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Research into Practice:

LITERACY

Purposeful Uses of Technology for Literacy and Learning Through Inquiry in Grades K–5

BY JULIE COIRO, PH.D.

Thinking about effective practices for using technology as part of inquiry can be overwhelming, especially amidst all of the important learning outcomes teachers are expected to address in today's curriculum. An important question becomes: How can teachers maximize instructional practices and the use of technology to promote comprehension, engagement, critical thinking, and creative innovation among students in elementary school? One helpful strategy is not to think about technology as technology per se, but rather to think about different technologies as either digital texts or digital tools designed to accomplish specific purposes. As literacy educators, this slight shift in language helps avoid getting caught up in thinking about each new technology as a shiny new toy to play with. Instead, it refocuses our attention on how texts and tools help accomplish important literacy practices such as reading, writing, thinking, and sharing ideas with others through conversation and creative response (Coiro, Dobler, & Pelekis, forthcoming).

What do we mean by digital texts and tools? **Digital texts** contain the content we want young learners to engage with—and, as you know, they can take on a number of different formats, modes, and purposes that allow teachers to diversify and differentiate the information that students have access to. Digital texts might include, for example, photographs, videos, multimodal informational and narrative texts, and multilingual texts—each kind of text helps learners build background knowledge and deepen their knowledge of key concepts. **Digital tools**, on the other hand, create opportunities for children to actively mark up, adapt, integrate, or reflect on the content they encounter as they read text or as they engage in a real-world experience that they want to capture and make sense of. Digital tools also provide open-ended spaces for young children to organize, represent, share, and act on their ideas in creative ways.

It's also helpful to understand that digital texts and tools for education fall into certain categories designed to support teaching and learning. This helps to keep your teaching or learning purpose always at the forefront. In addition, we all know how quickly one program or app is replaced by a newer one,

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or how often a free app turns into one requiring a paid subscription. Rather than spending time and energy fretting over the changes, it makes more sense to understand the most useful features of certain programs or apps and how they link together to form different categories of digital resources that are used for specific purposes and functions. When one tool from that category disappears, knowing the features you and your students liked best can help you find a new tool that serves the same purpose.

Once you reframe your thinking about technology as different ways of combining digital texts and tools for specific purposes, you can draw on what's already known from research on effective literacy instruction to think about how those digital texts and tools can enhance literacy teaching and learning before, during, and after reading.

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USING DIGITAL TEXTS AND TOOLS TO ENHANCE PRE-READING EXPERIENCES

The Internet provides easy access to digital images, texts, and video of complicated phenomena to activate children's prior knowledge, foster connections, or fill in some of the gaps in their knowledge needed to truly engage with the text they are about to read. Using digital resources as part of pre-reading experiences sparks curiosity, differentiates instruction, and offers young children some degree of voice and choice as they ask questions and discover the joy of spontaneous learning (Coiro, 2003; Coiro, 2015).

Many **informational websites for young learners** are specifically designed to integrate information created for children in a uniform way. These websites often bring together age-appropriate texts, pictures, and photographs into a searchable interface organized by theme, topics, subject area, or age group. Often, the information is organized alphabetically, to build on and reinforce the alphabetization skills of early learners. The features on these websites also provide a useful starting place to teach children about how to search by keyword or navigate layers of hyperlinks. These popular informational websites for young children are bound to provide images and video to spark initial conversations about topics and texts in your curriculum:

- **Little Explorers Picture Dictionary** (enchantedlearning.com/Dictionary.html), part of the Enchanted Learning website, contains more than 2,500 illustrated dictionary entries that lead to useful images, diagrams, text descriptions, and translations into several languages. Many terms lead to collections of digital resources around themes such as holidays, dinosaurs, geography, biomes, geology, and astronomy.
- **Interactive Maths Dictionary** (amathsdictionaryforkids.com/dictionary.html), created by educator Jenny Eather, contains more than 950 interactive entries to bridge the gap for children who might benefit from multimedia exploration of simple and more complicated math concepts. Many entries allow students to manipulate objects, actively explore the properties of each concept, and check the accuracy of their manipulations.
- **Journey North for Kids** (learner.org/jnorth/KidsJourneyNorth.html), created by Annenberg Learner, provides local tracking data about seasonal changes around the globe through pictures, stories, slideshows, and more. Teaching tools, observation handouts, and questioning strategies help to inspire close observation as children track the annual migration journeys of monarch butterflies, robins, hummingbirds, eagles, whooping cranes, or gray whales.
- **NASA for Kids** (nasa.gov/audience/forstudents/k-4/dictionary/index.html) links to short descriptions and images of space terms and concepts.
- **National Geographic Animals, Animals, Animals** (kids.nationalgeographic.com/animals/hubs/hub/)

provides a child-friendly space to explore photos, facts, games, and videos about all kinds of animals.

- **Ology** (amnh.org/explore/ology) is a science museum for young children created by the American Museum of Natural History. Photos, descriptions, videos, and interactive activities are designed to spark readers' interests about 14 different areas of study, such as anthropology, archaeology, paleontology, and zoology.
- **San Diego Zoo** (kids.sandiegozoo.org/animals) provides access to photos, videos, and facts about animals with a search engine that searches by animal type, geographic area, or endangered species status.

> "Ideally, inquiry aims to move learners beyond building knowledge to express, reflect on, and apply their knowledge in creative ways."

- **Wonderopolis** (wonderopolis.org/), created by the National Center for Families Learning (NCFL) in 2010, is a collection of more than 1,900 (and growing) daily wonders. Each wonder begins with a short video designed to draw learners in, which is followed by an engaging text and thought-provoking activities about topics of interest to young children. Digital supports are also embedded in each text to reinforce key vocabulary and build comprehension skills.

In addition to informational websites about many interdisciplinary topics, the range of **visual and multimedia texts** available on the Internet enables teachers to easily customize the use of media to meet the needs and interests of each small-guided reading group. **Pics4Learning** (pics.tech4learning.com/), for example, is a free, curated image library with copyright-friendly photos and illustrations in educational categories such as animals, countries, food, space, and geography. If you want to add a little mystery and some inferencing skills to the conversation, you might begin by showing only a piece of an image and then having students guess what the image is, using evidence from the image provided (see Coiro, 2015). This gives students an authentic opportunity to orally express their thinking while using picture cues as a first step toward later using evidence in writing to support their reasoning.

To extend this idea even further, **JigZone** (jigzone.com) is an online gallery of digital jigsaw puzzles appropriate for all ages, with puzzle sizes from 6 to 247 pieces. The gallery features a large collection of themed categories such as art, animals, flowers, holidays, ocean life, transportation, and travel for puzzles that can spark curiosity related to many elementary-level curricular themes. You can upload your own photos to turn into puzzles, and you can ask students to solve the puzzles to begin a reading activity. You can also send a puzzle postcard to student e-mail accounts or embed the puzzles into your own classroom website or blog.

Video is another powerful form of teaching that fosters curiosity as a pre-reading experience. For example, **SchoolTube** (schooltube.com/) is a safe video-searching resource for students and teachers. You can search for age-appropriate tutorials created by other classroom teachers or explore a growing collection of student-created videos about topics of inquiry. Take time to explore some of these digital resources with your grade-level colleagues and consider how you might use them to spark initial conversations with students about topics they are reading about.

USING DIGITAL TEXTS AND TOOLS TO ENHANCE DURING-READING EXPERIENCES

As readers begin to engage with printed and digital texts in your curriculum, at least four categories of digital resources can be especially useful to enhance students' during-reading experiences. These include **text-to-speech tools**, search tools, audio recording tools, and annotation tools. Even informational websites created for younger learners often pair images and diagrams with complex text, which can be frustrating for students with limited decoding skills. Pairing texts with text-to-speech tools enables young children to access information independently while deepening their understanding of important content (Bone & Bouck, 2016; Larson, 2010). Hyperlinked dictionaries and text-to-speech tools can also increase students' volume of reading and create more strategic and self-sufficient readers (Dalton & Jocius, 2013).

Most devices (e.g., laptops, tablets, mobile phones) and some common interfaces (e.g., Google Docs) now come equipped with options to set up text-to-speech readers. Once the option is set up, students simply highlight the digital text they'd like read aloud from a website or file and press the preset keys. The text is then read aloud right within the web browser interface. Having access to challenging information builds students' confidence and fuels their passion for learning more. Blending these texts with evidence-based instructional practices including reciprocal teaching and online reading comprehension instruction has been found to support Internet guided reading with young children (Castek, 2008; Dwyer, 2013 Salyer, 2015).

During guided reading sessions, students are likely to pose additional questions about new topics or concepts (Owens, Hester, & Teale, 2002). When appropriate, you might keep on hand a single device to search for more information using a **specially designed search tool** customized to meet the needs of elementary-age learners in terms of safety and age-appropriateness.

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Some digital interfaces, such as Symbaloo (symbaloo.com/) or Blendspace (tes.com/lessons), can be customized by the teacher and preset with specific resources and then shared with students, so they can have more control over where they choose to search for more information. When students are ready, child-safe search engines such as Kiddle (kiddle.co/), Kidssearch (kidssearch.com/), and KidRex (kidrex.org/) are powered by Google SafeSearch to filter young children's search experiences by maintaining their own databases of inappropriate websites and keywords. They provide picture icons alongside the search results and include searches for child-safe images, videos, and news. Short lessons to model how to search for and locate answers to questions students ask during guided reading can prepare learners to be efficient and effective online readers (see David Salyer's lesson example with primary-grade students or lessons by Zhang, Duke, & Jiménez [2011] for students in upper elementary grades).

Audio recording tools such as Audacity (audacityteam.org/), GarageBand (apple.com/mac/garageband/), or a web-based Voice Recorder (online-voice-recorder.com/) can provide practice building fluency for young readers as part of guided reading practice. Students simply find somewhere quiet to read, press record to begin, and press stop to end. Multiple recordings can be stored in digital spaces such as Google Drive or Podomatic (podomatic.com/) to help archive a child's growth in reading speed, accuracy, and expression over time.

When paired with Reader's Theatre performances, digital podcasts widen the audience for student readings and provide a permanent record of dramatic, repeated readings (Vasinda & McLeod, 2011). Scripts for many Reader's Theatre performances can readily be found online (see, for example, thebestclass.org/rtscripts.html or aaronshep.com/rt/RTE.html). If you're feeling adventurous, you can follow examples at the Langwitches School Blog (langwitches.org/blog/2011/05/24/1st-graders-create-their-own-read-along-audiobook/) to create your own scripts and podcast recordings with students. If you'd like to extend podcasting experiences even further, you might gather ideas from Radio Willow Web's collection of weekly informational news reports, created "By Kids, For Kids" (see podcasts.com/radio_willowweb).

A fourth category of digital resources can be used to introduce students to how to digitally annotate texts with questions, connections, and new ideas as part of their during-reading experiences. **Digital annotation or note-taking tools** allow you (or your students) to add to, highlight, or otherwise mark up a document or resource without changing the original content. Some annotation tools allow users to tag comments and share on social media, while others allow multiple users to annotate the same document at the same time.

Some of the most popular tools to use with young children for marking up and annotating texts, drawings, or photographs include ShowMe (showme.com/), Explain Everything (explaineverything.com/), ThingLink (thinglink.com/), and the drawing and note-taking

portions of SeeSaw (web.seesaw.me/). Each tool works a little differently, but a simple search on the Internet can lead you to short video tutorials and examples of annotated texts created by teachers and students. Second graders have, for example, successfully used digital note-taking and annotation tools to help them understand stories through retelling and personal commentary, record text-to-self personal connections, insert questions to ask for more information or clarification, and answer questions asked in the text about content or text features as a form of literary analysis (Larson, 2010).

USING DIGITAL TEXTS AND TOOLS TO ENHANCE POST-READING EXPERIENCES

After students complete their reading, several kinds of digital tools enable them to creatively respond and share what they have learned with others. Four categories that show promise for younger children include brainstorming or graphic organizer tools, digital creation and composition tools, screencasting or video reflection tools, and student portfolio tools.

Graphic organizer tools (also known as **brainstorming/mind-mapping tools**) use visual ways of organizing information that can help elementary-age children with problem solving, decision making, studying, planning research, brainstorming, and classifying ideas (Kingsley & Tancock, 2013; Salyer, 2015). Graphic organizers or mind maps can be used to create templates for thinking or note taking, or they can be used to represent and share final products of inquiry. Three free and popular mind-mapping tools that work directly in your web browser include Popplet (popplet.com/), Padlet (padlet.com/), and Bubbl.us (bubbl.us/). Popplet and Padlet enable children to easily and collaboratively organize ideas with graphics, hyperlinks, multimedia, and video. Elementary school teachers have collected and shared many multidisciplinary ideas for how to use these tools on online Pinterest boards. Bubbl.us is a more traditional web-based mind-mapping tool with basic shapes and arrows to connect ideas.

Digital creation and composition tools encourage students to creatively express and share what they've learned with others by combining photographs, video, animation, sound, music, text, and often, narrative voice into a single platform. Karen Pelekis and Carole Phillips (2014) describe the many ways that digital tools enhance each stage of the writing process for students in Grades K–3, providing opportunities for children to organize their writing, compose stories and opinion pieces, create digital slideshow presentations that can be shared effortlessly with others, design visual formats such as comic strips and professional-looking movies, and prepare informational reports from their online research. One of their favorite tools for children to publish their inquiry-based research findings is Alphabet Organizer, from ReadWriteThink (readwritethink.org/files/resources/interactives/alphabet_organizer/). This tool makes it easy to create ABC books by providing a template with artistic choices and save features that enable children to return to projects over time and break them into manageable pieces. The student interactive is available as a mobile app with a camera feature so children can easily insert drawings or photographs as companions to the facts they gather during inquiry. Many other examples of digital creation and composition tools are available online—just to name a few, elementary school teachers and literacy researchers have shared high-quality examples of inquiry products created with tools such as:

- Storybird (storybird.com/), inspiring writers with a platform of curated artwork from illustrators around the world;
- My First Storybook (mystorybook.com/), which works through a web browser with a very simple set of text and drawing tools;
- Glogster (edu.glogster.com/), which makes interactive multimedia posters;
- Doodle Buddy (goo.gl/w39fA9), which enables children to paint, draw, scribble, or sketch their ideas; and
- comic strip tools such as Make Beliefs Comics (make-beliefscomix.com/) or Comic Creator (readwritethink.org/files/resources/interactives/comic/).

With the support of digital creation and composition tools, young learners have the flexibility to add to and organize their ideas in ways that are personally meaningful (Hutchison, Beschorner, & Schmidt-Crawford, 2012). They can practice becoming active text critics (Wood & Jocius, 2014), and they "learn how to create and share opinion pieces that persuade others and/or promote social action" (Crawley, 2015, p. 51). Even open-ended blogging tools can provide young children opportunities for customized reflection and

guided discussion about what they have read while serving as formative assessment of students' comprehension performance (Stover, Yearta, & Harris, 2016).

A third set of digital tools, known as **screencasting and video reflection tools**, provide opportunities for children to reflect on what they've read and how it connects with other things they have read. Reflection is an integral part of the inquiry process (Coiro, Dobler, & Pelekis, forthcoming). **Screencasting tools** allow users to create a digital recording of all the action that happens on a computer screen along with a person's narration about the action or his/her thinking. Teachers can create screencasts of customized mini-lessons about an inquiry topic or a short tutorial on how to use a certain digital tool. Elementary-age students can create screencasts to document their conversations and evaluations of their work (see examples in White, 2015) or use them as a platform for sharing their final inquiry products with others (see examples in Stover & Young, 2014). Some of the simplest recording interfaces for young children's reflections include Shadow Puppet (get-puppet.co/), Screencastify (goo.gl/ssWJz6), Explain Everything (explaineverything.com/), Jing (techsmith.com/jing-tool.html), and the recording feature in SeeSaw (web.seesaw.me/).

Similarly, **video reflection/discussion tools** prompt student discussion or reflection around specific topics or open-ended conversations. These simple tools enable students to record short videos of their thoughts and then invite others into a video dialogue by responding with their own feedback or ideas. Currently, a popular video reflection tool for young children is Flipgrid (flipgrid.com). Short, 90-second responses encourage students to plan their responses and speak thoughtfully, and other children can use the discussion thread feature to build sets of ideas into a conversation with their own video recording. Teachers can make the discussions public or private, depending on your purpose or need.

A fourth set of tools being used in elementary school classrooms consists of **student portfolio tools**, which can help build a personal narrative of a student's growth in learning and achievement over time. Teachers and, optimally, students themselves can use these tools to privately or publicly add, annotate, and/or comment on work samples in just about any format imaginable—including audio, video, drawings, photos, and other kinds of archived documents—and then creatively organize these files to represent their learning over time. Optimally, parents can access and easily interact with their child's work as well.

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Currently, the easiest and most popular platform for digital student portfolios is known as SeeSaw (web.seesaw.me/learn-more/). SeeSaw Connected Blogs and formative assessment tools were recently added to the SeeSaw student-driven portfolio system to make this a natural choice for empowering students to independently document what they are learning at school. Two other digital portfolio tools with interesting features for young children are KidBlog (kidblog.org/home/) and ShadowPuppet (get-puppet.co/#home-alternate).

USING DIGITAL TEXTS AND TOOLS TO FOSTER DIGITAL CITIZENSHIP SKILLS

Outside of reading activities and across the elementary school curriculum, there are many other opportunities for teachers to support young children as they develop the skills to be safe and active citizens in an increasingly digital world. Two organizations continue to lead the way in developing curriculum and preparing educators and parents to support children in these endeavors. First, *Common Sense Media* has developed a comprehensive K–12 digital citizenship curriculum (**commonsense.org/education/digital-citizenship**) with free downloadable lessons organized by age level, student interactives, and support materials for teachers and parents. Activities focus on issues such as Internet safety, privacy, cyberbullying, digital footprints, online relationships, copyright, and information literacy. A second program, Be Internet Awesome (**beinternetawesome.withgoogle.com/**), is a "multifaceted program that includes a fun and free web-based game called Interland and an educational curriculum to teach kids how to be safe and responsible explorers of the online world." Lessons align with the International Society for Technology in Education's standards for students, and families can reinforce important lessons at home with the "Be Internet Awesome Pledge."

Overall, as you consider evidence-based practices for using technology for literacy and learning, talk with colleagues, know your students' literacy needs, understand your teaching and learning goals, and think about ways of using digital texts and tools in the classroom as a set of purposeful literacy practices. Then, you'll be amazed at the wealth of digital resources at your fingertips for extending the ways you teach reading and writing while also enriching how students learn and express their new knowledge in your classroom and beyond.

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