Handbook of Research on Digital Tools for Writing Instruction in K–12 Settings

Rebecca S. Anderson
University of Memphis, USA

Clif Mims
University of Memphis, USA

A volume in the Advances in Educational Technologies and Instructional Design (AETID) Book Series

Information Science REFERENCE

An Imprint of IGI Global

Chapter 30
The Integration of Digital Tools during Strategic and Interactive Writing Instruction

Jennifer Renėe Kilpatrick
University of Tennessee, USA

Hannah M. Dostal
University of Connecticut, USA

Rachel Saulsburry
University of Tennessee, USA

Kimberly A. Wolbers
University of Tennessee, USA

Steve Graham
Arizona State University, USA

ABSTRACT

The purpose of this chapter is to gain insight from the ways a group of elementary teachers of the deaf and hard of hearing chose to integrate digital tools into evidence-based writing instruction and the ways these technologies were used to support student learning. After professional development that exposed these teachers to twelve new digital tools, they were observed incorporating several new tools into their instruction; however, most of the tools were not the ones targeted during professional development. There are factors related to both teacher perspectives and professional development design that seem to play a role in what digital tools are used, how they are used, and who uses them. Based on these factors, suggestions are made for the design of future professional development that more effectively introduces technologies to teachers and supports their efforts to integrate these tools into classroom instruction.

INTRODUCTION

In the recent past, advances in technology have quickly and dramatically impacted the way we read, write and communicate. Blogs, wikis, e-mail, instant messaging, text messaging, digital gaming, social networking, and applications software have all become an integral part of students' community and personal literacies (Gerber & Price, 2011; Kist, 2010; Kress, 2003; Leu & Kinzer, 2000; New London Group, 1996). Digital tools are inextricably woven into their everyday

cultural and literacy practices. Given the ubiquity of digital tools in our societies, engaging in school-based learning devoid of these technologies might actually feel foreign to our students. Integrating technologies into the classroom in support of teaching and learning has the potential to help connect to students' prior knowledge and build on their previous experiences.

In this chapter, we give focus to instructional writing approaches that capitalize on the technologies available to the current generation of writers. When digital tools traditionally used outside of the classroom are invited into the classroom, there is potential not only to motivate students and connect with their interests and experiences, but also to enhance key components of effective writing instruction, such as idea development (Graves, 1983) and writing for authentic purposes and audiences (MacArthur, Graham, & Fitzgerald, 2005). We entered into this work by first observing and learning from teachers who integrate digital tools into effective, evidence-based writing instruction. The teacher participants were a small group of elementary teachers of the deaf and hard of hearing. These teachers were involved in grant funded development efforts related to Strategic and Interactive Writing Instruction (SIWI). We identified what digital tools they selected and used during writing instruction and explored how those tools were used to support the writing process. Then, we examined how teachers responded after a professional development session where they were introduced to new digital tools specifically chosen for their ability to complement their teaching and learning practices.

BACKGROUND

In this section, we provide information about the instructional approach that that guides the writing instruction in the classrooms involved in the study and the relevant research that has been done on the integration of digital tools during writing instruction.

What is Strategic and Interactive Writing Instruction?

The current study is a part of a three-year grant project to more fully develop SIWI for the later elementary level and then assess its ability to positively impact student literacy achievement. SIWI is an approach to instruction that includes a focus on both strategy instruction (Englert, Raphael, Anderson, Anthony, & Stevens, 1991; Graham, 2006) and interactive writing (Englert & Dunsmore, 2002; Englert, Mariage & Dunsmore, 2006; Mariage, 1996, 2001; Wolbers, 2007). Additionally, there are specific components of SIWI which respond to the linguistic and metalinguistic needs of students who are deaf and hard of hearing (Wolbers, 2010). For example, the approach includes the use of a strategy called the "language zone"--a space in which an idea can be captured in a variety of mediums (e.g., acting, drawing, writing) while developing the language associated with the idea. The language zone is often used to assist deaf and hard of hearing students who communicate manually in translating from American Sign Language (ASL) to English; however, it can be used with all students to develop their receptive and expressive language. Another component of SIWI is *NIP*-it lessons. *NIP*-it lessons are mini-lessons in which teachers *Notice* a student's need, then provide explicit *Instruction* outside of collaborative writing followed by opportunities for contextualized *Practice* of this skill within authentic writing.

While the SIWI instructional approach does encourage independent writing, guided, interactive writing is a core component. During guided, interactive writing, the students and teacher construct text collaboratively. Because SIWI also

places emphasis on authentic writing experiences, co-construction is done with an audience and purpose in mind (Wolbers, Dostal, Bowers, 2012). Students choose the topic they will write about, an audience they will write for, and the type of publication they will create. This provides the opportunity to target language and writing skills with text that is valued by and meaningful to students.

What Does the Research say about Digital Tools?

Although one might expect recent technology developments to have led to an increase in both technology use during writing instruction and the amount of research conducted on this use, a review of the literature indicates otherwise. A meta-analysis of 25 years of research examining the use of technology to support students with learning disabilities in writing composition reported that little new research has been done in the last ten years (Peterson-Karlan, 2011). In fact, this analysis indicates that the amount of research done in this area has actually dramatically declined since the turn of the century. In other words, while technology developments have been quickly impacting the way we are reading and writing, research has not equally reflected this area of focus. In a recent study of writing instruction in secondary schools by Applebee and Langer (2011), it was reported that teachers have been slow to include the use of technology during writing instruction. In this study, the researchers conducted observations of 260 classrooms in twenty middle and high schools across five states, and they found that technology was used in less than one-third of the English and Language Arts classrooms.

When digital tools are used during instruction, it is important to consider who is using the digital tools and which tools are being used. Research has reported that the primary users of technology in the classroom are teachers, not students (Applebee & Langer, 2011). This suggests that digital tools are not being used to provide students

with new opportunities; instead, they are being used to reinforce traditional patterns of teacher-centered instruction. Moreover, when secondary students are given opportunities to use technology during writing instruction, the technology typically consists primarily of word processing programs (Applebee & Langer, 2011; Harris, 2011). Applebee and Langer (2011) observed, "Students seem to mostly use word processors as a powerful typewriter with little embedding of video, audio, or graphics" (p. 23); this suggests students use word processing to continue writing in the way they always have. Research on the use of digital tools in writing instruction for students with disabilities has also focused largely on the use of word processing along with keyboarding, spellchecker, speech recognition software, text-to-speech software, and word prediction software (Peterson-Karlan, 2011). It seems these additional tools may have been chosen to make accommodations for students with disabilities to engage in traditional writing, rather than to influence or transform writing instruction.

Currently, the majority of the digital tools used during writing instruction are used for transcription (Peterson-Karlan, 2011); however, there are many digital tools that have the potential to be used in a variety of ways throughout the writing process (MacArthur, 1996). For example, there are a number of technologies that could be used during writing to help emerging writers generate ideas and allow them to share their work with authentic audiences. This is important because often students share their work only with their teacher and classmates. In a recent survey, a mere 11.1% of middle school teachers and 8.2% of high school teachers reported having students write for readers outside of the classroom (Applebee & Langer, 2011). In other words, almost 90% of these students had little to no access to an authentic audience. Creative story-building platforms (Tackvic, 2012), digital filmmaking tools (Sylvester and Greenidge, 2009), and blogs (Lacina & Griffith, 2012; McGrail & Davis, 2011) all provide users

with opportunities to write for authentic audiences by providing new, alternative, non-traditional ways to publish. As a result, these tools have the ability to influence *what* and *why* students write.

When elementary teacher Charlene Tackvic (2012) introduced students to Web-based story-building programs (e.g. Kerpoof, http://www.kerpoof.com; and Little Bird Tales, www.little-birdtales.com) she saw changes in *what* students wrote. She attributes these changes in content to the tools' ability to aid students with idea development, explaining, "The students loved having digital images to use when planning and writing. They weren't staring at a blank piece of paper; they were looking at thousands of images—images that helped with the creative process" (Tackvic, 2012, p. 427). Teachers in another study found similar results when they introduced elementary students to digital film-making. According to Sylvester & Greenidge (2009), film-making provides "a reason for writing and makes [students] more conscious of their audience, one that reaches beyond themselves and their teacher, and motivates them to write more clearly and with more detail" (p. 291). This suggests that these students were considering both *what* and *why* they were writing because using this digital tool provided them with an authentic purpose and audience.

Blogging is unique because it provides an avenue for discussion between the writer and the reader through commenting. Because classroom blogging provides opportunities to engage in authentic discussion, the use of this tool makes students more aware of their audience (Lacina & Griffith, 2012; McGrail & Davis, 2011). McGrail and Davis (2011) found this increased awareness caused students to begin with a purpose in mind and, consequently, had an impact on the content of their writing. This was especially evident in persuasive writing, where a comparison of writing samples from before and after blogging revealed that students had begun to synthesize while comparing and contrasting ideas. This suggests that blogs encourage students to consider both *what* and *why* they write.

In addition to the tools mentioned, there are a variety of tools that have the potential to be used during writing instruction to influence student constructions. MacArthur (1996) recommended several types of tools that could be used for a variety of writing processes. For example, digital checklists or prompting software that pose a series of questions to the writer could be used during planning or revising. Semantic mapping or outlining tools could be used to help students organize their ideas. Multimedia tools that allow students to draw, add background scenes, and objects in addition to text have the potential to help students with idea development, as well as, publishing. These tools were created to function as tools for writing, but it may also be possible that tools designed for purposes other than writing could be used during writing instruction.

THE USE OF DIGITAL TOOLS DURING SIWI

The research reviewed indicated that digital tools have the potential to support SIWI by helping the students consider both *what* and *why* they write. Using this rationale, we introduced a focus on digital tools to our existing research on SIWI and examined the results. After a brief description of the context of the study, we will describe how the study was designed, how the data was collected, and what we found after using professional development to introduce the teachers to new digital tools.

Context

Because SIWI is a flexible intervention framework, it can be implemented successfully in a variety of academic settings and language environments. In this particular study, six teachers, with 4 to 25 years of experience, provided writing instruction in programs with various language philosophies. These classrooms included one bilingual program classroom, one oral program classroom, and three

total communication, residential program classrooms. The 31 deaf and hard of hearing student participants had a variety of language histories, including students who use ASL, spoken English, English-based sign language, as well as students who were severely delayed in their expressive language development.

Methods and Data Collection

In this study, we explore two distinct sets of questions:

1. What digital tools do teachers use during SIWI? In what ways do these technologies support the writing process?
2. When teachers are introduced to digital tools through professional development, which tools do teachers choose to adopt for use during SIWI? In what ways do these technologies support the writing process?

These questions guided the design of the research.

We began our investigation by determining which tools teacher participants were already using during SIWI and which tools they might be interested in exploring. First, we reviewed video-recordings of the teacher participants' writing instruction and made note of the tools they were using and how they were using them. Next, we compiled a list of digital tools had the potential to assist teachers and students in the development and sharing of ideas, cooperative planning, and collaborative writing, as well as the publication of writing in a digital mode. This list consisted of approximately 50 digital tools—tools that had been used by members of the research team, recommended by consulted information technology specialists, and found using Internet searches of several key phrases (e.g., digital tools for writing, apps for writing, apps in education). We read descriptions and reviews of each of these tools and considered ways in which they could be

used during writing instruction before narrowing the list to approximately 35 digital tools. We then experimented with each of the tools on this list to identify the tools that were the most versatile and user-friendly. Based on these two criteria, we created a final list of 20 digital tools (see Table 1), consisting primarily of applications software, more commonly referred to as "apps."

Next, we designed and distributed a survey to participating teachers. The purpose of this survey was to determine which digital tools the teachers were most interested in exploring and considering for implementation. The survey included the name, a brief description, and a hyperlink to a Website with additional information for each tool. Teachers indicated whether or not they would be likely to implement each tool using a Likert scale (1- Definitely Not, 2- Probably Not, 3- Neutral, 4- Probably, 5- Definitely). Because there was a desire to introduce the teachers to tools which could be used for a variety of processes throughout collaborative writing, the survey was divided into three sections: Planning and Organizing, Co-Constructing Text, and Publishing Writing. The tools were placed into these groups to ensure that we gave attention to all parts of the writing process during the professional development; however, it is important to note that many of these tools are versatile and could be used for a variety of writing processes.

In accordance with our commitment to the use of digital tools, the survey was developed and the responses were collected using *Google Drive*, a free, Web-based tool designed for creating, sharing, and collaborating via digital documents. This digital tool allowed us to quickly and easily design the survey and subsequently administer it electronically. After the teacher participants completed the survey, we used *Google Drive* to compile their responses into an easy-to-read *Google Spreadsheet*. We used the data collected to identify the twelve tools the teachers were most interested in implementing. Next, we planned and conducted a two-hour professional development

Table 1. Digital tools. This figure provides descriptions of the apps included in the teacher survey.

Planning		
Tools 4 Students	iPad	Tools 4 Students features 25 graphic organizers perfect for use as a pre-writing activity. You can save the graphic organizer a digital file or print it.
Popplet*	iPad	Popplet is a collaborative brainstorming tool that allows you to display your ideas. You can create graphic organizers, timelines, and many other forms of visual organization.
Knowmia*	iPad	Knowmia is a free lesson planning and recording tool for teachers. You can import your own visual aids, write on the screen, and record video of yourself.
Screenchomp*	iPad	ScreenChomp allows you to analyze and annotate over pictures or write on the screen like whiteboard. Your work can be recorded and played back from the Internet.
Corkulous*	iPad	Corkulous is a place to store your ideas. You can upload photos and add text to a cork background. It can be used for inspiration, notes, and brainstorming.
Co-Construction		
Educreations*	iPad	Educreations turns your iPad into a recordable whiteboard. It allows you to create video tutorial with voice recording, realistic digital ink, photos and text.
Evernote*	iPad, iPhone, Web	Evernote is designed for notetaking. A "note" can be a piece of formatted text, a full Webpage or Webpage excerpt, a photograph, a voice memo, or a handwritten "ink" note. Notes can also have file attachments (including short videos).
Notability	iPad	Notability is also designed for notetaking. You can type, change font sizes, draw, insert pictures and Web clips, create your own drawings, and include handwritten notes.
Padlet*	Web	Padlet is a blank wall. You can type, add pictures, or add links to videos, Websites, and files.
Upad Lite	iPad	Upad is another notetaking app. You can type, hand write, or add pictures.
Dropbox*	iPad, Web	Dropbox is a place to store your files on the Internet. "Never e-mail yourself a file again!" Because your files are on the Web, you can access your pictures, videos, documents, and another other files you might save on all your devices. It also makes sharing your files with others quick and easy.
Publishing		
Kid Blog*	iPad, Web	Kidblog is a blog publisher based on WordPress. It's designed just for kids without the unnecessary distractions.
Wikispaces*	Web	A wiki is a space on the Web where you can share work and ideas, pictures and links, videos and media—and anything else you can think of. Wikispaces is designed to be easy for students and teachers.
Fodey*	Web	Fody allows you to publish your writing in a newspaper format. When you're done, you can download your newspaper clipping as a jpeg to print or publish on a class Website, wiki, blog, or twitter.
iBooks Author	Web on a Mac	iBook Author allows you to write books by adding pictures and text to a blank template. Documents created with iBooks Author may be exported as PDF files or published as iBooks on iTunes.
Book Creator	iPad	Book Creator allows you to create ebooks directly on the iPad. You can drag saved images to your workspace and resize them or move them as you like. You can add text by typing into a text box and choosing the font size, type, and color. You can publish as an iBook or PDF.
Story Jumper*	Web	Story Jumper is a site that allows you to create digital books. After stories are created, they can be read online. A hard copy of the book can also be purchased.
Glogster	iPad, Web	Glogster is a social media site that allows users to create free interactive posters or "glogs." It looks like a poster, but readers can interact with the content. You can add text, pictures, videos, and links to anything on the Internet.
(POW!) Strip Designer	iPad	Strip designer allows you to create a comic strip using your own pictures. You can add photos from your photo album or draw your own sketches, then add speech bubbles and text boxes.
Chogger	Web	Chogger is an online comic strip maker. It allows you to draw images from scratch or use your own (pre-existing) pictures. You can even connect your Webcam to Chogger to capture pictures for use in your comic strip.
*Digital tools introduced to teachers during the professional development session.		

session to introduce the teachers to these tools. During the first ninety minutes of the professional development, we highlighted the key functions of the digital tools, used artifacts and ideas from the teachers recent lessons to present examples of the various ways the tools could be used, and asked the teachers to discuss how they envisioned implementing these tools in their classrooms. The last half-hour, we provided laptops and iPads for the teachers to experiment with these new digital tools with our support. We concluded the session by asking the teachers two questions: 1) Which of these digital tools do you want to implement in your classroom? 2) If you could design a digital tool to use in your classroom, what would it allow you to do?

Following the two-hour session, we provided continuing professional development by modeling several of the digital tools, which had been introduced to the teacher participants. For ten weeks, we continued to collect data on the teachers' use of digital tools by video-recording and reviewing their daily writing lessons and collecting and examining their co-constructed writing samples. Observation notes were inclusive of tools introduced through professional development, as well as, tools the teachers selected and incorporated on their own. In weekly meetings, we were able to ask the teachers to provide additional information on their use of digital tools to clarify and expand on our observation notes. At the conclusion of the ten weeks, we conducted a group interview with the teacher participants and asked them to reflect on their use of digital tools to support SIWI.

Findings

The findings are structured into two sections in response to our research questions. In the first section, we give attention to the digital tools that teachers selected and implemented without input or assistance from the research team. Teachers were observed using these tools both prior to and following the professional development session. In the second section, we give attention to the tools that were introduced and modeled by the team.

Question 1

What digital tools do teachers use during SIWI? In what ways do these technologies support the writing process? Over the course of the study, teacher participants were observed using a variety of digital tools that were not introduced by the researchers. The tools teachers selected and implemented included computer projectors, online video calling software, Web-based books, wireless keyboards, and a video editing software application.

All teachers were observed using computer projectors during guided writing instruction. Five of the six teachers had interactive whiteboards in their classroom. One teacher did not have an interactive whiteboard but used her laptop and a projector in similar ways. The teachers were seen using these tools with students throughout several processes of writing. For example, some teachers used the interactive whiteboard as a language zone to help the group reach a shared understanding of new ideas and build knowledge of the language representing those ideas before adding them to the co-constructed text. Teachers guided this process by projecting Websites, screenshots of videos, and other images onto the whiteboard in order to label vocabulary terms, expand or translate student language, and support rich language discussions on a wide variety of topics. Using the projectors and whiteboards in this way allowed students to develop their ideas and impacted *what* they were writing. After planning and organizing with the support of the language zone, all of the classes used the interactive whiteboard to co-construct text. In some classrooms, as students expressed sentences through the air, the teacher transcribed them using typewritten text in a word processing program, which was projected on the interactive

whiteboard. In other classrooms, teachers used an interactive whiteboard program to transcribe students' sentences using digital handwritten text. Edits and revisions were then made in the same manner, typically using an alternate color.

One teacher was observed using *Skype* (https://login.skype.com/login), a Web-based interface that allows persons to make audio and video calls. This teacher had planned to purchase a pet fish for the classroom and engaged her students in the researching and decision-making process. Together, they researched types of fish, aquariums, and additional information related to caring for fish. As a part of this process, the class created questions for a fish expert, and then invited a *Petco* employee to visit the school for an interview. The employee's schedule prevented him from being able to visit the school during the students' writing time, so *Skype* was used to allow him to enter the classroom virtually. After using *Skype* to gather necessary information, the class purchased the fish, fish food, and caretaking supplies. Meanwhile, they also created a poster with expository text on how to care properly for one's fish and tank. The class sent a copy of their completed poster to the *Petco* employee for him to hang near the fish tanks in the store so that the information their class learned could be helpful to others who planned to buy a fish. Not only did the teacher provide an authentic experience for writing, she used a digital tool to support the authenticity of the process. Using *Skype* in this way allowed her students to consider both *what* and *why* they were writing.

During the planning phase of writing, several teachers took advantage of the benefits of Web-based books (e.g., *Big Universe*, http://www.biguniverse.com, and *Reading A-Z* books, http://www.readinga-z.com). When teachers projected these books onto the interactive whiteboard during read-alouds, students were able to see both the English print and the ASL side-by-side. These books served as model texts, helping to build knowledge of genre-specific writing structures

and content language. During planning, the teachers often projected these Web-based books as a reference for idea development, impacting *what* they were writing. For example, the students in one class wanted to write about "starfish," so the teacher used several Web-based digital books to guide the students in their research prior to writing, and the students were able to use this information to develop their ideas, create a plan, and construct their own expository text about the animal.

Some teachers were observed using a wireless keyboard during instruction. This tool allowed teachers to use the keyboard from anywhere in the classroom and to share keyboard capabilities with students. One teacher participant expressed frustration that her laptop screen acted as a physical barrier to signed communication with her students. This occurred particularly when the teacher was typing during the co-construction of text. She decided to experiment with a wireless keyboard and quickly began to treasure this new device. The teacher also used this tool to increase student participation. When editing and revising, the teacher allowed the students to take turns using the keyboard to edit sentences, highlight targeted objectives (e.g., topic sentence, pronouns, past tense verbs, etc.), and use the cursor to lead classmates in re-readings of the text. The teacher commented, "Now that I have the wireless keyboard, I feel like I'm able to be more interactive with my students and that they are more engaged during lessons."

Finally, one teacher used *iMovie*, a software program used to combine and edit video clips, to increase student motivation and engagement and to impact *what* the students were writing. After transitioning from narrative to expository writing, the teacher found that her students were struggling to develop their ideas and maintain interest throughout the writing process. Because many of her students enjoyed talking and learning about cats, the teacher thought that using her own cat as a writing topic would be a good way to target expressive language development while also in-

creasing participation. She was able to bring her cat into the classroom by showing the students a video created in *iMovie*. Following several viewings of the video, the students readily participated in both general discussions about the video and focused conversations regarding ASL to English translations. Next, the teacher placed screenshots from the video into the language zone, where the class discussed their ideas in ASL before adding English words and phrases. During planning and organizing, the language zone was as a reference to assist with the continued development of ideas. While co-constructing text, the students continued to use the language zone and also the planning document as a reference.

Question 2

When teachers are introduced to digital tools through professional development, which tools do teachers choose to adopt for use during SIWI? In what ways do these technologies support the writing process? As we mentioned previously, we concluded the professional development session by asking the teachers the following two questions: 1) Which of these digital tools do you want to implement in your classroom? 2) If you could design a digital tool to use in your classroom, what would it allow you to do? In response to the first question, four of the teachers said they would like to use *Popplet* (www.popplet.com), an iPad app that allows the user to create Webs, timelines, and other graphic organizers. One teacher commented that this app would have been a perfect tool for her students to have used for planning during a recent co-construction. Another teacher was interested in using *Dropbox* (www.dropbox.com), a cloud-storage and sharing tool. A final teacher planned to further explore *Wikispaces* (http://www.wikispaces.com) and *Kidblog* (www.kidblog.org/home). In response to the second question, several teachers discussed the desire to have interactive whiteboard software that would allow them to scroll or slide between pages and/

or screens easily. They reported that they would use this tool to keep multiple documents (e.g. planning, organizing, language zone, and co-constructed drafts) easily accessible throughout co-construction. This tool would grant them the opportunity to emphasize the recursive nature of writing by allowing them to move seamlessly between the processes.

While the majority of the teachers reported that they planned to try out *Popplet*, none of them did. During the study we observed teachers using only two of the digital tools that were introduced to them through professional development. These tools included *Dropbox* and a wiki site similar to *Wikispaces*. There were also several digital tools that we, the authors and members of the research team, chose to use in order to provide further modeling and support classroom writing instruction.

Dropbox is cloud storage that is accessible via most computers, tablets, and smartphones. This tool allows the user to upload, share, and download files—documents, images, videos, presentations, etc. When a *Dropbox* user uploads files, they are automatically saved as "private," meaning only the user can see them. However, the user can change the settings to share a file or folder with individuals or make it "public" to anyone with the hyperlink. Several teachers used *Dropbox* to share student work products. After publishing a co-constructed text, teachers used *Dropbox* to share work with the research team and additional audiences. In addition to co-constructed text, teachers also shared independent student samples in this way.

When introduced to *Wikispaces* and *Kidblog* during the two-hour professional development session, one teacher thought these tools would be a great way to expand the audience for whom her students were writing. While she was interested in these tools, she was aware that her school's server provided a wiki tool. A wiki is essentially a Website that allows individuals to collaboratively create content. When she returned to her school she sought assistance in setting up a class wiki. For the remainder of the school year, the class

posted both English and ASL co-constructions on the wiki that was accessible only by their parents. Parents were able to read their students' writing and respond through comments. This communication between the writers and readers provided an authentic audience and purpose for writing. This impacted *why* the students were writing and also increased the students' motivation for writing.

Following the initial professional development session, we felt that it was important to model the use of various technologies while providing support to teachers and students. We did this to further demonstrate the benefits and value of using digital tools. Prior to introducing a focus on technology into our research, we had begun to provide feedback to students on their writing through both videorecordings of ASL responses and written notes. Our feedback was intended to make the students more cognizant of both *what* and *why* they were writing, by increasing student awareness of the audience. During the last quarter of the school year, we chose to use *Knowmia* (see Figure 1) and *Skitch* to provide feedback to students on their writing. *Knowmia* (http://www.knowmia.com) is an application that turns an iPad

into a recordable interactive whiteboard allowing the user to capture pictures, drawing, writing, and sound to create a movie. Unlike other recordable interactive whiteboards (e.g., *ShowMe*, http://www.showme.com; *ScreenChomp*, http://www.techsmith.com/screenchomp.html; and *Educreations*, http://www.educreations.com), *Knowmia* also allows the user to embed videos recorded using the iPad's built-in camera into the movie. This feature allowed the user to combine both written and video-recorded feedback to create a movie that allowed students to view their writing sample and written feedback while also watching feedback provided in ASL. *Skitch* is an app that allows users to type, write, sketch, and add shapes and arrows on imported images (e.g. photos, screenshots from the Internet, maps, PDFs, etc.) We took digital photographs of student writing samples, imported them into *Skitch*, and added feedback using the available tools. Both of these tools allowed the user to provide feedback that was more accessible to students, strengthening the writer-reader relationship.

Another app, *Educreations*, was used to provide support for one student who was not showing

*Figure 1. Screenshots from video feedback created using Knowmia*

progress on his instructional objectives. When two of his teachers expressed concern over his inconsistent performance in writing, a meeting was scheduled with the teachers, several members of the research team, and a special education consultant from a local university. During the meeting, the teachers emphasized that this student responded well to auditory prompting. To capitalize on this strength, it was suggested that auditory support be added to the editing checklist he used during independent writing. After the meeting, a new student checklist was created and implemented using *Educreations* (see Figure 2). Like *Knowmia*, this app turns the iPad into a recordable whiteboard and allows the user to create a movie that can be played again and again. *Educreations* was used to create a checklist that included both visual and auditory scaffolds. When the student began to use the app to access his checklist and edit his independent writing samples, he subsequently

began to make observable progress on his writing objectives. Educreations was used to meet a need that would have been more difficult to meet using traditional methods.

Although we provided additional modeling of *Knowmia*, *Skitch*, and *Educreations*, none of the teachers incorporated these digital tools into their writing instruction. We saw potential for these tools to be used to support SIWI during various processes of writing. For example, both *Skitch* and *Educreations* could be used in the language zone to foster language development. They could also be used during planning or to create editing or revising checklists. *Knowmia* could be used in these ways, but it could also allow students to publish English and ASL texts side-by-side. While we saw the potential for these technologies to be used in these ways, our modeling demonstrated only one possible function for each of the applications.

Figure 2. Screenshots from a writing checklist created using Educreations
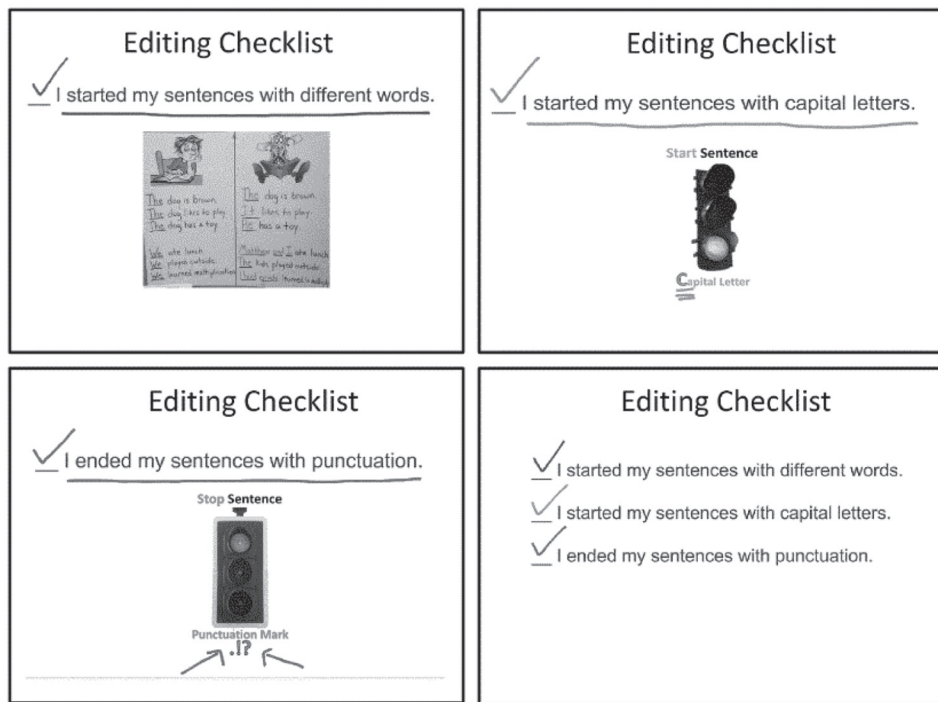
Discussion

In the initial stage of this study, we observed the teacher participants using several digital tools during writing instruction. After receiving professional development focused on technologies that could be used to support SIWI, the teachers integrated several additional tools into their instruction. However, the majority of the additional tools the teachers implemented were found without assistance from the research team. Technologies introduced during the professional development session, including those modeled extensively by the team in the weeks that followed, were not taken up by the teachers, with the exception of *Dropbox* and a wiki. In this discussion, we identify several factors that may have influenced teachers' decisions to incorporate digital tools available to them, including factors related to teacher perspectives and factors related to the design of professional development. Finally, we make recommendations for the design of digital tool professional development for teachers based on each of these factors.

Recognizing Teachers as Digital Immigrants

Students of the 21st century were born into a world infused with technology. Prensky (2001) designates these students as *digital natives*. On the other hand, Prensky (2001) explains that teachers "who were not born into the digital world but have, at some later point in (their) lives, become fascinated by and adopted many or most aspects of the new technology are, and always will be, compared to (students) *digital immigrants*" (pp. 1-2). This distinction is important, because teachers are ultimately the ones who decide what digital tools will be used and how those tools will be used to support writing instruction. While digital immigrants embrace technology, they tend to approach it in a very different way. For example, digital natives assume that a digital tool itself will teach them how to use it, but digital immigrants

will often still read the instructions prior to use (Prensky, 2001). Teachers may see the value of adding technology to their instruction without seeing the *necessity* of it. Moreover, they may not see the necessity for students to be the users of the technology.

Our findings mirrored prior that has shown that teachers are the primary users of technology in the classroom (Applebee & Langer, 2011). Students did use digital tools such as interactive whiteboards, wireless keyboards, Skype, and an Educreations checklist; however, teachers were still leading the use of these technologies. One teacher reported that she chose not to have the students use the school iPads during writing instruction because she felt that they would become a distraction. This may be one of the reasons that the iPad apps introduced through professional development were not implemented by teachers. Teacher beliefs have an impact on decisions regarding the use of technologies. For teachers to change their practices, they must first make changes to their beliefs (Albion & Ertmer, 2002). We recommend using professional development to have teachers begin to examine and transform their beliefs about the use of technologies. One way to focus on teacher beliefs is to present teachers with questions that require them to think about how they view the technology and its purpose. Building this awareness is imperative if they are to use technology to extend and increase the effectiveness of their instruction by allowing students to use technology to write (Ertmer & Ottenbreit-Leftwich, 2010).

Acknowledging Affordances and Constraints

When teachers select digital tools to implement in support of their writing instruction, they consider what have been referred to as *affordances* and *constraints* (Gibson, 1979; Norman 1999). Affordances are the things that a digital tool allows the user to do, things that could not have

been done otherwise. Constraints are the things that a digital tool does not allow the user to do. Consider the writing checklist that was created for a student using *Educreations*. *Educreations* allowed us to add visual and auditory supports to his checklist; these are affordances of this digital tool. *Educreations* was chosen in this instance because the available functions afforded us the ability to make a checklist that fit the student's needs. However, *Educreations*, unlike *Knowmia*, does not allow the user to add in videos. If the student had needed sign support, this constraint would have prevented us from selecting *Educreations* for this purpose. Norman (1999) emphasizes that there is a difference between an affordance and a perceived affordance. This is important because the affordances that matter are those that are perceived by the teacher selecting the tool. The teachers in this study typically selected tools that clearly allowed them to do something they could not have done without the tool. Wireless keyboards allowed teachers and students to add text to a construction from anywhere in the room. *Skype* allowed students to communicate with a person who was unable to come to the classroom. *iMovie* allowed a teacher to bring her cat into the classroom. The wiki allowed the students to extend their audience to include their parents. But there are affordances that are less tangible, such as idea development and increased motivation. Tools that provide affordances that go unnoticed are less likely to be adopted. We recommend that professional development explicitly recognize the affordances of the tools introduced to teachers. It is especially critical that affordances that are difficult to perceive be made visible through discussion and demonstration.

Choosing a Number

It is possible that the number of digital tools introduced during the session may have been overwhelming to teachers, accounting for their limited adoption of the tools. We chose twelve tools in order to provide a wide range of resources for teachers to choose from; however, twelve tools may have been too many to introduce at one time. One of the members of our research team recalled a similar professional development experience from her teaching career saying,

I loved using technology in my classroom. But I remember leaving one technology-focused professional development with a notecard full of usernames and passwords, feeling completely overwhelmed. There were a lot of great tools introduced, but I only implemented a few of them that year, and I know that many of my colleagues didn't implement any.

We recommend introducing tools in a way that allows teachers the opportunity to start implementing technology with small successful experiences (Ottenbreit-Leftwich, 2007). Limiting the number of tools introduced at one time through professional development will increase the amount of time spent on each tool. This approach has the potential to make the integration of new technologies more accessible to teachers.

Selecting Tools

Professional development should introduce teachers to tools that meet their instructional needs (Kanaya, Light, & Culp, 2005); consequently, teachers need to be involved in the selection of digital tools prior to professional development. We developed and used the survey in order to gather input from the teachers before planning the professional development. However, our approach was still somewhat researcher-centered. Instead of beginning by seeking input regarding how teachers felt technology could best be used to support instruction, we provided the teachers with choices, thereby limiting their influence on the digital tools selected for professional development. We recommend beginning with the teachers and students. They are the best resource for determin-

ing what affordances digital tools should provide. Finding out what needs teachers currently perceive in their classrooms prior to selecting technologies for modeling has the potential to increase teacher adoption of digital tools.

Modeling Tools

Ertmer & Ottenbreit-Leftwich (2010) recommend professional development that uses existing knowledge as a starting place and makes small steps in response to student needs. The intent of our professional development session was to provide teachers with a wide variety of digital tool options. As a result, we spent the first ninety minutes of the session providing a basic understanding of the various ways in which each tool could be used. We attempted to make these examples authentic and meaningful by incorporating ideas and artifacts from the teachers' previous lessons to demonstrate how these technologies could be used to enhance their current writing instruction. However, truly meaningful examples are unable to be provided within the confines of a professional development session (Eifler et al, 2001; Vannatta & Beyerbach, 2000). Although we did connect the digital tools to their classroom instruction, the tools were still modeled out of context, we recommend modeling tools within an authentic classroom setting and situating it within the context of teachers' ongoing work (Cole, Simkins, & Penul, 2002). Using this approach allows professional development to focus on how tools can be used to impact student learning goals, instead of on the technology itself (Ertmer & Ottenbreit-Leftwich, 2010). Teachers are more likely to incorporate technologies when they believe the tools address important learning outcomes (Ottenbreit-Leftwich, 2007) and have the knowledge (Lawless & Pellegrino, 2007) necessary to implement them in a way that supports those outcomes.

Building Teacher Self-Efficacy

While knowledge of digital tools is important, knowledge alone is not enough for teachers to adopt technologies; teachers must not only believe that digital tools can be used to achieve student learning objectives, but also believe that *they* can use digital tools to achieve student learning objectives. In other words, professional development needs to be structured in a way that increases teachers' confidence with digital tools. One way to develop self-efficacy with technology is for teachers to have positive classroom experiences with tools (Ertmer and Ottenbreit-Leftwich, 2010). Digital immigrants are often scared to take risks, and becoming comfortable with a digital tool can take a substantial amount of time. If a tool is not intuitive and cannot be quickly and easily understood or learned, a teacher is less likely to adopt that tool due to the amount of time required to become confident prior to implementing. With the amount of time teachers spend doing paperwork, planning lessons, and creating materials outside of instructional hours, there is little remaining time for teacher to devote to familiarizing themselves with new technologies. As a result, providing contextualized supports for teachers to build self-efficacy with a tool during the school day is critical. In addition to having their own positive classroom experiences with tools, teachers can also develop self-efficacy by observing their peers using technology effectively to facilitate student success (Albion & Ertmer, 2002; Ottenbreit-Leftwich, 2007). We suggest providing professional development that is focused on building teacher self-efficacy with digital tools and includes contextualized support during the school day. Positive experiences should include both opportunities to integrate digital tools into instruction, as well as, opportunities to witness knowledgeable peers integrate digital tools into instruction. Addition-

ally, support should be provided to teachers during initial uses of technologies to ensure those uses are successful (Ertmer and Ottenbreit-Leftwich, 2010). Initial success is essential if teachers are going to have the confidence to continue using digital tools in the classroom.

Timing Professional Development

The timing of the professional development provided by the research team may also have impacted the teachers' adoption of the tools that were introduced. The session was done in early April when most of the participating classrooms were finishing their third quarter of the school year. In the final quarter of the year, teachers may not have been focused on implementing digital tools but were instead thinking about final instructional units and assessments. Much instructional time was lost to high-stakes state tests and end-of-year progress monitoring assessments. During the ten weeks we observed the teachers' use of digital tools, the classes were also transitioning from expository writing to persuasive writing. At the professional development, teachers specifically brainstormed how they could use the digital tools during expository writing which was not as applicable as they began writing with different purpose. The transition from expository to persuasive text may, therefore, have been one factor that impacted the adoption of introduced tools. Lastly, by the fourth quarter of the school year, teachers had likely already formed classroom routines and habits, to which the students had become accustomed. Presuming the teachers were already finding success with other methods, they may not have seen the value in altering their practices mid-year. When one of the researchers visited one of the classrooms on the first day of the following school year, the teacher and students were excited to share the "About Me" Webs they had created using Popplet, a tool she had not chosen to implement during the ten-week study. This may indicate that teachers are more likely to

try out new teaching practices at the start of a new school year or even a new semester. We recommend considering the school calendar when planning professional developments to select a time that would be most conducive to the implementation of new tools.

FUTURE RESEARCH DIRECTIONS

"Our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (Prensky, 2001, p.1). Schools need to make radical changes of their own by altering how technology is viewed and used in education. Teachers must begin to use digital tools not only to support their instruction, but also to transform their instruction. This is especially true of the instruction occurring in writing classrooms, where technology should be used to impact what and why students are writing rather than to reinforce traditional writing instruction methods. Consequently, future research needs to aim at identifying ways to influence the expansion of digital tool use. Specifically, research should focus on identifying strategies to: 1) transform writing instruction through the use of digital tools; 2) influence teacher beliefs regarding the use of digital tools; 3) facilitate successful adoption of digital tools for instructional use.

Within the context of future SIWI research, we plan to encourage the use of digital tools to support SIWI through the implementation of ongoing professional development. We plan to further explore the impact of professional development on the adoption of digital tools when it is designed and implemented as follows:

1. Consider the school calendar and select a time of year that will best facilitate the adoption of digital tools.
2. Ask teachers to examine their beliefs regarding the instructional use of technology, and emphasize the need for students to have opportunities to use digital tools.

3. Select tools based on the digital tool affordances valued by teachers, as well as, teachers' current instructional objectives.

4. Introduce tools one at a time within the context of teachers' current instructional practices.

5. Create opportunities for teachers to implement digital tools successfully and observe peers implementing digital tools successfully.

CONCLUSION

In this chapter, we presented our examination of six teachers' uses of digital tools in support of SIWI. After providing these teachers with professional development on twelve digital tools, only two of those tools were selected and integrated into writing instruction. However, teachers were observed integrating a variety of digital tools, many of which they had already been using for non-instructional purposes, in support of several writing processes to impact what and why students were writing. The primary use of the digital tools was to allow teachers to perform tasks that they could not perform without technology or could perform more easily with technology. Furthermore, while students were observed using digital tools during the study, teachers were the primary users of technology in the classroom. Based on these observations, we made several recommendations for the design of future professional development that has the potential to expand the integration of digital tools during writing instruction.

REFERENCES

Albion, P. R., & Ertmer, P. A. (2002). Beyond the foundations: The role of vision and belief in teachers' preparation for integration of technology. *TechTrends*, *46*(5), 34–38. doi:10.1007/BF02818306

Applebee, A. N., & Langer, J. A. (2011). A snapshot of writing instruction in middle schools and high schools. *English Journal*, *100*(6), 14–27.

Cole, K., Simkins, M., & Penuel, W. (2002). Learning to teach with technology: Strategies for inservice professional development. *Journal of Technology and Teacher Education*, *10*, 431–455.

Eifler, K., Greene, T., & Carroll, J. (2001). Walking the talk is tough: From a single technology course to infusion. *The Educational Forum*, *65*(4), 366–375. doi:10.1080/00131720108984518

Englert, C. S., & Dunsmore, K. (2002). A diversity of teaching and learning paths: Teaching writing in situated activity. In J. Brophy (Ed.), *Social constructivist teaching: Affordances and constraints* (pp. 81–130). Boston, MA: JAI. doi:10.1016/S1479-3687(02)80006-2

Englert, C. S., Mariage, T. V., & Dunsmore, K. (2006). Tenets of sociocultural theory in writing instruction research. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 208–221). New York, NY: The Guilford Press.

Englert, C. S., Raphael, T. E., Anderson, L. M., Anthony, H. M., & Stevens, D. D. (1991). Making strategies and self-talk visible: Writing instruction in regular and special education classrooms. *American Educational Research Journal*, *28*, 337–372. doi:10.3102/00028312028002337

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*(3), 255–284. doi:10.1080/15391523.2010.10782551

Gerber, H. R., & Price, D. P. (2011). Twenty-first-century adolescents, writing, and new media: Meeting the challenge with game controllers and laptops. *English Journal*, *101*(2), 68–73.

Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York, NY: Guilford.

Graves, D. H. (1983). *Writing: Teachers and children at work*. Exeter, NH: Heinemann.

Harris, B. (2011). Writing in schools with computers: What does it take to make it happen? *Engineers Australia*, *46*(1), 40–51.

Kanaya, T., Light, D., & Culp, K. M. (2005). Factors influencing outcomes from a technology-focused professional development program. *Journal of Research on Technology in Education*, *37*, 313–329. doi:10.1080/15391523.2005.10782439

Kist, W. (2009). *The socially networked classroom: Teaching in the new media age*. Thousand Oaks, CA: SAGE.

Kress, G. (2003). *Literacy in the new media age*. London: Routledge. doi:10.4324/9780203164754

Lacina, J., & Griffith, R. (2012). Blogging as a means of crafting writing. *The Reading Teacher*, *66*(4), 316–320. doi:10.1002/TRTR.01128

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, *77*, 575–615. doi:10.3102/0034654307309921

Leu, D. J. Jr, & Kinzer, C. K. (2000). The convergence of literacy instruction and networked technologies for information and communication. *Reading Research Quarterly*, *35*, 108–127. doi:10.1598/RRQ.35.1.8

MacArthur, C. A. (1996). Using technology to enhance the writing processes of students with learning disabilities. *Journal of Learning Disabilities*, *29*(4), 344–354. doi:10.1177/002221949602900403 PMID:8763550

MacArthur, C. A., Graham, S., & Fitzgerald, J. (Eds.). (2005). *Handbook of writing research*. New York, NY: Guilford Press.

Mariage, T. V. (1996). *The construction and reconstruction of two discourse spaces in a special education classroom: A sociolinguistic examination of Sharing Chair and Morning Message* (Doctoral dissertation). Retrieved from Proquest June 20, 2011.

Mariage, T. V. (2001). Features of an interactive writing discourse: Conversational involvement, conventional knowledge, and internalization in ''Morning Message.''. *Journal of Learning Disabilities*, *34*, 172–196. doi:10.1177/002221940103400206 PMID:15497267

McGrail, E., & Davis, A. (2011). The influence of classroom blogging on elementary student writing. *Journal of Research in Childhood Education*, *25*(4), 415–437. doi:10.1080/02568543.2011.605205

New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*, *66*(1), 60–92.

Norman, D. A. (1999). Affordance, conventions and design. *Interaction*, *6*(3), 38–43. doi:10.1145/301153.301168

Ottenbreit-Leftwich, A. T. (2007). *Expert technology-using teachers: Visions, strategies, and development.* (Unpublished doctoral dissertation). Purdue University, West Lafayette.

Peterson-Karlan, G. R. (2011). Technology to support writing by students with learning and academic disabilities. *Assistive Technology Outcomes and Benefits*, *7*(1), 39–62.

Prensky, M. (2001). Digital natives, digital immigrants part 1. *Horizon*, *9*(5), 1–6. doi:10.1108/10748120110424816

Sylvesters, R., & Greenidge, W. (2009). Digital storytelling: Extending the potential for struggling writers. *The Reading Teacher*, *63*(4), 284–295. doi:10.1598/RT.63.4.3

Tackvic, C. (2012). Digital storytelling: Using technology to spark creativity. *The Educational Forum*, *76*, 426–429. doi:10.1080/00131725.2012.707562

Vannatta, R. A., & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and preservice teachers. *Journal of Research on Computing in Education*, *33*(2), 132–148.

Wolbers, K. (2007). Using balanced and interactive writing instruction to improve the higher order and lower order writing skills of deaf students. *Journal of Deaf Studies and Deaf Education*, *13*, 255–277. doi: doi:10.1093/deafed/enm052 PMID:17965129

Wolbers, K. (2010). Using ASL and print-based sign to build fluency and greater independence with written English among deaf students. *L1-Educational Studies in Language and Literature, 10*(1), 99-125.

Wolbers, K., Dostal, H., & Bowers, L. (2012). "I was born full deaf." Written language outcomes after one year of Strategic and Interactive Writing Instruction (SIWI). *Journal of Deaf Studies and Deaf Education*, *17*(1), 19–38. doi:10.1093/deafed/enr018 PMID:21571902

ADDITIONAL READING

Albion, P. R., & Ertmer, P. A. (2002). Beyond the foundations: The role of vision and belief in teachers' preparation for integration of technology. *TechTrends*, *46*(5), 34–38. doi:10.1007/BF02818306

Applebee, A. N., & Langer, J. A. (2009). What is happening in the teaching of writing. *English Journal*, *98*(5), 18–28.

Applebee, A. N., & Langer, J. A. (2011). A snapshot of writing instruction in middle schools and high schools. *English Journal*, *100*(6), 14–27.

Barone, D., & Wright, T. E. (2008). Literacy instruction with digital and media technologies. *The Reading Teacher*, *62*(4), 292–302. doi:10.1598/RT.62.4.2

Boling, E., Castek, J., Zawilinski, L., Barton, K., & Nierlich, T. (2008). Technology in literacy education: Collaborative literacy: Blogs and Internet projects. *The Reading Teacher*, *61*(6), 504–506. doi:10.1598/RT.61.6.10

Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (Eds.). (2008). *Handbook of research on new literacies*. Mahwah, NJ: Lawrence Erlbaum.

Cole, K., Simkins, M., & Penuel, W. (2002). Learning to teach with technology: Strategies for inservice professional development. *Journal of Technology and Teacher Education*, *10*, 431–455.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*(3), 255–284. doi:10.1080/15391523.2010.10782551

Forzani, E., & Leu, D. (2012). New literacies for new learners: The need for digital technologies in primary classrooms. *The Educational Forum*, *76*(4), 421–424. doi:10.1080/00131725.2012.708623

Handsfield, L. J., Dean, T.R., & Cielocha, K. M. (2009). Becoming critical consumers and producers of text: Teaching literacy with Web 1.0 and Web 2.0. *The Reading Teacher, 63*(1), 40-50. doi:10:1598/RT.63.1.4

Husbye, N. E., Buchholz, B. A., Coggin, L. S., Wessel-Powell, C., & Wohlwend, K. E. (2012). Critical lessons and playful literacies: Digital media in PK–2 classrooms. *Language Arts*, *90*(2), 82–92.

Kanaya, T., Light, D., & Culp, K. M. (2005). Factors influencing outcomes from a technology-focused professional development program. *Journal of Research on Technology in Education*, *37*, 313–329. doi:10.1080/15391523.2005.10782439

Kara-Soteriou, J., Zawilinski, L., & Henry, L. (2007). Children's books and technology in the classroom: a dynamic combo for supporting the writing workshop. *The Reading Teacher*, *60*(7), 698–707. doi:10.1598/RT.60.7.13

Karchmer, R. A., Mallette, M., Kara-Soteriou, J., & Leu, D. J. Jr., (Eds.). (2005). *New literacies for new times: Innovative models of literacy education using the Internet*. Newark, DE: International Reading Association.

Kay, R. H. (2006). Evaluating strategies used to incorporate technology into preservice education: A review of the literature. *Journal of Research on Technology in Education*, *38*(4), 383–392. doi:10.1080/15391523.2006.10782466

Kress, G. (2003). *Literacy in the new media age*. London: Routledge. doi:10.4324/9780203164754

Lacina, J., & Griffith, R. (2012). Blogging as a means of crafting writing. *The Reading Teacher*, *66*(4), 316–320. doi:10.1002/TRTR.01128

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, *77*, 575–615. doi:10.3102/0034654307309921

Leu, D. J. Jr, & Kinzer, C. K. (2000). The convergence of literacy instruction and networked technologies for information and communication. *Reading Research Quarterly*, *35*, 108–127. doi:10.1598/RRQ.35.1.8

McGrail, E., & Davis, A. (2011). The influence of classroom blogging on elementary student writing. *Journal of Research in Childhood Education*, *25*(4), 415–437. doi:10.1080/02568543.2011.605205

Morrell, E. (2012). 21st-century literacies, critical media pedagogies, and language arts. *The Reading Teacher*, *66*(4), 300–302. doi:10.1002/TRTR.01125

New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*, *66*(1), 60–92.

Norman, D. A. (1999). Affordance, conventions and design. *Interaction*, *6*(3), 38–43. doi:10.1145/301153.301168

Ottenbreit-Leftwich, A. T. (2007). *Expert technology-using teachers: Visions, strategies, and development. (*Unpublished doctoral dissertation). Purdue University, West Lafayette.

Sylvesters, R., & Greenidge, W. (2009). Digital storytelling: Extending the potential for struggling writers. *The Reading Teacher*, *63*(4), 284–295. doi:10.1598/RT.63.4.3

Tackvic, C. (2012). Digital storytelling: Using technology to spark creativity. *The Educational Forum*, *76*, 426–429. doi:10.1080/00131725.2012.707562

Vannatta, R. A., & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and preservice teachers. *Journal of Research on Computing in Education*, *33*(2), 132–148.

Wolbers, K. (2008a). Strategic and Interactive Writing Instruction (SIWI): Apprenticing deaf students in the construction of English text. *ITL International Journal of Applied Linguistics*, *156*, 299–326. doi:10.2143/ITL.156.0.2034441

Wolbers, K. (2008b). Using balanced and interactive writing instruction to improve the higher order and lower order writing skills of deaf students. *Journal of Deaf Studies and Deaf Education*, *13*(2), 255–277. doi:10.1093/deafed/enm052 PMID:17965129

Wolbers, K. (2010). Using ASL and print-based sign to build fluency and greater independence with written English among deaf students. *L1-Educational Studies in Language and Literature, 10*(1), 99-125. Retrieved June 20, 2013 from http://l1.publication-archive.com/public?fn=enter&repository=1

Wolbers, K., Bowers, L., Dostal, H., & Graham, S. (in press). Deaf writers' application of ASL knowledge to English. *International Journal of Bilingual Education and Bilingualism*.

Wolbers, K., & Dostal, H. (2010). Interventions for the deaf and language delayed. In R. Allington, & A. McGill-Franzen (Eds.), *Handbook of reading disabilities research* (pp. 392–406). Mahwah, NJ: Lawrence Erlbaum, Inc.

Yancey, K. B. (2004). Using multiple technologies to teach writing. *Educational Leadership*, 38–40.

KEY TERMS AND DEFINITIONS

Affordances: Functions that can be accomplished by using a given digital tool.

Apps: This term is used as an abbreviation for *applications software* (e.g. Knowmia, Educreations, Popplet, etc.).

Co-Construction: In this chapter, this term is used to represent a piece of writing created collaboratively by the teacher and student(s).

Constraints: Functions that cannot be accomplished by using a given digital tool.

Digital Tools/Technologies: These two terms are used interchangeably to refer to electronic hardware and software.

Language Zone: A space in which an idea can be captured in a variety of mediums (e.g., acting, drawing, writing) while developing the language associated with the idea, or a space that can be used to guide translation from ASL to English.

Strategic and Interactive Writing Instruction (SIWI): SIWI is an approach to instruction that includes a focus on both strategy instruction and interactive writing. There are specific components of SIWI that respond to the linguistic and metalinguistic needs of students who are deaf and hard of hearing.