engaged and participate in writing instruction and do the related assignments. This practice had encouraged interaction and collaboration with others around text construction which could enhance their performance in organizing how they would work together and share responsibility for specific tasks and, in turn, could improve their collaborative knowledge construction, learning experience and quality of their final output. These environments can also be supportive for reluctant writers and students who struggle with literacy learning since technology inherently presents some assistive supports and scaffolds that could increase their self-confidence while facing

challenges in the composing process (see Williams & Beam, 2018). This point is in line with the ideas of sociocultural theory of learning that emphasizes the mediating role of technologies in diagnosing students' problems and providing a ZPD-sensitive assistance that can empower them to resolve their problems and reach higher levels of learning.

On the whole, the emergence of online writing environments and tools have provided some valuable opportunities for learners "to access and manipulate enhanced input, receive immediate feedback on their efforts, and engage in collaborative, reflexive, and exploratory writing practices as integral to writing skill development" (Dugartsyrenova, 2020, p. 2). Moreover, students can have the opportunity to have practice in extended writing while performing on authentic tasks for real purposes, receive explicit instructional support on writing process and strategies, engage in collaborative writing endeavors, and benefit from teacher and peer-feedback through mini-lessons and conferencing that can enhance the quality of their writings in academic and social contexts (see e.g., Applebee & Langer, 2011; Pritchard & Honeycutt, 2006). Despite of growth and improvements in technology-based environments, students' success while performing on these assignments requires the consideration of issues like writing topics and genres, task types and complexity levels, learners' L2 proficiency levels, group dynamism and so on (Chapelle & Sauro, 2017).

DISCUSSION

The findings of present study confirmed the positive contribution of ICT-based resources to the teaching and learning of academic writing. Digital technologies have drastically transformed and reshaped the forms, purposes and genres of writing and the types of literacy practices the individuals engage in their academic and social lives (Chun et al., 2016; Zheng & Warschauer, 2017). Even though traditional writing courses can be highly effective in enabling the students master the conventions and competencies required for writing, the existing research also highlights and confirms the significance of principled, meaningful, well-designed and engaging online learning activities to facilitate the process of learning to write in various real social and pedagogical tasks (Bernard et al., 2014; Means et al., 2010). The investigated literature also revealed that echnology mediated instruction can provide more authentic learning experiences and materials, can facilitate higher level thinking skills and content area learning, can increase the chances of dialogue and communication between the teacher and student writers by reducing the 'transactional distance' and providing dialogic feedback, can support strategies-based instruction for various stages of writing process, can increase the students' level of engagement in the learning process by offering a more learner-centered teaching approach, can enhance quality of self-directed learning opportunities and, thus, can lead to learner autonomy by encouraging learners to take responsibility for their own learning and reach higher levels of writing development (Strobl et al., 2019; Vetter et al., 2019; Zhang et al., 2021). Writing instructors are currently benefiting from online platforms and social media tools because they think that such environments have the potential to provide more opportunities for reflective writing, writing for an audience using various genres, writing collaboratively, and engaging in other interactive activities like (a-) synchronous discussions in web-authoring platforms that provide ideal environments for students' learning because of providing the students with more time to analyze and respond to each other's outputs and comments than the time-bound, face-to-face classroom contexts (Hilliard & Stewart, 2019; Warnock, 2015).

The present study also introduced some tools which have been applied for teaching and assessing writing and maintained that the availability of these technologies has the potential to improve the quality of teaching and learning of L2 writing processes and outcomes because they provide platforms for the effective teaching of writing in multimedia environments, can enhance the opportunities for scaffolding and provision of feedback for the students, can ease the meaning-making process by integrating various design features and modalities, can improve the students' new literacies skills by making academic writing closer to their real-life experiences, can facilitate interaction and collaboration in writing and so on (Chun et al., 2016; Elola & Oskoz, 2017; Godwin-Jones, 2018; Strobl, 2015; Zheng & Warschauer, 2017). In fact, It is maintained that "there are many potentials in incorporating these technologies into language learning and teaching, such as enhanced motivation and engagement as well as contextualized learning" (Alizadeh, 2019, p. 29). In addition, the documented positive effects of technology on text quality, learner attitudes and self-regulation, greater consciousness of the writing process and writing conventions, and learners' motivation and engagement had urged L2 writing practitioners to restructure their pedagogical practices by integrating available digital tools into their writing development programs (Elola & Oskoz, 2017). Consequently, their integration in the educational settings is a favorable addition and can enrich the quality of learning experiences provided for learners. On the whole, technological tools and resources are considered fundamental to the writing process and calls are made for incorporating multimodal writing in educational settings, which demands the appropriate use of digital infrastructure and financial resources to support it (Ball & Kalmbach, 2010; Rodrigo & Romberger, 2017).

Despite these assets, use of technology in classrooms is overshadowed by three main factors: (1) teacher beliefs about negative impact of technology on the teaching-learning process, (2) the need for relevant professional development to acquire the necessary knowledge and skills to implement technology-based courses, and (3) limited access to technology (e.g., Internet, instructional software and IT support) for instructional purposes (Williams &

Beam, 2018). In addition, teachers' expertise in developing such platforms, students' knowledge of how to work with technological devices (i.e., their digital literacy skills) and perform in such environments, the addition of workload in some cases for the instructors and requirement for a support team should not be ignored because working with technologies naturally requires technical expertise and support in maintaining and operating such devices. In fact, besides the needs for teachers' professional development on pedagogical uses of technology (i.e., multimedia and digital tools) in the classrooms and building students' digital literacy skills, institutional support is needed to ensure the availability of computers and appropriate applications in every classroom.

On the whole, the key message that can be driven from this review is that technology is an asset which can facilitate the students and their instructors' engagement in the process approach of writing which can be improved by the use of multimedia and digital tools. The prominence of online writing in CALL research is a welcome development given the central role that digital texts play in our everyday lives. If learners invest in their online writing and are motivated to engage more fully and more frequently in writing texts of various lengths and complexities and in various genres, it can result in gaining more confidence in holistic writing ability and appreciating styles, conventions and affordances of various genres (Elosa & Oskoz, 2017). The integration of multimedia resources into writing assignments can be productive, innovative, transformational and motivating for the learners since it is applicable to the future job skills students might feel they need (Darrington & Dousay, 2015).

Despite being a highly challenging issue to the world's health and economy, Covid-19, being a blessing in disguise, has provided some avenues for the integration of information and communication technology resources into instructional programs throughout the world. Currently, many institutions have prepared infrastructures to present their instruction and materials freely online, teachers have been urged to design instructional programs and multi-media materials online and enrich the content of their teaching in order to improve the students' learning, and students have been required to attend such classes, try to learn the content presented, do their assignments and even be assessed on such platforms. This trend can also be further continued and exploited towards creation of higher quality curricula and instructional programs for teaching various aspects of students' learning.

CONCLUSION

The present study has used the principles of systematic reviews (more specifically PRIZMA model in records screening and selection and content analysis for the in-depth analysis of the identified articles) to investigate the use and implications of technological resources in teaching academic writing. Results of this systematic review indicated that growth in the use of technological resources such as computers, applications, and web-based learning environments in teaching and assessing ELT-related writing in academic contexts can enhance the quality of instruction provided. Currently, there are many technological platforms and devices available that might overwhelm the writing teachers; consequently, they must develop frameworks that assist them in selecting appropriate tools for their instructional practices and resolving the problems they encounter in the classrooms. New technologies not only have supported the teaching of writing by providing new spaces and resources but also have transformed the nature of writing process and the way this skill is being taught and learned. The most beneficial aspects of technology for teaching writing can be the provision of opportunities for individualized instruction and independent learning inside and outside classrooms, engagement in real and extended writing practices and increased opportunities for offering strategies-based instruction on various stages of writing and provision of high quality timely feedback on the students' performance.

Despite some practical limitations for applying these technologies in writing courses, most of the reviewed studies confirmed the positive effects of technology integration in enhancing the effectiveness of teachers' pedagogical practices, and learners' knowledge and use of new digital literacies and writing development provided that the adequate facilities and institutional supports are available. Despite of attempting to provide a comprehensive coverage of the theory and practice of technology use in writing classroom, the present descriptive research synthesis has only presented the topical results with a pedagogical focus in mind without doing a critical evaluation of the findings of the papers or exploring the methodologies adopted for highlighting the positive aspects or possible biases, lack of methodological rigor or weak evidence in the articles, which can be attended by future research studies. In addition, future researchers need to explore teachers' and students' actual experimentation and engagement in the multimedia environments, techniques and strategies while using ICT-based tools, and the affordances and liabilities of various technological resources for the teaching and learning of various academic subjects and skills.

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DECLARATION OF COMPETING INTEREST

None declared ■

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