



How computer-assisted language learning literacy is conceptualized in research: a general overview

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ABSTRACT

In order to achieve the effective integration of any tool, including digital technologies, into their daily teaching practices, language instructors need to develop their understanding of such technologies and develop their pedagogical knowledge to maximise their benefits. In other words, they require relevant computer-assisted language learning (CALL) literacy. While research on professional, technical, and digital literacies is growing, CALL literacy has not been adequately addressed in second and foreign language learning research. The present article features a comprehensive overview of literature on the concept of digital and CALL literacy and offers suggestions for research in this regard.

Keywords: CALL literacy, language teacher, digital literacy, literature overview.

¿Cómo se conceptualiza la alfabetización del aprendizaje de idiomas asistido por ordenador en la investigación? El camino hasta ahora

RESUMEN

Para la integración efectiva de cualquier herramienta, incluidas las tecnologías digitales en sus prácticas diarias de enseñanza, los profesores de idiomas deben desarrollar su comprensión de dichas tecnologías y desarrollar sus conocimientos pedagógicos para aprovecharlas. En otras palabras, requieren una alfabetización relevante en el aprendizaje de idiomas asistido por computadora. Si bien la investigación sobre alfabetizaciones profesionales, técnicas y digitales está creciendo, la alfabetización aprendizaje de lenguaje asistido por computadora no se ha abordado adecuadamente en la investigación sobre el aprendizaje de segundas lenguas y lenguas extranjeras. El presente artículo ofrece una revisión exhaustiva de la literatura sobre el concepto de alfabetización digital y aprendizaje de lenguaje asistido por computadora y ofrece implicaciones para la investigación en este sentido.

Palabras clave: alfabetización aprendizaje de lenguaje asistido por computadora, profesor de idiomas, alfabetización digital, revisión de la literatura.



Introduction

Despite the diversity of perspectives on whether technology-enhanced language instruction has satisfied teacher/learner expectations of effective learning and knowledge construction (Murday et al., 2008; Reynolds et al., 2003), there appears to be a consensus on that technology has left a significant impact on language teaching profession (Guemide & Benachaiba, 2012; Phelps et al., 2011). In effect, the discussion in computer-assisted language learning (CALL) research over the past few decades has shifted away from *whether or not* technology should be integrated into language instruction to *how, when, and for what* purpose it should be used in a productive way (Hong, 2010; Labbas & El Shaban, 2013).

To fulfill this objective, teachers are required to develop and apply CALL-related literacy (see Chen, 2020). Teachers play a determining role in effective technology-enhanced instruction (Vanderlinde & van Braak, 2011) or in Egbert et al.'s (2011) view, are central to effective technology-enhanced language instruction endeavor. As Baskerville (2012) put it, dealing with students "who have access to anything they want to learn on their own, at any time" (p. 119) places a high demand on 21st-century technology-using teachers to design relevant and rich teaching/learning environments for their learners. For doing so, they are expected to be able to pedagogically think, decide, argue, select, and develop *relevant* tools, content, and material based on their work needs.

In Marcinkiewicz's (1993) words, "full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers" (p. 234). When everything ranging from information and communication technology (ICT) infrastructure and relevant support to personal factors are in place, the main issue that can inhibit teachers' from effective integration of technologies into their instruction is inadequate CALL literacy. This problem, which is commonly related to the ineffectiveness of CALL teacher education courses and programs, might have its roots in the absence of a consensus on what comprises CALL literacy. Decades after the first introduction of digital technologies into language education, CALL literacy has still remained to be comprehensively conceptualized. This article reviews scholarly research conducted and published in three internationally-recognized CALL-related journals on CALL literacy to shed more light on its overall meaning.

Background

Factors affecting teachers' technology integration for instruction

Factors affecting teachers' technology use are well documented in the literature. Extensively reviewing the issues confronted by second language teachers while integrating technology, for instance, Ertmer (1999) identified: external (first-order) and internal (second-order) factors affecting technology use (also Park & Ertmer, 2007). External or environmental factors, in Teo's (2009) terms, encompass the availability of information and communication technology (ICT) resources and infrastructure, equipment, support, adequate teacher education, faculty/school perception (institutional policies), and time issues (also Chen, 2008; Figg & Jammani, 2011; Kay, 2006). Internal factors which directly relate to teachers (also Ertmer et al., 2006) encompass their subject matter proficiency and preparedness, technology acceptance, and self-efficacy. Cuban (2001), similarly, has highlighted the significance of technology-related knowledge/skills and institutional support.

For Hew and Brush (2007), access to or availability of resources (i.e. time, technology, and support), institutional factors, teachers' attitudes, their specific technology knowledge and skills,

assessment, and the culture of the subject largely determine effective technology-enhanced instruction. Synthesizing the bulk of variables highlighted in the research, Hong (2010) came up with a three-component spherical model which includes: CALL teacher education, contextual factors, and teachers' personal (individual) factors. Hong's (2010) model highlights the "multi-dimensional aspects of teachers' integration of computer technology" (p. 80). While not indicating any absolute sequential order for the factors identified, the centrality of the teacher education circle in the model suggests its relative significance (Hong, 2010). Teacher education is generally believed to influence personal attributes.

As Ertmer (1999) noted, although in the presence of contextual problems, technology integration is a totally impossible task, their removal does not necessarily result in a smooth transition toward effective technology integration. While the first group of factors can be recognized and fixed, the second group are more difficult to address and may require significant changes since "even after first order-order barriers are removed, it is still difficult for teachers to integrate technology into the classroom, possibly because of second-order barriers" (Park & Ertmer, 2007, p. 248). In other words, while the extrinsic contextual factors are significant for effective technology use, they might not be sufficient (Ertmer et al., 2006).

Considering the close relationship between teachers' pedagogical knowledge and potentials and their instruction, it can also be argued that relevant preparation attempts should aim at developing teachers' subject matter competencies (in this case CALL-related knowledge/skill) (see Kay, 2006). As Jeong (2017) put, "the growing importance of CALL in EFL education has required language teachers to become more proficient in dealing with ICT" (p. 6). Hence, it is suggested that limited technology use even after the removal of the contextual barriers may be attributed to teachers' limited or lack of pedagogical knowledge and required literacy to effectively use technology for language instruction (e.g., Kadjevich, 2012). This, in part, stems from the fact that decades after the coinage of the term CALL, there is still a lack of consensus on what comprises CALL-related literacy or competency.

Conceptualizations of teachers' technology-related literacies/competencies over the past two decades

With the advent of computers and information and communication technologies (ICTs) decades ago and its growing popularity in educational milieu, the conceptualization of the term literacy underwent a significant change. Today, literacy is no longer restricted to the ability to understand and use a language (written or orally) in a comprehensive way. Rather it is redefined and expanded to literacies that encompass multiple abilities and practices in the digital world (see Chen, 2020). A careful review of research on the notion of literacies in the digital era brings different terms to the forefront. These terminologies range from computer literacy, information literacy, digital literacy, electronic literacy, and technological literacy to technological, pedagogical, and content knowledge (TPACK) and CALL literacy. It should be noted that in many studies, the word 'knowledge' and/or 'competencies' are applied in reference to literacy. Hubbard and Levy (2006) noted that when knowledge is used, it should be accompanied with the word 'skills' given that without skills, the knowledge cannot be translated into practice.

Technology competency (knowledge) is conceptualized under different labeling schemes (Ertmer & Ottenbreit-Leftwich, 2010) including technical skills (Berge, 1995), general computer literacy (Willis, 2001), electronic literacy (Shetzer & Warschauer, 2000; Warschauer, 2002, 2008), subject competency (Selinger & Austin, 2003),

specific technology knowledge and skills (Hew & Brush, 2007; Hughes, 2005), technical CALL knowledge and skills (Hubbard & Levy, 2006), technology knowledge (Mishra & Koehler, 2006, 2008), and technological knowledge and skills (Compton, 2009).

Berge (1995) asserted that teachers using technology need to have technical knowledge of the tools they use. Shetzer and Warschauer (2000) and Warschauer (2002, 2008) with a similar emphasis introduced the term electronic literacy including (1) *computer literacy* as fluency in and comfort with using computers and keyboarding which should also encompass the knowledge and skill to evaluate and adapt new educational technologies as they emerge, (2) *information literacy* as knowledge of using search engines and web browsers and the ability to evaluate and analyze the sources of information, (3) *multimedia literacy* as the ability to combine texts, photos, graphics, sounds to create presentations for instance, and (4) *computer-mediated communication (CMC) literacy* as the knowledge, skills, and pragmatics to effectively interpret and take part in online communication. While some of the proposed definitions address the topic more generally, others offer a more detailed description of technology knowledge and skills trying to specify the range of tools and devices whose knowledge is required. Table 1 summarizes the widely known studies which have specifically highlighted technology types in their discussion of technology knowledge.

Table 1. *Types of Technological Knowledge (TK) Highlighted in Research*

No.	Reference	Technological Knowledge
1	Willis (2001)	Knowledge of operating systems, spreadsheets, databases, word processing, and telecommunications
2	Turner (2005)	Knowledge of scanner, Windows Explorer, file management, email management, and software downloading skills
3	Banister & Ross (2006)	Knowledge of file management, word processing, presentation, the Internet, and spreadsheet software
4	Carroll & Morrell (2006)	Knowledge of data management tools (with 8 subcategories), web-based tools (with 5 subcategories), and digital manipulation tools (with 10 subcategories)
5	Brinkerhoff (2006)	Knowledge of file management, Internet search and validation of resources, web page creation, Microsoft office use, and the application of camera, scanner, and microphone
6	Hew & Brush (2007)	Knowledge of computers and different technologies such as the Internet, social software, and databases
7	Barsotti & Martins (2009)	Knowledge of weblogs, web pages, electronic gaming, and multimedia text production
8	Aduwa-Ogiegbaen (2009)	Knowledge of different computer components, word processing, electronic presentation, databases, email software, spreadsheets, and Internet search
9	Álvarez et al. (2009)	Knowledge of multimedia, support services, technological access, software, data analysis, tool/resource use, multimedia and web-based material, and tutorials

Collecting data from 51 School of Education faculty members and 378 student teachers in teacher education programs in 6 colleges in Oregon, for instance, Carroll and Morrell (2006) identified three categories of instructional technologies: data management (8 subcategories), web-based (5 subcategories), and digital manipulation (10 subcategories). In a more general definition, Hubbard and Levy (2006) define technological knowledge and skills as “systematic and incidental understanding of the computer system, including peripheral devices... hardware, software, and networking” (p. 16).

Such knowledge evolves as a consequence of open-ended contact with ICT (Mishra & Koehler, 2008) and enables teachers to identify, apply, and adapt relevant technologies (Kereluil et al., 2011). In her three-component framework of the required skills for online language teaching, Compton (2009) places a similar emphasis on technological competency for handling issues regarding hardware/software use (also Ertmer & Ottenbreit-Leftwich, 2010). While a number of technologies entail common applications for every user and discipline, there are tools with unique uses for specific areas. Hence, technology competency encompasses the knowledge and skills required to handle and operate a variety of technologies, some of which are discipline- and context-specific.

Given the rapid pace of technology change and emergence, many of which may have educational applicability, technological competencies alone may not serve educators’ purpose to their full potential (Fuchs, 2006; Willis, 2001). Teachers also need to understand the possible ways these technologies can be applied in teaching. In other words, today’s teachers who use technology for their instruction need to exhibit additional knowledge and skills. Technology-related teacher education must also aim at developing participant teachers’ technological pedagogical content knowledge (Chen, 2008). Such knowledge base, according to Mishra and Koehler (2008), embraces the knowledge of pedagogy and content in addition to technology (Chen, 2008). For Willis (2001), such literacy encompasses

- familiarity with the advantages of integrating technology in educational contexts drawing on the available literature;
- basic knowledge about technology including computers and the possible ways they can be applied in education;
- specific primary knowledge and experience in using technology for teaching the subject content;
- having the ability to outline the challenges and solve the problems as they occur;
- demonstrating creativity in using technology by moving beyond following prescribed plans and integrating certain technology types; and
- “observing teacher educators, content specialists, and mentor teachers modeling innovative uses of technology to support learning” (p. 309).

Selinger and Austin (2003) offered a three-component categorization of teachers’ required ICT knowledge and skills including personal, subject, and teaching competencies. Subject competency encompasses an understanding of the various functions and uses of ICT and specific courseware and their applications in teaching. Personal competency refers to an understanding of technology functions when/not, and how of its integration, use, and operations in teaching a particular subject.

According to Hughes (2005), technology-supported pedagogy entails three technology functions including: replacement, amplification, and transformation. The first function refers to the application of technology to serve a specific instructional purpose in a

different way. For instance, rather than writing the instruction on the board, the teacher uses Power Point and an overhead projector for the same purpose. The second function embraces technology use for the more effective accomplishment of the tasks. For example, using a weblog environment for writing practice, the teacher can amplify the plausibility of students having access to peers' sample writing. The last category relates to providing creative opportunities to engage students in problem-solving activities related to their cognitive processes. As an instance, students use concordances to learn how to write term papers.

From among the bulk of studies reviewed, standing out from the rest for its significant contribution to the field is perhaps Mishra and Koehler's (2006) technological, pedagogical, and content knowledge (TPACK) model. The most prominent component in the framework is the intersection between technology, content, and pedagogy widely referred to as TPACK. Such knowledge encompasses an understanding of how to use technology to (1) understand particular concepts, (2) tailor teaching of the content to learners' needs, (3) develop an understanding of difficulties inherent in teaching various concepts, (4) learn about students' technological and content-related assumptions and understandings, and (5) build on this knowledge to help students in the process of learning (Harris et al., 2009). Defined this way, competency moves beyond the traditional descriptions of literacy, the focus of which has been mostly on instrumental literacy (Mishra & Koehler, 2008). However, TPACK "offers no specific directives about *what* content to teach... *which* pedagogical approaches are useful... and *what* kinds of technologies to use in teaching" (Mishra et al., 2011, pp. 23-24).

Such competency, according to Guichon and Hauck (2011), encompasses a range of capacities including the ability to (1) conduct a needs analysis to apply relevant technologies appropriately and based on a pedagogical order, (2) design proper activities, and (3) manage classroom time to optimize technology use. While "there are some technology pedagogical skills that are fundamental for teaching with technology across all subject areas" (Figg & Jamani, 2011, p. 1238), each subject matter area and instructional context encompasses peculiarities that may require particular technology-related literacies. Accordingly, CALL literacy might include a number of competencies shared with other subject areas while featuring unique knowledge and skill types for the context of second and foreign language teaching. In what follows, the conceptualization of CALL literacy in related research will be explored.

Method

In order to accomplish the aforementioned goal, an extensive synthesis was carried out on the secondary data. Given the diversity and range of the sources on technology-related literacies in education, an advanced keyword search was conducted. The keywords included *literacy* and *literacies*. After the identification of the key articles, the search was narrowed down to studies that directly related to digital and CALL literacy(s). This preliminary review of the bibliographic sources was an attempt to identify the desired literature in the field.

The research reviewed included both quantitative and qualitative studies which were identified and selected through searching three main journals in the field of CALL, namely *Computer Assisted Language Learning* journal, *CALICO* journal, and *ReCALL*. Obviously, there may be other studies not included in this review and unintentionally overlooked by the researcher due to the rapid pace with which large number of research is carried out. As

this project proceeds, new studies are being conducted and other competencies are being analyzed in different contexts.

Results and discussion

Of a total of 231 studies published in *Computer Assisted Language Learning* journal under the topic of literacy(s), five (i.e., Chen, 2020; Dashtestani & Hojatpanah, 2020; Simpson, 2005; Thomas, 1997; Yeh & Swinehart, 2020) related to digital literacy and no study directly addressed CALL literacy (see Table 2). Thomas (1997) was amongst the early generation of researchers who has aimed at defining new literacies in the digital age. Focusing on the role of personal computers and the way they have changed communication, Thomas noted that hypertext in computer-mediated communication has challenged the conventional notions of written communication. Thomas (1997) explored how contribution to a synchronous text chat forum impacts the development of the skills related to what he calls *electronic literacy*, which includes technological knowledge and skills along with discourse management skills engaged in real-time written CMC.

Chen (2020) explored the application of an approach for raising students' awareness about using language online (as a form of digital literacy). Similarly focusing on students, Dashtestani and Hojatpanah (2020) developed a questionnaire to explore the digital literacy of students and observed that they were generally at a low to moderate level in this regard. The researchers rightly acknowledged that developing the digital literacy of the students is still not a concern for the policy-makers. Similar to the previous two studies, Yeh and Swinehart (2020) restricted the focus to language learners and information literacy. Interestingly enough, however, no study in this journal thus far has explored the concept of CALL literacy for language teachers.

Table 2. The studies addressing digital and CALL literacy in the three journals

	Studies addressing the concept of digital literacy	Studies addressing CALL literacy
CALL journal	Thomas (1997)	—
	Simpson (2005)	—
	Chen (2020)	—
	Dashtestani & Hojatpanah (2020)	—
	Yeh & Swinehart (2020)	—
CALICO journal	Thorne & Reinhardt (2008)	Winke & Goertler (2008)
ReCALL	Rosell-Aguilar (2004)	—
	Fuchs (2006)	—

Of a total of 290 articles identified in the *CALICO* journal which addressed different types of literacies in second and foreign language learning contexts, only two were empirical studies about digital or CALL literacy. Introducing a strategy called the *bridging activities approach*, Thorne and Reinhardt (2008) highlighted the essence of designing relevant language activities to increase language learners' awareness of multiliteracies and communicative practice in the digital age. Acknowledging the fact

that CALL literacy has not been adequately addressed in computer-assisted language learning research, Winke and Goertler (2008) surveyed CALL literacy of 911 college-level students in foreign language programs. CALL literacy in their survey is defined as the ability to use digital and multimedia technologies for personal and academic purposes and to carry out computer-based activities. They noted that students did not possess adequate CALL literacy, namely the knowledge to use the digital tools for teaching language.

A total of 160 published articles were identified in the *ReCALL* journal which related to the concept of literacy(s). Of these, only two addressed digital literacy. Rosell-Aguilar (2004) explored foreign language learners' appropriate Web search ability (as an aspect of digital literacy). Fuchs (2006) drew on computer-mediated peer collaboration to enhance pre-service teachers' professional and electronic literacy. For Fuchs, electronic literacy encompasses computer skills and Internet proficiency. Similar to the *Computer Assisted Language Learning* journal, no published work on CALL literacy and language teachers was found.

The results indicate that despite the abundance of studies on CALL over the past decades, research that conceptualizes the knowledge and skills or competencies required for second and foreign language teachers to effectively integrate technology into their instruction (i.e., CALL literacy) is still growing. There is a need to reach a consensus on what knowledge and skill types are actually required for technology integration in language instruction (Chapelle & Hegelheimer, 2004). It may result in a better understanding of technology-enhanced language instruction but, more particularly, with a view of coming up with a referential framework in the design of CALL professional development courses and activities. In essence, this observation leads us to carefully review the various directions suggested thus far to determine what technology-related competencies encompass (Guichon & Hauck, 2011).

Concluding Remarks

In addition to the knowledge of subject matter content, the pedagogical knowledge of teaching methods, and the way these methods can be applied to facilitate student learning, educators also need to demonstrate the basic knowledge of the tools they are integrating as well as the pedagogical knowledge required for due integration of such tools. For example, teachers in a virtual classroom need to expand their pedagogical knowledge to address the requirements of CMC and learning in an ICT environment. According to Kereluil et al. (2011), teachers require a new form of competency "as a collection of skills, competencies, and knowledge of how to use (multi-) disciplinary knowledge, pedagogical techniques, and technological tools... to repurpose (subvert) them for their needs" (p. 15). In UNESCO's (2008) technology literacy approach module, technological pedagogical knowledge is defined as teachers' knowledge of where, when/not, and how to integrate technology for instruction. Accordingly, basic digital literacy skills as well as the ability to identify and use relevant educational technologies to fulfill pedagogical objectives including teaching, assessment, and managing the classroom comprise the technology-related competencies required for teacher development (UNESCO, 2008). For instance, how best to appropriate and apply social software which is inherently designed basically for entertainment for language instruction requires specific knowledge and skills. Hence, creativity becomes a determining quality in this process (Harris et al., 2009).

It is imperative to address these competencies through the course of CALL teacher education, as they would comprise the

main part of language teachers' overall technology-related professional development. It is also essential to remember that the development of these competencies through the course of preparation is but one aspect of the complex process of CALL teacher education. In conjunction with developing teachers' CALL competencies, there needs to be a special focus on teachers' technology-related perceptions and beliefs that influence teachers' technology use. It is the teacher who can make meaningful pedagogical application of technology.

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