6 Technology and L2 Writing

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Introduction

New information and communication technologies are altering writing practices in important ways. As Relles and Tierney (2013) put it, “the integration of communication technologies with academic culture suggests that the writing habits of tomorrow’s students will be navigational across myriad discourse situations that do and will yet exist” (501). Students in fourth grade, for example, while still working on writing sentences, may be routinely asked to go beyond traditional writing tasks to put together PowerPoint slides, collages, or contribute text to blogs. High school students, while drafting persuasive essays, may be tasked with writing Facebook or Twitter posts. College students continue to write lab reports but also need to construct multimodal compositions that include both text and visuals. Successful business people must be able to write communications to be disseminated through a variety of social media.

In this context, all teachers, schools, and colleges are challenged to respond to the changing nature of writing (Herrington and Moran 2009). Fortunately, the same wave of technologies affecting writing practices provides a wealth of tools for the teaching of second or foreign language writing. Such tools have been adopted by business and education to improve the teaching and learning of writing. In this chapter, we describe technologies developed to aid in the writing process, which are also used for teaching. Following the description, we provide a critical analysis of the empirical research on the effectiveness of software and web-based technologies in teaching L2 writing. We conclude the chapter with a look at future research and development of technologies and pedagogies for L2 writing.

Technologies for L2 writing

The wide variety of technologies for L2 writing can be divided into three general categories. The most general purpose of the three is the Web 2.0 application, which allows for authorship of multiple users who contribute content to a common repository online. The second category is automated writing evaluation systems developed specifically for analysis and feedback to writers during the writing process. The third category is the corpus-based tools, which serve as a reference to writers as they strategically examine the language used in
collections of existing electronic texts. Many software tools exemplify each of these categories, but we have chosen a few to illustrate the affordances offered writers by tools of each of the three types.

**Web 2.0 applications**

Web 2.0 tools include the variety of social media sites, such as Facebook and Twitter, as well as blogs. For L2 learners, these sites provide unprecedented opportunities to experiment with their language in settings where their language appears before and communicates with real audiences rather than being confined to communication for practice within the language classroom. The use of language for communication, rather than for practice alone, is a core goal of most language instruction. Beyond opportunities for communication, Web 2.0 applications like Google Docs provide the tools for collaborative writing.

Lang-8 (http://lang-8.com/) is a good example of a social networking site designed to encourage L2 communication by creating a community where language learners are matched with native speakers of target languages. Each member can contribute to the virtual language learning community by writing posts in the language they are learning and giving feedback or making corrections to other members’ written posts in his or her native or stronger language. With a few buttons for editing, such as color changing and crossing out, users can easily correct or edit others’ posts on Lang-8. Lang-8 rewards active users with “L” points, which help make their posts more visible to proficient users, thus increasing the probability that they will receive feedback or corrections. In other words, the more a member of the community contributes to the process of language correction, the more his or her own writing or posts are corrected. In addition to written corrections, Lang-8 has integrated Skype, an online tool allowing for international, live video communication. Lang-8 allows learners to practice writing on their own. Language instructors can also create groups on Lang-8 and design collaborative writing activities for their students and others in the larger community.

Google Docs, another important example, is a free online word processor within Google Drive, an office suite developed by Google Inc. Users need a Google account to create, edit, and share Google Docs files. Google Docs features a full-fledged word processor with an easy-to-use text-editing interface. Compared to traditional word processing software, Google Docs is unique in its capability for real-time collaboration, including editing, commenting, and chatting by and among multiple users on a shared file. Additionally, the composing and revision history on Google Docs is automatically saved and a record of the entire composing process is available for review. A completed piece of writing can be published online or downloaded in different file formats, including Microsoft Word, pdf, plain text, html page, and so on. As a collaborative writing platform, Google Docs has gained popularity in language teaching classrooms at all levels.

**Automated writing evaluation**

Automated writing evaluation (AWE) systems have been developed to assist both native speakers and L2 learners to write more accurately by providing them with automated corrective feedback. AWE systems utilize sophisticated natural language processing (NLP) techniques and machine learning to create tools that are more powerful than traditional spelling and grammar checkers (Shermis, Burstein, and Bursky 2013). NLP technologies have become sufficiently widespread that a number of these systems have been developed, although because of the substantial resources required to develop them, they are typically not freely available on the Internet. Criterion, Turnitin, and Writing Pal are among the widely used AWE systems.
**Criterion** (http://www.ets.org/criterion/) is a web-based commercial writing evaluation and feedback tool developed by Educational Testing Service (ETS, 2015). **Criterion** targets the writing instruction both in K-12 programs and higher education and provides a holistic score and feedback based on level-specific models considering both the age and proficiency levels of the learners. Building on **e-rater**, an automated scoring engine, **Criterion** is capable of providing holistic scores (1–4 or 1–6 points) to the essays written to its own prompts. In addition, detailed diagnostic trait feedback, in a mixture of both direct and indirect feedback formats, is available in five categories: grammar, usage, mechanics, style, and organization, and development. Beside the holistic score and individualized feedback, it provides resources such as an essay planning tool and the Writer’s Handbook at different levels for students to understand and evaluate the feedback provided. The handbook is available in different languages for ESL learners speaking Chinese, Spanish, Korean, and Japanese. Teachers can assign writing tasks from the built-in pool of writing prompts or create their own essay topic. Moreover, it allows for teacher and peer feedback. This web-based tool can be used at different stages of writing instruction for various purposes. Language instructors can use it in-class for an essay planning or a peer-feedback activity, or out-of-class for students to submit and revise based on the feedback.

**Turnitin** (http://turnitin.com/) was initially launched as an online plagiarism prevention service by iParadigms, LLC, in 1997. Recently, through partnering with or acquiring other companies, iParadigms added more functions to **Turnitin** and transformed it from an originality-checking tool to a comprehensive platform of online automated grading and peer review (Turnitin, 2015). For example, **Turnitin** has integrated **e-rater**, the automated scoring engine developed by ETS as well as LightSide Labs’ **LightSide Revision Assistant** to enhance its grammar checking and assessment function. In addition, **Turnitin** facilitates teacher feedback by providing frequently used comments and rubrics as well as a voice commenting tool. **Turnitin** can be integrated with mainstream learning management systems (LMS), such as Blackboard Learn, Moodle, Canvas, and so on. Turnitin targets customers in the field of education, including educators and students in middle and high schools, colleges and universities. **Turnitin** also provides online tutorials and training to teachers, students, and school administrators. Currently, **Turnitin** has found its place in a number of institutions as a plagiarism detection tool and several empirical studies have been conducted to investigate its utility and user perceptions (Rolfe 2011; Stapleton 2012). **Turnitin's** recent expansion of grading and peer reviewing functions invite empirical investigations into its effects on writing pedagogy as well.

**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**’s intended users are native English-speaking students in high schools. However, English language learners in high school and college freshmen have also been included in some empirical studies of **W-Pal** in the United States. Unlike other AWE tools, **W-Pal** is designed as a writing strategy instruction tool based on four principles for teaching writing, namely, strategy instruction, modularity, extended practice, and formative feedback (Roscoe and McNamara 2013). Accordingly, **W-Pal** provides eight animated learning modules covering the typical writing process, including writing strategies used in the pre-writing phase, drafting phase, and the revision phase. The learning modules are coupled with two types of interactive practices to improve student engagement and learning motivation: game-based practices as well as essay-based practices. Student essays produced on **W-Pal** can be scored automatically with automated formative feedback, using **Coh-Metrix** – a system developed for computing cohesion in the written and spoken texts by the Institute for Intelligent Systems at the University of Memphis—and other text analysis tools.
Corpus‐based tools

Like AWE systems, a number of corpus‐based tools have been developed as resources for L2 writers to gain access to examples of authentic language use in collections of electronic texts. Corpus‐based pedagogies, data‐driven learning, are based on the idea that students need to have access to examples of language (i.e., data) as they write, and that such examples need to meet specific writing needs at the time of writing (Flowerdew 2009). Corpus tools, therefore, consist of corpora of texts as well as the software tools required for searching and displaying the examples. The Corpus of Contemporary American English (henceforth COCA, Davies 2008) serves as a good example of a widely used corpus.

COCA (http://corpus.byu.edu/coca/) is a freely available online corpus of English, created by Mark Davies at Brigham Young University. The corpus has over 450 million words of text that covers spoken, fiction, popular magazines, newspapers, and academic text genres. Users can search for exact words and phrases, parts of speech, and collocations through the COCA interface. In addition, users can take advantage of semantically‐based queries to differentiate usages of synonyms (e.g., little vs. small) or related words (e.g., men vs. women).

The COCA interface “Word and phrase” (http://www.wordandphrase.info/) permits users to interact with the tool differently. For example, users can submit a whole text for analysis and see a detailed frequency report on the words that they produced. Learners can also compare their use of phrases to the phrases in the corpus. The words and phrases can be limited to academic texts so that users can analyze an academic text as well as search for academic word lists and collocations. COCA can be used for different purposes in second language writing instruction. For example, language instructors can use it to expose learners to the authentic use of language and thus the form and functions of different language uses, which in turn might encourage learners to implement these features in their own writing.

Summary of L2 writing tools

The pedagogical writing tools described above and summarized in Table 6.1 serve as an illustration of the technological support available to learners and teachers. In view of the energy and expertise being applied to the development of writing software today, it is likely that the future improvements on these tools as well as additional tools will continue to appear. In this environment, the pressing needs of writers and advances in technology are likely to result in tool development ahead of research on how people write and learn through the use of the tools.

Empirical research on L2 writing technologies

Empirical investigations into the usefulness of writing technologies for L2 writing have been undertaken for each of the three categories of writing tools introduced above. Research encompasses a range of methodologies to address questions about learners’ writing strategies, their language use, their writing practices, attitudes, and writing outcomes. Table 6.2 provides an overview of published research on various software tools, the context of the study as well as the methodology the authors employed and key findings.

L2 writing with Web 2.0 applications

Social networking sites (SNS) and wiki‐type tools as representative Web 2.0 platforms have allowed the researchers to investigate L2 writers’ engagement in meaningful social interaction as well as collaborative writing (Lee 2010). Recent research has shown that collaborative writing
Table 6.1  Example technologies for L2 writing.

<table>
<thead>
<tr>
<th>Category</th>
<th>Example technology</th>
<th>Type</th>
<th>Context/Target users</th>
<th>Key functions</th>
<th>Potential application</th>
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<tbody>
<tr>
<td>Automated writing</td>
<td>Google Docs</td>
<td>Free</td>
<td>Writers in general</td>
<td>Online collaborative writing</td>
<td>Collaborative writing practices (i.e., peer review, group projects)</td>
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<td>evaluation</td>
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<tr>
<td>Web 2.0 applications</td>
<td>Lang-8</td>
<td>Free</td>
<td>Language learning community with language learners and native speakers in multiple languages</td>
<td>Offer corrections on written posts in one’s native language and receive corrections on written posts in a target language</td>
<td>Journal writing; grammar checking; collaborative writing with native speakers</td>
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<tr>
<td>Corpus-based</td>
<td>Criterion</td>
<td>Commercial</td>
<td>K-12 and College level English language writers</td>
<td>Essay evaluation (holistic scores) and individualized feedback on grammar, usage, mechanics, style, and organization and development</td>
<td>Grammar checking; Formative assessment tool</td>
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<tr>
<td>Tools</td>
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<td></td>
<td>Turnitin</td>
<td>Commercial</td>
<td>Teachers and students in middle and high schools, colleges and universities</td>
<td>Originality checking, grading, peer reviewing</td>
<td>Feedback on possible plagiarism; Grammar checking</td>
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<td></td>
<td>W-Pal</td>
<td>Not publicly available</td>
<td>Native and non-native English speaking high school students</td>
<td>Strategy instruction, modularity, extended practice, and formative feedback</td>
<td>Teaching writing strategies used in the pre-writing, drafting, and revising phases</td>
</tr>
<tr>
<td></td>
<td>COCA</td>
<td>Free</td>
<td>Writers in general</td>
<td>Access to large corpus</td>
<td>Editing and revisions of words and phrases; Evaluation of word choice</td>
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<tr>
<td>Category</td>
<td>Technologies or software</td>
<td>Example study</td>
<td>Context and focus</td>
<td>Research methods</td>
<td>Major findings</td>
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<tr>
<td>Web 2.0 applications</td>
<td>Wikis</td>
<td>Aydin and Yildiz (2014)</td>
<td>Effects of task type on Turkish English language learners’ collaborative writing on three types of writing topics</td>
<td>Mixed-methods approach</td>
<td>Collaborative writing on different topics yielded differential writing behaviors.</td>
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<td></td>
<td>Google Docs</td>
<td>Strobl (2014)</td>
<td>Effects of collaborative writing on the writing performance of advanced Dutch learners of German</td>
<td>Mixed-methods approach</td>
<td>Collaborative texts appeared to have better content and text organization, but not different in terms of accuracy, fluency, and complexity, compared with individually written texts.</td>
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<tr>
<td></td>
<td>Web 2.0 applications in general</td>
<td>Chen (2014)</td>
<td>Benefits of using Web 2.0 applications for peer review</td>
<td>Interpretive synthesis of 20 empirical studies (1990 to 2010)</td>
<td>Overall, positive impacts of technology-supported peer feedback were identified.</td>
</tr>
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<td></td>
<td>Facebook</td>
<td>Shih (2010)</td>
<td>Peer assessment on Facebook for first-year English majors in Taiwan</td>
<td>Mixed-methods approach; pre- and post-test design</td>
<td>Better writing performance with peer assessment on Facebook and positive perceptions by the students were found.</td>
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<tr>
<td>Technology/Software</td>
<td>Study Details</td>
<td>Methodology</td>
<td>Research Findings</td>
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<td><strong>MY Access!</strong></td>
<td>Chen and Cheng (2008)</td>
<td>Qualitative approach</td>
<td>The AWE tool was not perceived very positively. EFL instructor’s approach to integrating the AWE tool affected students’ perceptions.</td>
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<td><strong>Writing Roadmap 2.0</strong></td>
<td>Rich (2012)</td>
<td>Mixed-methods approach, quasi-experimental design</td>
<td>Students using the AWE tool had a higher automated score. The majority of the students showed positive views on the tool and became more confident in writing after the treatment.</td>
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<td><strong>CorrectEnglish</strong></td>
<td>Wang et al. (2013)</td>
<td>Mixed-methods approach, quasi-experimental design</td>
<td>More accurate texts and better learner autonomy awareness were achieved by the students who used the AWE tool.</td>
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<tr>
<td><strong>Criterion</strong></td>
<td>Link et al. (2014)</td>
<td>Qualitative approach with longitudinal data</td>
<td>A best practice model involving the use of AWE was proposed based on the qualitative analysis of five ESL instructors in seven ESL writing classes.</td>
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<table>
<thead>
<tr>
<th>Category</th>
<th>Technologies or software</th>
<th>Example study</th>
<th>Context and focus</th>
<th>Research methods</th>
<th>Major findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corpus-based Tools</td>
<td>Concordance tools on COCA and MICUSP</td>
<td>Garner (2013)</td>
<td>Effects of data-driven learning (DDL) on ESL students’ use of linking adverbials in English writing at an American university</td>
<td>Quantitative approach; quasi-experimental design</td>
<td>Students benefited from the DDL instructions and showed a better use of linking adverbials than the control group.</td>
</tr>
<tr>
<td>AntConc 3.2.1; three learner corpora and one professional corpus of reports</td>
<td>Friginal (2013)</td>
<td>Effects of using corpora on students in forestry in developing reporting writing skills, specifically in four linguistic characteristics</td>
<td>Quantitative approach; quasi-experimental design</td>
<td>The two-week period of corpus-based training helped the students in the experimental group in writing reports, which became more similar in the selected linguistic characteristics to those in the professional corpus.</td>
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<tr>
<td>The Collins COBUILD Corpus</td>
<td>Yoon (2008)</td>
<td>Impacts of corpus technology on L2 students’ writing development in a graduate-level ESL writing class</td>
<td>Qualitative approach; case studies</td>
<td>Use of general corpus helped L2 writers solve language problems in writing and promoted learner autonomy.</td>
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<tr>
<td>PREFabricated Expression Recognizer (PREFER), corpus-based e-paraphrase tool</td>
<td>Chen et al. (2015)</td>
<td>Effects of PREFER on EFL freshmen’s paraphrasing performance in an Asian university</td>
<td>Quantitative and qualitative; single group pre- and post-test design</td>
<td>PREFER was helpful for EFL students to improve their paraphrasing. The majority of the students were satisfied with paraphrase examples and functionality of the tool.</td>
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</table>
on web-based word processing tools, such as Google Docs, benefit learners’ writing development through peer editing and meaning-related revising. For example, Kessler, Bikowski, and Boggs (2012) investigated the use of Google Docs in a team-based project-oriented writing activity in an English for academic purposes training program with 38 L2 writers. The study found that the L2 writers focused more on meaning than form and the grammatical changes they made collaboratively were mainly accurate, which in general contributed positively to the quality of their writing. Overall, wiki-based collaborative writing tends to yield written pieces with higher accuracy (Storch 2011, 2012; Wigglesworth and Storch 2012).

Research has found that success of using wiki-based approaches to teaching L2 writing depends on factors including task type, writing topics, grouping methods, group dynamism, learner’s L2 proficiency level, and so on. For example, Aydin and Yildiz (2014) studied the collaborative writing processes of 34 Turkish learners of English on three writing prompts, namely argumentative, informative, and decision-making topics. They found that the argumentative topic appeared to trigger more peer corrections while the informative topic elicited more self-correction. In terms of the effect of learner proficiency level, Strobl (2014) studied a group of 48 advanced university-level Dutch learners of German on Google Docs-based synthesis tasks and found that collaborative texts tended to have more appropriate content selection and text organization, possibly due to group members’ engagement in their planning stage. However, Strobl (2014) also noticed that for this group of advanced L2 writers there were no significant differences in collaborative texts and individual texts in terms of accuracy, fluency, and complexity.

The benefits of using Web 2.0 applications for peer review in particular are well documented by Chen (2014), who carried out an interpretive synthesis of 20 empirical studies on technology-mediated peer feedback published from 1990 to 2010. The technologies involved in these studies include synchronous and asynchronous tools, such as email, course management systems, blog websites, online forums, real-time communication software, and Microsoft Word. In general, technology-supported peer feedback is characterized by motivating interaction, flexible discourse patterns and language usages, and effective shifts in teachers’ and students’ roles in the process of providing peer feedback.

Educational uses of social media websites, such as Facebook and Twitter, have begun to be investigated by researchers (Manca and Ranieri 2013). For example, Shih (2010) implemented a Facebook-integrated blended learning model in an English writing class for first-year students majoring in English at a Taiwanese university. Peer assessment was included on the Facebook page designed for English writing. Using a pre- and posttest design, Shih (2010) found that the students made significant improvement in English writing in terms of content, organization, structure, vocabulary and spelling, and genre awareness. The use of Facebook as a platform for peer assessment was positively perceived by the students as Facebook-based activities promoted collaborative learning and enhanced students’ interest and motivation. However, as Manca and Ranieri (2013) note, the educational value of Facebook has not yet been fully explored and the assumption that using Facebook could meet the expectations of younger generations of learners, known as digital natives, is not well supported by empirical studies. Manca and Ranieri (2013) reviewed 23 research articles on using Facebook as an instructional platform and noticed that the digital natives or millennial learners did not necessarily have enthusiasm for educational technology and some of them were not willing to use Facebook for formal learning because it seemed to them in conflict with the purpose of Facebook.

**L2 writing and AWE**

In the past decade, research has examined the use of AWE tools for helping learners with their writing, that in some cases these promising tools can be challenging to implement with the intended effects. For example, in a critical analysis, Stevenson and Phakiti (2014)
evaluated outcomes from research encompassing AWE systems specifically designed as tools for providing corrective feedback in the writing classroom. Overall, they found “only modest evidence that AWE feedback has a positive effect on the quality of the texts that students produce using AWE” with the exception of few cases where the researcher reported error correction improvement in students’ texts (Stevenson and Phakiti, 2014, 62). They also noted from their critical analysis of the research on the effects of AWE feedback on the quality of writing that “there is little clarity about whether AWE is associated with more general improvements in writing proficiency” (62). One problem that they noted with the research is the lack of clarity as to whether or not the feedback provided by AWE tools in their English class helps with writing students do in their content courses because “AWE programs generally offer only a limited number of genres, such as persuasive, narrative and informative genres” (Stevenson and Phakiti 2014, 13). Such a limitation might be avoided by having students work with more genres (see Burstein, Elliot, and Molloy 2016 for a detailed discussion of this issue) as well as by enabling teachers to use their own prompts such as in Criterion and My Access!

Another issue identified in research on AWE is that the automated corrective feedback in the AWE systems need to be implemented in view of the target audience and learning context. For instance, Chen and Cheng (2008), in a qualitative study investigating the use of AWE in the EFL classroom context in Taiwan, found that AWE feedback can be more effective when it is combined with teachers’ feedback. However, this study did not investigate the effects of the use of different feedback approaches on written production. Link et al. (2014) note that there are numerous possible ways of integrating AWE with teacher feedback. To illustrate, students can use AWE to help them improve the quality of initial drafts before submitting to the teacher for feedback or teachers can use AWE as a diagnostic tool to identify the problems that students have with their writing and provide feedback based on the automated analysis. Research needs to investigate the effects of these various options. Chen and Cheng’s (2008) study also showed that “the teachers’ attitudes towards AWE scores and feedback, their views on the role of human feedback, their conceptions of teaching and learning of writing, and their technology-use skills in working with the AWE program” (103) all affected the ways they used AWE in their classes.

In addition to the empirical studies on Criterion and My Access!, Rich (2012) conducted a quasi-experimental study using a pre- and post-test design to examine the effects of Writing Roadmap 2.0, an AWE tool developed by CTB/McGraw-Hill, on Chinese learners of English at a middle school in Dalian, China. In Rich’s study, Writing Roadmap 2.0 was used by the experimental group in two writing prompts during a period of 7–10 weeks and the AWE-generated scores were used to gauge students’ improvement. The experimental group had a higher average gain score than the control group with an effect size of 0.30. In a post-test survey, Rich (2012) found that 94% of the respondents liked the AWE tool and 75% of them reported that they became more confident in English writing. Middle-school student participants in Rich (2012) were more active users of AWE and 61% of the respondents revised their essays three or more times. Wang, Shang, and Briody (2013) represent a research effort on a different AWE tool, CorrectEnglish, used in an EFL context in Taiwan. Through a comparison of the writing scores in a pre-test and a post-test of students in an experimental group and a control group, Wang et al. (2013) found that the experimental group had a positive perception of the AWE tool and they identified positive effects of the AWE tool on the experimental group students regarding error reduction and awareness of learner autonomy.

The previously mentioned studies approached the effects of AWE mainly from learner perspectives and paid limited attention to the instructors in AWE-supported classrooms. Grimes and Warschauer (2010), by contrast, investigated the perceptions of middle-school teachers’ use of My Access! in the United States. The middle-school teachers showed a high
level of trust in the AWE tool and they expressed interest in balancing their use of the AWE tool and conventional feedback. However, Grimes and Warschauer (2010) did not address how these teachers actually used the AWE tool to complement their teaching. Addressing this question, Link et al. (2014) investigated university-level ESL instructors’ perceptions and understanding of the use of Criterion. More specifically, their study looked at the ways that teachers used the tool in the ESL writing classroom, investigated teachers’ experiences with the AWE tool, and outlined areas of concern and suggestions the teachers expressed. Overall, they found that AWE tools can be implemented to achieve a variety of purposes, ranging from fostering student autonomy and motivation, to enhancing students’ metalinguistic knowledge. Also, some instructors used the AWE tool as a grammar checker to help them to spend “less time on students’ language issues and more time on organization and meaning, which fits the nature of a process-based approach to writing” (338). Link et al. (2014) found that the teachers had a positive perception of the effectiveness of the AWE tool especially with the grammar feedback it provided. Moreover, they found the tool to be a motivational factor for their students to write better. Based on the teachers’ reflections, Link et al. (2014) noted some key practices for an effective integration of AWE into the university-level ESL writing classrooms. Specifically, the lack of familiarity with the AWE tool had a direct impact on teachers’ ability to integrate it into their classroom. Further, discussion and collaboration with the other teachers was a key to using the affordances of the tool creatively and effectively. Even when AWE tools exhibit flaws—as all tools will—knowing what these are can help teachers to identify potential learning opportunities for their students. For example, inconsistent and inaccurate feedback from an AWE tool can be pointed out to draw their attention to grammatical issues and show them how to overcome difficulties with less than perfect feedback.

**L2 writing and corpus-based technologies**

Empirical studies of corpus use for data-driven learning have yielded positive findings (Flowerdew 2012). For example, Garner (2013) examined the effects of a data-driven learning approach on ESL undergraduate students’ use of linking adverbials. Two data-driven learning activities were designed as treatments: (1) indirect corpus use by showing a concordance line and short context reading, and (2) direct corpus consultation using the COCA and the Michigan Corpus of Upper-level Student Papers (MICUSP). Through an analysis of pre- and post-treatment essays produced by the students in a control and a treatment group, Garner (2013) found that the students in the treatment groups used more academic linking adverbials with a higher accuracy in their post-treatment essay, compared with the students in the control group, who received traditional instruction on linking adverbials. Similarly, Friginal (2013) compared the development of report writing skills of two groups of students (N=28), one with corpus-based instruction and one with traditional instruction within a two-week period at an American university. A corpus of professional writing and learner corpora was used in the treatment group with special attention to four linguistic features: linking adverbials, verb tense, reporting verbs, and passive sentence structure. This study found that the post-treatment writing by the students in corpus-based instruction group was closer to the professional writing in terms of frequency and distribution of the targeted linguistic features.

Investigation of English language learners’ interaction with corpus-based materials through micro-level analysis of learners’ behaviors has revealed positive learning outcomes associated with intensive interactions with corpus tools. For example, Park (2012) followed three Chinese undergraduates in an academic English writing class at a U.S. university and analyzed their use of Google’s Custom Search on a corpus of academic texts, based on screen recordings, oral and written reflections, and student essays. Analysis revealed that the
students were active in solving language issues through “retrieving, evaluating, and appropriating search results from the corpus” (Park 2012, 380). Park highlighted the importance of evaluating and analyzing query results on the students’ part, which calls for careful learner training in L2 writing classes. With a focus on the use of a corpus as a source to inform students’ revision in a short essay-writing assignment, Tono, Sataka, and Miura (2014) studied 93 EFL undergraduates’ revision behavior with the aid of IntelliText, an online corpus query system. The findings indicated that interacting with the corpus tool helped students correct grammatical errors. However, the accuracy of correction was significantly different among three types of errors, namely omission, mis-formation, and addition, which highlights the need for research to have a closer look at the learner-corpus interaction for different purposes.

Besides the use of corpus tools for lexico-grammatical learning, there are relatively fewer studies on the use of a corpus for discourse level learning and writing, especially for academic writing (Birch-Becaas and Cooke 2012; Chang 2012; Charles 2007; Tribble and Wingate 2013). Tribble and Wingate (2013) reported on their design and ongoing construction of the Apprentice Writing Corpus (AWC) at King’s College, United Kingdom, which is unique in that it is a corpus in which genre features (move structure) are analyzed. The authors hosted seven workshops for the students in Applied Linguistics and Pharmacy separately and evaluated the materials based on a discipline-specific corpus using questionnaires and audio recordings of participants’ discussion. It was found that the workshop participants positively perceived this top-down processing of corpus data with discipline-specific move structure.

Another major area of corpus-based research on L2 writing results is the development of new tools. For instance, Chen et al. (2015) built a paraphrasing tool called PREFabricated Expression Recognizer (PREFER) based on an English-Chinese parallel corpus using natural language processing technique and machine translation. According to Chen et al. (2015), PREFER features a multiword search and multiple types of output, including a list of paraphrases in English and Chinese, usage pattern, and example sentences. The utility of PREFER was investigated with 55 Chinese-speaking learners of English in a pre- and post-test design. Results suggest that students’ paraphrasing performance improved and that students preferred this tool over online dictionaries and a thesaurus for paraphrasing purposes.

Following the principles of accessibility, simplicity, and functionality, Bloch (2009) reported a design of a web-based concordancing program which is specialized for learning and choosing reporting verbs in academic writing. This online tool is designed to enable users to customize their queries regarding the functional features or rhetorical impact of reporting verbs. The output includes suggested reporting verbs, as well as sample sentences based on a search in an academic writing corpus. These two tools exemplify the advantages of combining corpus analysis and online technology for teaching writing and hint at technologies to come.

Future research and development

Findings from empirical research on L2 writing technologies are promising. The availability of a wide range of technologies has the potential to facilitate the L2 writing, teaching, and learning process. At the same time, it also challenges L2 writing practitioners and researchers to investigate the best techniques and strategies to utilize these technologies to best answer the specific needs of their learning contexts. More emerging technologies are yet to be incorporated into L2 writing activities, L2 writing pedagogy, and L2 writing research. Some of the new technologies currently under investigation are learning analytics (i.e., data for recording learners’ responses and choices) embedded in course management systems, keystroke logging, as well as eye tracking.
Learning analytics is defined as the educational instruments designed to collect, measure, and analyze students’ learning data with a goal of better understanding learning processes and predicting learning outcomes in educational contexts (Long et al. 2011). In many fields of study, efforts are being invested in analytic approaches to learn from large datasets. In education, such data mining research may inform approaches to L2 writing data collection and analysis. Writing-based learning analytics, such as Mi-Writer developed at Athabasca University, Canada, is one of the learning analytics designed to capture data throughout a writing process, including planning, composing, reviewing, editing, and feedback-giving. For example, students’ writing behavior and interaction with peers and teachers can be recorded in real-time. Mi-Writer is also capable of generating writing-related metrics for both L2 writers and L2 writing instructors (Clemens, Kumar, and Mitchnick 2013). Such data collection mechanisms open the possibility of facilitating automated real-time feedback that is tailored to individual learners.

Learning analytics can be treated as a comprehensive technology which will also benefit from integrating other techniques such as keystroke logging and eye-tracking technologies. New unobtrusive data gathering techniques such as keystroke logging and economically more feasible techniques involving eye tracking can help practitioners and researchers better understand students’ writing behavior, multimodal composition processes, as well as strategies employed for resource use and self-regulation (Anson and Schwegler 2012; Johansson et al. 2009; Leijten and van Waes 2013). For example, Johansson et al. (2009) employed keystroke logging software and eye tracking to explore the writing processes of two types of computer-based writers: monitor gazers and keyboard gazers. Their findings indicated different patterns of reading and writing behaviors from these two types of writers, as well as the impact of these behaviors on writing production. Miller, Lindgren, and Sullivan (2008) utilized keystroke logging software to record the bursts and pauses in 17 learners’ typing as a way to monitor their writing process. Miller et al. (2008) argued that keystroke logging as an unobtrusive instrument can reveal learners’ planning, formulation, and revising processes. They also suggested several applications of a keystroke logging instrument in teaching L2 writing. Replaying the keystroke logging data, for instance, may provide diagnostic information to teachers and valuable opportunities for learners to reflect on their writing process. Therefore, the analysis of keystroke logs shows potential in L2 writing research, even though aligning such data with L2 writers’ cognitive process is not incorporated into CALL practices yet (Baaijen, Galbraith, and de Glopper 2012).

Conclusion

This chapter reviewed the three major categories of technologies, namely Web 2.0 applications, AWE, and corpus-based tools. These new technologies are shaping how L2 writing is practiced and taught. Therefore, language teachers should be open to the development of new technologies that have the potential to assist L2 writing. Openness in this domain means that L2 writing teachers are expected to experience these technologies themselves and then to make critical evaluation of the technologies for their utility in L2 writing contexts. In using these technologies, language teachers should not underestimate the importance of learner training. Even when using technologies that L2 learners are already familiar with, teachers need to teach the desired practices through carefully designed learner training (Hubbard 2004; O’Bryan 2008; Pritchard 2013). Likewise, Reinders and Hubbard (2013) remind us of a potential mismatch between learners’ “natural” use of technology and suggested “ideal” use of technology for learning (372). Consequently, learner training is even more critical with the technologies designed especially for writing pedagogy, such as corpus-based tools (Breyer 2009) and AWE tools (Link et al. 2014). While independent access remains possible, the
relative success of many of these tools will continue to rely on classroom teachers as teachers play a pivotal role in technology-enhanced classrooms (Chen and Cheng 2008; Hubbard and Levy 2006; Kim 2007).

REFERENCES


