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CALL AND ELECTRONIC MEDIA

Soobin Yim and Mark Warschauer

Introduction

Technology-mediated research, writing, and collaboration are core components of academic work in today’s world. Recognizing this, researchers and teachers are increasingly exploring how use of digital media helps to improve students’ development of English for academic purposes (EAP). This chapter provides an overview of computer-assisted language learning (CALL) research that is particularly pertinent to EAP teaching and learning. It discusses historical developments and critical issues of EAP-relevant CALL research, as well as the tool applications and main research methods that have particular affordances for EAP instruction and research. Through this overview, we aim to explore the potential of CALL and electronic media, which lies not only in enhancing the learning and teaching of EAP language skills, but also in promoting broader participation of second language (L2) students in academic discourse communities.

Historical discussion

Perspectives on CALL have shifted over the years, paralleling the shifts in language learning theories and approaches to language teaching (Kern & Warschauer, 2000; Warschauer, 2004). The major theoretical perspectives are illustrated in Table 44.1, summarizing the difference between the three perspectives in terms of principal role of technology, objectives, and exemplary use in EAP contexts. The multiplicity of roles and contexts that technology has assumed over time has contributed to the development of both CALL and EAP, and informs our understanding of current practices and options.

The first phase, structural/behavioristic CALL, derived from the dominant behaviorist theories of language learning in the 1960s and 1970s (Warschauer, 1996). The prime focus of structural/behavioristic CALL is rooted in the structuralism of language teaching, which mainly adopted grammar-translation and audiolingual methods. With the objective of improving learners’ accuracy, EAP-related CALL research under this framework focused on the effectiveness of online drill tools and related academic reading programs designed to teach grammar and vocabulary.

The next generation, communicative CALL (1980–1990s), utilized communicative tools that incorporated a wider range of student choice, control, and interaction compared to the
Drill and practice programs (Warschauer, 1996). Grounded in the cognitive view of language learning (e.g., language as an internal mental system developed through interaction), this approach aimed to enhance learners’ fluency by giving them opportunities to manipulate linguistic input. For example, concordancing programs support the process of deductive learning of academic vocabulary by exposing students to multiple occurrences of keywords from designated corpora in context.

The more recent approach of integrative CALL broadly emphasizes meaningful interaction in authentic discourse communities (Kern & Warschauer, 2000). This approach is grounded in the sociocognitive view of language as a process of apprenticeship or socialization into particular discourse communities (Gee, 1996). Common research topics include students’ authentic and purposeful learning of academic study skills using social media, as well as collaborative processes of knowledge, discourse, and identity development through online platforms.

Finally, it is important to note that the historical development of CALL should not serve as a record of outdated methodologies, but rather as a window of options that EAP teachers can skillfully adopt in the appropriate context. Effective integration of technology depends on the affordances of the particular technology and the ways its strengths and challenges can be coordinated as a pedagogical tool (Levy, 2009).

### Table 44.1 CALL framework and application to EAP (modified from Kern & Warschauer, 2000)

<table>
<thead>
<tr>
<th>Framework</th>
<th>View of language teaching paradigm</th>
<th>Principal role of technology</th>
<th>Principal objective</th>
<th>Technology examples in EAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural/behavioristic CALL (1960s–1970s)</td>
<td>Structural (a formal structural system); Grammar-translation &amp; audio-lingual approach</td>
<td>To provide unlimited drill, practice, tutorial explanation, and corrective feedback</td>
<td>Accuracy</td>
<td>Vocabulary drills, grammar checker</td>
</tr>
<tr>
<td>Communicative CALL (1980s–1990s)</td>
<td>Cognitive (a mentally constructed system through interaction); Communicative Language Teaching</td>
<td>To provide communicative exercises through language input and analytic/inferential tasks</td>
<td>Fluency</td>
<td>Multimedia simulation software, concordancing</td>
</tr>
<tr>
<td>Integrative CALL (21st century)</td>
<td>Sociocognitive (developed in social interaction through discourse); community of practice; EAP/ESP</td>
<td>To provide authentic contexts for social interaction; to facilitate access to existing discourse communities and the creation of new ones</td>
<td>Agency (the satisfying power to take meaningful action and see the results of our decisions and choices, from Murray, 1997, p. 126)</td>
<td>Computer-mediated communication and social media integrated in EAP instruction, online academic forums</td>
</tr>
</tbody>
</table>
Critical issues

In today’s knowledge economy, one of the biggest challenges for EAP learners is to effectively engage in collaborative research and writing. As communicative technologies improve, pair or group collaboration has become increasingly important in academic research and publication. In what Pearce et al. (2010) call the “digital scholarship” age, the use of web-based communication technology has become “a necessary, but not sufficient, condition for a radical opening up of scholarly practice” (p. 40). Hence, EAP researchers are increasingly aware of the role of CALL and electronic media in apprenticing learners to enhance their technology-mediated collaboration, which involves participating, communicating, sharing information, and co-constructing knowledge in academic disciplines (Hamp-Lyons, 2011).

Many L2 researchers are interested in how social media tools, such as educational wikis, blogs, and cloud-based platforms, can provide students with opportunities to access collaborative learning environments (Kuteeva, this volume). Studies have suggested that these tools help strengthen L2 students’ academic identity and authorship, enhance their confidence in and motivation for writing, and facilitate the development of writing skills (see Table 44.2 for research examples). However, empirical research on the effects of incorporating these media tools into L2 learning environments is still in its infancy stage (Golonka et al., 2014), particularly in the EAP context. Further research is needed in order to, for example, investigate how specific characteristics of technologies (see Table 44.2; Miyazoe & Anderson, 2010) may have differential effects on students’ collaborative feedback and revision patterns.

Maximizing the value of these writing environments requires careful training of students in the nature and stages of collaborative writing. Academic writers need to reflect on why and how the negotiated changes are made during the process, as well as to understand the complex collaboration process, which includes role-assigning, planning, brainstorming, drafting, reviewing, revising, and editing (Calvo et al., 2011), and collaboration patterns (joint writing, parallel writing, single writing with feedback, Noël & Robert, 2004). Researchers have also warned that without a clear goal and guidance, students are reluctant to participate in the collaborative writing process. For example, students tend to express discomfort about having their unfinished work seen by others (Parker & Chao, 2007), or about editing others’ work due to their concerns regarding their own editing skills (Lund, 2008).

Automated writing evaluation or peer review systems can facilitate the necessary training to be involved in the diverse patterns and stages of collaborative academic writing by guiding students through feedback and revision processes. For example, Scholar, an online peer review tool, helps students identify the flow of collaborative knowledge production by providing distinct work space for the “creators,” who are the main authors, the “contributors,” who review and annotate works, the “publishers,” who coordinate groups in the collaborative knowledge production flow, and the “community,” which reads and discusses works (Cope et al., 2013). This program also has a self-review window that helps students reflect on the changes they have made from version to version. A similar web-based reciprocal peer review system called SWoRD (scaffolded writing and rewriting in the discipline) uses the entire cycle of the journal publication process as its practice model (Cho & Schunn, 2007). These tools are designed to enhance the metacognitive and reflective processes that are considered important components of becoming a successful academic writer.

iWrite, an online academic writing system designed for engineering students, is another collaborative writing tool that can be helpful in EAP contexts. This tool provides support for assigning topic-specific writing tasks and automated feedback, as well as analyzing group revision behaviors and patterns of collaboration through functions such as the revision
### Table 44.2 A typology of social media in L2 post-secondary academic writing contexts

<table>
<thead>
<tr>
<th>Technological characteristics</th>
<th>Research examples</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic forums</strong></td>
<td></td>
<td></td>
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<tr>
<td>Threaded presentation;</td>
<td>Kol &amp; Schcolnik</td>
<td>The use of academic forum in</td>
</tr>
<tr>
<td>controlled by moderator;</td>
<td>(2008)</td>
<td>an EAP course was perceived</td>
</tr>
<tr>
<td>one or more administrators;</td>
<td></td>
<td>as positive, but there were no</td>
</tr>
<tr>
<td>editing typically not allowed</td>
<td></td>
<td>significant improvements in</td>
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<tr>
<td></td>
<td></td>
<td>students’ writing.</td>
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<tr>
<td><strong>Blogs</strong></td>
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<td></td>
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<tr>
<td>Reverse chronological</td>
<td>Noytim (2010)</td>
<td>The use of blog helped increase the</td>
</tr>
<tr>
<td>presentation; controlled by</td>
<td></td>
<td>sense of authorship, self-</td>
</tr>
<tr>
<td>author; one administrator;</td>
<td></td>
<td>reflection, and self-expression.</td>
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<tr>
<td>editing by creator</td>
<td>Sun &amp; Chang (2012)</td>
<td>Blog served as a learning</td>
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<tr>
<td></td>
<td></td>
<td>community through multiple</td>
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<tr>
<td></td>
<td></td>
<td>channels of online social support.</td>
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<tr>
<td></td>
<td>Bloch (2007);</td>
<td>Blog served as a forum to bridge L1</td>
</tr>
<tr>
<td></td>
<td>Sun &amp; Chang (2012)</td>
<td>with a more academic form of L2</td>
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<td></td>
<td></td>
<td>English.</td>
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<td><strong>Wikis</strong></td>
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<tr>
<td>Final product with revision</td>
<td>Turgut (2009)</td>
<td>The use of wiki led to</td>
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<tr>
<td>processes displayable upon</td>
<td></td>
<td>improvements in students’</td>
</tr>
<tr>
<td>request; open structure;</td>
<td></td>
<td>idea-sharing, critical feedback,</td>
</tr>
<tr>
<td>multiple administrators;</td>
<td>Mak &amp; Koniam</td>
<td>confidence, and motivation in</td>
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<tr>
<td>editing by multiple users</td>
<td></td>
<td>Collaborative feedback and</td>
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<td></td>
<td>Kuteeva (2011)</td>
<td>revision in a wiki led to a greater</td>
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<tr>
<td></td>
<td></td>
<td>quantity, quality, and coherence</td>
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<td></td>
<td>Aydin &amp; Yildiz</td>
<td>Wiki-based academic writing</td>
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<tr>
<td></td>
<td>(2014)</td>
<td>contained a high use of</td>
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<td></td>
<td></td>
<td>reader-oriented features and</td>
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<td></td>
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<td>interactional metadiscourse</td>
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<td></td>
<td></td>
<td>markers, suggesting the potential</td>
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<td></td>
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<td>role of wiki use in raising reader</td>
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<td></td>
<td></td>
<td>awareness.</td>
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<tr>
<td><strong>Google Docs</strong></td>
<td></td>
<td>Different task types (e.g.,</td>
</tr>
<tr>
<td>Final product with revision</td>
<td>Kessler et al. (2012)</td>
<td>argumentative, informative)</td>
</tr>
<tr>
<td>processes displayable</td>
<td></td>
<td>facilitated varying levels and</td>
</tr>
<tr>
<td>upon request; open structure;</td>
<td></td>
<td>amounts of collaborative feedback</td>
</tr>
<tr>
<td>one or more administrators;</td>
<td></td>
<td>and revision behaviors.</td>
</tr>
<tr>
<td>enables both synchronous and</td>
<td></td>
<td>Collaborative space helped</td>
</tr>
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<td>asynchronous editing;</td>
<td></td>
<td>increase student participation and</td>
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<tr>
<td>simultaneous auto saving</td>
<td></td>
<td>focus students’ attention on the</td>
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<td></td>
<td></td>
<td>accuracy of their texts and</td>
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<tr>
<td></td>
<td></td>
<td>their revision practices; students</td>
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<tr>
<td></td>
<td></td>
<td>perceived the collaborative process</td>
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<td></td>
<td></td>
<td>as a positive and productive</td>
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<tr>
<td></td>
<td></td>
<td>experience.</td>
</tr>
</tbody>
</table>
map or the topic evaluation chart (Calvo et al., 2011; Southavilay et al., 2013). Analysis has revealed that high writing performances achieved by students are related to the students’ approach in using iWrite, and not necessarily whether they used the tool (Calvo et al., 2011). The finding confirms the prime role of the pedagogical approach in utilizing collaborative online tools to improve students’ academic writing ability.

**Current contributions**

This section discusses the affordances of CALL applications that are particularly well suited to teaching and learning academic reading (textual scaffolding), vocabulary (concordancing program), and writing (automated feedback and evaluation). While a wide range of available CALL tools have contributed to EAP, this section limits its discussion to these three applications, which hold significant affordances for both academic content learning and domain-specific language skills.

**Textual scaffolding**

With advances in technological development and research on reading processes, a number of textual scaffolding tools have been developed to support struggling readers in coping with the challenge of analyzing complex academic texts. As summarized in Table 44.3, technology-based reading environments transform electronic text to increase its accessibility and comprehensibility (Anderson-Inman & Horney, 2007). Techniques range from embedded translational supports (e.g., online dictionaries), to illustrative supports with multiple modalities (e.g., audio, video) and enrichment supports with hyperlinks to useful resources (e.g., background information, concept maps).

More recently, syntactically-based text scaffolding tools have gained attention as a way to help L2 readers both read and learn to read. Compared to spoken English, academic English is characterized by the use of expanded noun phrases and nominalizations, a lack of contextual cues, complex grammatical features, and a less explicit use of logical linkages such as conjunctions (Snow, 2010). Text reformatting tools that provide more explicit syntactic cues at the phrase or sentence level have the potential to help L2 students understand complex layers of meaning, thus enhancing comprehension of academic reading texts (Warschauer et al., 2011).

Recent technological developments using eye-tracking and cognitive science provide an advanced approach to increase text accessibility and readability of lengthy web documents. For example, the visual syntactic text formatting (VSTF) tool presents text in a cascading pattern (see Figure 44.1). Such a pattern is a more accurate measure of the human eye span and highlights the syntactic meaning units of texts, enhancing the readability of massive online texts (Walker et al., 2005). Based on eye-tracking and natural language processing techniques, VSTF breaks up sentences along salient clause and phrase boundaries, as well as highlighting the content verbs. These techniques result in visual clusters across multiple rows to denote syntactic hierarchies of dense texts (Walker et al., 2005). Jenga, a similar syntactic parsing tool, converts text into a block-shaped Jenga format by using white spaces to divide a paragraph into interlocking sentences (Yu & Miller, 2010).

Students using these syntactic scaffolding tools have shown improvement in their reading comprehension (Walker et al., 2007; Yu & Miller, 2010) and retention of academic content, for example, in social science (Walker et al., 2007). These findings suggest the potential benefits of using this tool in disciplinary-specific contexts to support the complex process
### Table 44.3 Types of textual scaffolding and exemplary applications in EAP (modified from Anderson-Inman & Horney, 2007)

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Applications in EAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentational</td>
<td>Enables the text and accompanying graphics to be presented in varying ways, hence customizable to meet the needs of individual readers</td>
<td>Basic MS Word or web-based word processing programs that enable the adjustment of text (e.g., font size, style, text, background color)</td>
</tr>
<tr>
<td>Navigational</td>
<td>Provides tools that allow the reader to move within a document or between documents</td>
<td>E-books with across/within-document links, embedded menus, links from other resources such as table of contents, glossary, bibliography</td>
</tr>
<tr>
<td>Translational</td>
<td>Provides a one-to-one equivalent or simplified version that is more accessible or familiar to the reader</td>
<td>Text modification or reformatting tools that provide simplified or sophisticated versions provided for varying reading levels</td>
</tr>
<tr>
<td>Explanatory</td>
<td>Provides information that seeks to clarify the what, where, how, or why of some concept, object, process, or event</td>
<td>Online reading programs with scaffolding questions or background information</td>
</tr>
<tr>
<td>Illustrative</td>
<td>Provides a visual representation or example of text designed to support, supplement, or extend comprehension of the text</td>
<td>Multimedia glosses with photos, simulations, videos, sounds, music that illustrate the definition, topic, or concept of the given word or sentence</td>
</tr>
<tr>
<td>Summarizing</td>
<td>Provides a summarized or condensed way of viewing some feature of the document</td>
<td>Graphic organizers or text-mining tools that provide concept map, list of key ideas, chronology, which may support summarizing</td>
</tr>
<tr>
<td>Enrichment</td>
<td>Provides supplementary information that adds to the readers’ appreciation or understanding of its importance or historical context</td>
<td>Hyperlinked texts with broader background information (e.g., publication history, biography of the author, influence on other writers)</td>
</tr>
<tr>
<td>Instructional</td>
<td>Provides prompts, questions, strategies, or instruction designed to teach some aspect of the text or how to read and interpret the text</td>
<td>Reading tutorials with instructional prompts, study guides, or embedded study strategies</td>
</tr>
<tr>
<td>Notational</td>
<td>Provides tools for marking or taking notes on the text to enable later retrieval for purposes of studying or completing assignments</td>
<td>Annotation tools with electronic highlighting, bookmarking, margin notes, or outlining</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Provides tools for working or sharing with other readers, the author, or some other audience</td>
<td>Collaborative platforms such as blogs, wikis, Google Docs, that support threaded discussion, online chat, e-mail or hyper links</td>
</tr>
<tr>
<td>Evaluational</td>
<td>Provides materials, prompts, and assignments designed to assess student learning from the text</td>
<td>Reading assessment tools with questions, quizzes, tests, surveys, online interviews, assignments leading to products</td>
</tr>
</tbody>
</table>
of comprehending content-area academic text with multiple layers of meanings due to the saliency of syntactic structures. Most interestingly, there is some evidence that use of these programs may help students develop their reading skills, even on reading passages that are in traditional block format (Walker et al., 2005). This presumably occurs through developing students’ understanding of the structure of written English, or simply by increasing their confidence in reading. Further research is needed to confirm these results as well as to better understand the possible underlying mechanism.

Concordancing

One of the major applications of computers in EAP teaching and learning is the use of corpora and concordances (Hamp-Lyons, 2011; Yoon, 2011). Corpora have been deployed in EAP for decades. Today, with a range of corpora and concordancing software now freely available online, including the British Academic Written English corpus (BAWE), the Michigan Corpus of Academic Spoken English (MICASE), and the International Corpus of Learner English (ICLE), researchers are exploring a wide range of ways to incorporate online concordances into EAP instruction (see Nesi, this volume).

Several studies have examined the effect of using concordances on academic vocabulary acquisition. Kaur & Hegelheimer (2005) showed that a concordancing approach combined with the use of an online dictionary is more effective than online dictionary use without concordancing in helping students write sophisticated academic language. Others have reported how the use of a specialized concordancer intended to teach a specific grammar and vocabulary unit helps L2 academic writers’ metacognitive development, for example, in understanding the use of connectives (Cresswell, 2007). Chang and Kuo’s (2011) study examined how a discipline-specific concordancer guides L2 computer science majors through the process of analyzing disciplinary vocabulary, move structure, and discourse conventions. Their study suggested that the tool helped improve students’ writing outcomes, as well as their awareness of rhetorical moves and their functions. Qualitative examination further suggested improvements in students’ competence, responsibility, and independence as writers through use of the software (Yoon, 2008).

However, there are some elements to be cautious of, including a lack of rigorous observation and logical reasoning during corpus investigation (Kennedy & Miceli, 2001), and a lack of long-term retention of the lexicogrammatical awareness gained through corpus...
CALL and electronic media

use (Gaskell & Cobb, 2004). Presenting marked variations in corpus use among three adult L2 learners with differing language proficiencies, Kennedy and Miceli (2010) stressed that requisites for effective concordancing, especially among students of lower proficiency, are explicit learner preparation and ample practice. They conclude that mastering corpus consultation is a gradual, long-term process that needs to be treated as an integral part of the overall language-learning process. They propose to integrate training in the use of corpora through a series of homework and class activities throughout the curriculum so as to monitor and overcome learners’ difficulties and possible negative responses. Obstacles and pessimistic feedback, they claim, are expected in the early stages of mastering an important but challenging tool, such as concordancing. Given that there are only a few freely accessible academic writing websites that utilize concordancers, it would also be desirable to develop more EAP concordancers that can provide a genre-based and corpus-informed approach for writing research articles in specific disciplines (Chang & Kuo, 2011).

Automated feedback and evaluation

Automated scoring programs have been used in EAP since at least the 1970s. Their presence has been necessitated by the high demand for academic writing skills and the need for practice opportunities. These automated scoring programs assign essays a numerical rating based on their similarity to prototypical essays previously scored by human raters (for an overview, see Warschauer & Ware, 2006). Some have criticized these programs as conflicting with the goals of a sociocognitive approach to writing, warning that their prevalence leads to the potential demotivation of student writers (e.g., Chen & Cheng, 2008). In the last two decades, these issues have been addressed in part with the development of broader automated writing evaluation (AWE) programs, which combines an automated scoring feature with a range of other tools (e.g., model essays, scoring rubrics, graphic organizers, word banks, discussion boards, chat system) that can support an interactive writing process (Grimes & Warschauer, 2010).

Research on major AWE programs such as the Criterion e-rater, MY Access!, and Intelligent Essay Assessor has reported the tools’ affordances in facilitating more writing practice and improvement in students’ motivation to write and revise (e.g., Burstein et al., 2003). The programs have also been found to ease classroom management by offloading response to earlier drafts to the software (Grimes & Warschauer, 2010). In recent years, many studies on AWE used in L2 academic contexts have emphasized that automated feedback should be used in conjunction with teacher feedback, ultimately supplementing, but not substituting for, classroom instruction (Cotos, 2011; Hyland & Hyland, 2006). For example, Chen and Cheng’s (2008) study of L2 college students’ use of AWE in academic writing revealed that AWE was perceived more favorably by students when it was used in the early stages of the writing and revising process, followed by feedback from both the teachers and peers. This study also revealed that more advanced learners expected AWE to allow content-specific feedback and interaction with readers, as well as help transcend conventional writing styles.

In recent years, progress in computational linguistic approaches such as textual machine learning and natural language processing (NLP) techniques has favored the development of better-targeted and more sophisticated AWE tools tailored to meet the disciplinary needs of academic writing. For example, the Intelligent Academic Discourse Evaluator (IADE) analyzes the writer’s use of discourse conventions within a specific section (e.g., introduction) and generates individualized and discipline-specific feedback on the
appropriate use of discourse markers (Cotos, 2011). With the help of preprogrammed scripts, percentages of the move distribution in the students’ draft are automatically calculated and compared with the distribution of moves in the corpus of the students’ academic field. Cotos’ (2011) study of international graduate students’ use of IADE found that the tool helped raise students’ awareness of genre and discourse form and improved the rhetorical quality of their writing.

The multi-faceted information about student writing available through AWE can support teachers’ long-term instructional plans and assessment, for example, when integrated into a teacher dashboard (Grimes & Warschauer, 2010). Using programs that include such dashboards, teachers can view spreadsheets that record student scores, frequency of revisions, minutes spent on a task, questions asked, and error analysis reports. This may serve as a valuable assessment resource as it creates longitudinal portraits of student work, which helps track progress across time. AWE’s potential to support the iterative and collaborative process of EAP writing and publishing appears promising. Nevertheless, only a few studies have investigated AWE in EAP contexts, and those studies mainly focus on writing outcomes, not the learning process (see discussion in Cotos, 2011). Given that the success of AWE largely depends on how educators implement and integrate the tool within a social writing process (Chen & Cheng, 2008; Grimes & Warschauer, 2010), additional research is needed to demonstrate the benefits and challenges of the tool’s classroom applications, and the contextual factors that contribute to its successful use.

**Main research methods**

Both case studies and experimental studies are commonly employed in technology-mediated EAP research. Given the rapidly changing trends of educational technologies, case studies employing measures such as interviews, surveys, classroom observations, content analysis of teacher logs, lesson plans, or chat discussions can help explore and document teachers’ and students’ use of new tools (e.g., Liu & Jiang, 2009; Hafner, 2014). At the same time, experimental and quasi-experimental studies measuring comprehension, deploying working memory measures (e.g., non-word repetition, reading span tests), or analyzing feedback and revision can focus more on quantifiable learning outcomes (Golonka et al., 2014). Both within and beyond case studies and experiments, two additional methods are potentially promising in exploring the use of digital media in EAP: computational text analysis and social network analysis.

**Computational text analysis**

Advances in a variety of computational linguistics tools have propelled research into linguistic and text characteristics of L2 academic writing. Such research aims to identify the challenges and needs for improvement in L2 writing. One of the earliest web-based text analysis tools that has been widely employed in EAP is Vocab Profile (Cobb, 2002), which performs lexical text analysis measuring the proportions of low- and high- frequency vocabulary and of academic work use (Coxhead, 2000). Using Vocab Profile, Cons (2012) revealed an overall lack of academic vocabulary use in L2 writing and a differential use of academic vocabulary by L2 students of varying language proficiencies. Compared to native English speaking peers and advanced L2 students, low-proficiency L2 students used limited academic words both in quantity and quality, for example, in creating cohesion and precision, and adding vivid detail.
Recent developments in natural language processing has opened up the possibility for a more sophisticated tool for analyzing linguistic features of L2 academic writing, including online text complexity measures such as Lexile (MetaMetrics) and Coh-Metrix (Graesser et al., 2004), and in-house programs such as SourceRater (Educational Testing Service). These text complexity measures provide information on both superficial linguistic features (e.g., word frequency, sentence length) and in-depth features (e.g., text cohesion) of writing. They are helpful in assessing text difficulty for materials selection, and also in enhancing teachers’ understanding of the linguistic and textual characteristics of L2 academic texts compared to that of native speakers. For example, several studies used the Coh-Metrix to measure the differences in cohesion and lexical network density between native speaker and non-native speaker academic corpora (Crossley & McNamara, 2009). The findings revealed that L2 texts, compared to native speakers’ texts, are characterized by an overuse of explicit cohesive markers and less dense lexical networks (Crossley & McNamara, 2009), suggesting the need for more instructional attention on the appropriate use of these markers in teaching cohesion.

Characteristics pertaining to discourse conventions and organization in L2 academic writing have also been widely investigated in EAP by using, for example, a tagging technology of corpus linguistics (see Nesi, this volume). More advanced textual mining techniques, although new to EAP research, have significant potentials to reveal L2 academic text characteristics (e.g., development of argumentation) or to elucidate processes of knowledge building and critical thinking in asynchronous discussion forums (Schrire, 2006). In collaborative writing research, new text mining tools specifically designed to extract information on writers’ collaborative behaviors can quantify or visually represent the collaborative writing patterns (see Figure 44.2), particularly across large numbers of exemplars. These tools can provide important usage statistics, such as amount of writing and revision, number of words written, number of edit sessions that can be examined at the individual- and group-level. These usage statistics can also be studied over the course of time, which can provide rich insights into L2 students’ academic writing and learning process in collaborative online environments.

Social network analysis

Many academic settings utilize social media tools such as blogs or wikis to integrate collaborative discussion, writing, and sharing. Social network analysis (SNA), which examines the articulation of a social relationship among nodes (e.g., individuals) through both quantitative (e.g., interaction frequency) and qualitative (e.g., observation, case-study) network data (Laumann et al., 1989), is a promising, yet less-investigated, method for exploring the opportunities and patterns of participation among L2 students in technology-mediated academic forums (Gallagher, 2012). Through modeling and visualizing interaction patterns (e.g., sociograms), these analyses can discern the form and frequency of participation across academic forums and situations, as well as the context-dependent factors of participation. Despite the potential for analyzing how EAP students network into academic discourse communities, only a few SNA studies have been carried out on technology-based interaction in L2 academic contexts.

As an example, Zheng and Warschauer (2015) conducted a social network analysis of L2 adolescent writers’ online discussion threads and posts in classroom blogs over the course of a year. Their study found that interaction patterns changed from teacher-centered to student-centered. Interestingly, students with low English proficiency skills exhibited the fastest growth in group discussion frequencies, suggesting the potential of the blog as an
Figure 44.2 DocuViz tool that visualizes the revision history of a collaboratively written document on Google Docs (Olson et al., 2015)
Each column represents the editing sessions, with the heights of the bar representing the amount of text. Authorship of the segments of text is noted in different colors. (a) shows the slices in order of appearance; (b) shows the slices on a timeline, where one can see bursts of activity and then delays. The key at the bottom shows which person corresponds to which color and how many characters in the final document they contributed.
active participation channel for this otherwise marginalized group. Ferenz’s (2005) qualitative study of a college EFL (English as a foreign language) academic writing course investigated the relationship between the audience network (i.e., with whom the students discussed their L2 writing tasks) and their desired social identity and future goals. Through interviews and analyses of online chat interactions, Ferenz (2005) found that those oriented towards their academic network reported a more organized, systematic pattern of decision-making in their writing. The result of Ferenz’s study showed that L2 students’ social identity when writing to their preferred academic audience networks differed from that presented to their non-academic audience networks. Considering the increasingly popular use of technology-based academic forums and their critical affordances as spaces for developing identity and a broader discourse community (e.g., Hafner, 2014), it is worth exploring the issue of L2 participation and interaction using a more diverse range of research methods, including SNA.

**Recommendations for practice**

Given the ever-increasing importance of academic collaboration, information sharing, and knowledge construction mediated by technology, digital media is increasingly valuable in EAP instruction. The diverse options of EAP technology tools, however, have to be carefully chosen and integrated depending on the instructional contexts and purposes in order to maximize their capabilities. In doing so, technology should be used to tailor instruction to a learner’s needs and characteristics (Stevens, 1988), such as language proficiency. Students with lower proficiency often need more scaffolding support and explicit training, as seen in the examples of automated feedback (e.g., Chen & Cheng, 2008) or learner-centered use of concordancing programs (e.g., Kennedy & Miceli, 2010).

Although the main role of CALL in EAP lies in supporting the development of domain-specific academic skills, a need exists for broader research into how technology can support EAP students in developing individual and collaborative research skills that are based on robust information literacy (Stapleton, 2003). Such approaches could include, for example, multimedia projects for science experiments (e.g., Hafner, 2014) or WebQuest activities (e.g., Ramachandran, 2004) that guide students through the process of searching, evaluating, annotating, and citing the sources for their own disciplinary research. These approaches can also embrace collaborative writing platforms so that EAP students can apprentice their way into academic discourse communities, and develop appropriate disciplinary identity (Duff, 2010).

EAP teachers and researchers are also advised to consider students’ naturally-occurring technology practices and discover ways to incorporate them into their curriculum and instruction. This will help teachers better understand how technology relates to both the personal and academic lives of L2 learners, and thus enhance student engagement (Yi, 2013). Out-of-school digital literacy practices typically involve a high volume of reading and writing, and also present challenges such as frequent exposure to non-standard forms of English and the instability of online genres (e.g., Black, 2009). Instructional effort is needed to help students critically evaluate their digital literacy practices, for example, by implementing e-portfolios, in which students collect daily writing activities through social media and record their own reflections on how their writing may connect to academic literacy (Babaei, 2012).

What remains crucial in implementing the technology-integrated EAP curriculum is the teacher’s role: that of facilitating and guiding students in the language-learning process, as well as providing them with the appropriate materials and approaches that are currently within reach. EAP teachers should embrace their multiple roles as co-inquirers, researchers,
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and instructors during the process of utilizing digital media in instruction. Lastly, teachers’ personal and professional online networks can facilitate the sharing of technology skills, lesson plans and collaboration across disciplines, which enable more effective use of technology in the EAP classroom.

Future directions

This brief overview of technology-mediated EAP hints at the abundant opportunities that CALL and electronic media can provide for researchers and practitioners to better understand and help expand L2 students’ academic language and literacy. Advances in computational analysis of texts are particularly worthy of attention due to their affordances to broaden the range and scope of EAP instruction and research. For example, new forms of machine learning can potentially allow more sophisticated automated analysis of text, thus providing not only scores to students but also more helpful feedback (see, e.g., Mayfield & Rosé, 2013). Similar machine learning techniques can enable automated agents to monitor and intervene in computer-mediated student discussion, generating questions and comments to help learners expand their thinking and writing skills. Existing software for analyzing texts can be better integrated into cloud-based environments to better scaffold students’ use of vocabulary, syntax, and writing strategies, and also to help teachers assess students’ individual development as writers. The wide variety of tools for scaffolding digital reading can also be better integrated, so that non-native students can easily and automatically access formatting, presentation, corpus, and networking tools to aid them in understanding and interpreting texts. In summary, teachers, scholars, and software developers interested in uses of digital media for EAP face a rapidly changing and highly promising terrain.

Further reading

Lawrence, et al. (2013); Onrubia & Engel (2009); Warschauer et al. (2004)

Related chapters

14 Acquiring academic and disciplinary vocabulary
16 Corpus studies in EAP
20 Multimodal approaches to English for academic purposes
33 Research blogs, wikis, and tweets

References


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