Web 2.0 in Teacher Education: Characteristics, Implications and Limitations

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Abstract

Like the variety of Web 2.0 applications, theories of learning and instructional models are also primarily content independent. So it is left up to the teacher educator to match learner characteristics, content, pedagogy and technologies. This chapter will concentrate on the use of Web 2.0 technologies in contemporary constructivist and cognitivist learning environments. We will present the characteristics of Web 2.0 tools to support teaching and learning, including low threshold applications, a variety of tools and models, as well as access to tools and knowledge. Finally, we will identify the limitations and challenges that exist with using these tools, such as immature applications, longevity of applications, number of applications, unconsolidated services and security and ethics.

INTRODUCTION

We have arrived at the time in teacher education, both preservice and in-service education, where a large portion of the learners is deemed digital natives. In their personal, professional and academic lives, these individuals are *plugged in*. Differentiation is central to both Web 2.0 and education. In Web 2.0, small, niche applications address individual productivity needs. In education, differentiated learning calls for instruction that is tailored around the individual. Teacher education needs to accommodate for these trends.

Many Web 2.0 applications are discipline neutral or can be repurposed to diverse instructional needs. Like the variety in these applications, theories of learning and instructional models are primarily content independent. However, with the excitement or apprehension surrounding new technologies, it is easy and tempting to remain focused solely on the technology. This would be a disservice to learners. So it is left up to the teacher to match learner characteristics, content, pedagogy and technology. Therefore, teacher educators and teachers must be cognizant of both the technology affordances and learning theory compatibilities.

This chapter will concentrate on the use of Web 2.0 technologies in contemporary constructivist and cognitivist learning environments. In particular, we will first examine the tenets and applications of constructivism and cognitivism. Then we will present the characteristics of Web 2.0 tools to support teaching and learning in these environments. Finally, we will identify the limitations and challenges that exist with using these tools. To consolidate and respect page constraints, a list of all the applications we have embedded throughout the chapter are aggregated into the "Resources" section at the end.

CONSTRUCTIVIST AND COGNITIVIST LEARNING

One's ideas about knowledge and the process of learning influence instructional practice. Educators that believe learners actively construct knowledge while making sense of the world will likely design instruction emphasizing the development of meaning and understanding. Educators, believing that learners passively receive information, will likely develop instruction that emphasizes knowledge transmission.

Constructivist Learning

Constructivism is based on the premise that learning is an active process and learners construct knowledge and understanding of the world by reflecting on their experiences. Learning becomes active when students are able to connect new knowledge with their prior understanding (Piaget, 1954, 1974; Mims, 2003). Piaget suggested that learners construct new knowledge from their experiences through the processes of assimilation and accommodation (Piaget, 1967). Assimilation occurs when learners are able to incorporate new experiences into their existing mental framework without having to change it.

However, some experiences contradict a learner's mental model. In these cases, accommodation occurs when the learner reconstructs his/her mental framework allowing for integration of the new experience.

Constructivist learning is epitomized by key interactions with others and the environment (Driscoll, 2005) and meeting the needs of the learner at their instructional level. Constructivism is often associated with independent learning, self-regulation, and student-centered learning. Problem solving, hands-on activities and real-world scenarios provide new experiences and encourage learners to use active techniques as they assimilate or accommodate new knowledge.

Many researchers have considered technology's role in education and demonstrated that it can enhance instruction, facilitate learning and serve as a medium allowing students to more fully express themselves, often in creative ways (Grant & Branch, 2005; Papert, 1980; Schank, Berman & Macpherson, 1999). Web 2.0 technologies integrate well with constructivist learning as many of the tools are social and encourage interaction with others. The wide assortment of technologies (images, audio, video, text) allow for multiple representations of understanding, foster creativity and help teachers provide individualized instruction and tailored learning opportunities for students.

Cognitive Learning

Cognitivism, modeled by information processing theory, is organized by three serial apportionments: a sensory register, working memory and long-term memory (Driscoll, 2005). The sensory register allows stimuli to be perceived and attended, both of which have limited capacities, passing received stimuli to working memory. Similarly, working memory is a processing center for active learning, but it also has a limited capacity. This capacity can be extended through memory strategies, such as mnemonics, rehearsal and chunking of information. Finally, new learning can be processed from working memory into long-term memory, theorized as permanent unlimited storage. In long-term memory, new learning can be adpated and shaped with previous learning in the form of organizational structures called *schemata* (Ausubel, 1980).

Cognitive load theory highlights the specific limitations of working memory. Three types of cognitive load (i.e., intrinsic, germane and extraneous) have been associated with learning (Clark, Nguyen & Sweller, 2006). In particular, intrinsic and germane cognitive load are associated with the learning content and the learner, while extraneous cognitive load is often associated with poor instructional development, complex learning environments and poor usability. These types of cognitive load are significant given the capacity limitations of working memory. Since they are additive, the cognitive load types compete for space in working memory (Clark & Mayer, 2003). Particularly relevant to technology-enhanced learning, too much extraneous cognitive load associated with difficult software applications and poorly designed interfaces deleteriously affects learning.

Cognitive learning emphasizes strategies to meaningfully encode and decode knowledge to and from long-term memory (Driscoll, 2005), as well as reduce cognitive load. Several cognitive instructional models and strategies complement Web 2.0 applications. Schema construction and advance organizers consider the structure of a learner's knowledge (Ausubel, 1980). New knowledge can be added into long-term memory schemata by accretion, tuning and restructuring (Driscoll). Similarly, advance organizers offer an organizational strategy for learners to begin processing and encoding knowledge (Mayer, 1979). So using technology applications that support construction of schemata in long-term memory have the potential to relate new knowledge with prior knowledge in an multisensory way.

Reigeluth (1999) suggests that the sequence of learning is important for relating or distinguishing among traits in the learning content. Similarly, the sequencing strategy (i.e., topical or spiral) is also dependent on the learning content. The instructional sequences result "in the formation of stable cognitive schemata to which more complex understanding are more easily added" (p. 433). However, building effective instruction is not simple. Nevertheless, some Web 2.0 applications enable combining multiple sources of information, such as text, video, photographs, quickly. So, it may be easier for a teacher to produce a more effective instructional sequence with one of these applications.

WEB 2.0 TO SUPPORT TEACHING AND LEARNING

Web 2.0 is typically defined by the characteristics, or design patterns, set forth by O'Reilly (2005), including the long tail and perpetual beta. These computer-based design patterns relate little pedagogy. There are, however, several attributes of Web 2.0 that support constructivist and cognitivist teaching and learning. These are (a) low threshold applications, (b) variety of tools and models and (c) low cost and networked community. Each is described below.

Low Threshold Applications

Low threshold refers to how easily a tool—specifically, a technology-based tool—is to adopt and how easy it is to learn. Gilbert (2002) and his colleagues at the Teaching, Learning and Technology Group affirm that low threshold applications are (a) easy to learn by both teachers and students, (b) not intimidating to require re-examination of epistemologies and teaching practices, (c) simple enough to require little technical training for use and (d) almost ubiquitous (para. 4). From a teacher's perspective or an efficiency point of view, these are attractive.

In contrast, Sade (2005) emphasizes student use of low threshold applications: Those technologies that afford a variety of technical skill levels among students should be the ones integrated into curricula by teachers. These technologies, Sade suggests, allow for the construction and sharing of learning artifacts. So students are able to represent their learning in a contemporary method most indicative of their experiences.

In both sets of characteristics, low threshold applications suggest a shallow learning curve and dedicating few cognitive resources to the tools. The entry point for teachers and students to learn the tools is quick. Both Gilbert (2002) and Sade (2005) suggest tools should be selected based on high usability characteristics (c.f., Nielsen, 2000). This certainly reduces extraneous cognitive load.

The characteristics of low threshold applications to support teaching and learning are rooted in both cognitivism and constructivisim. Appropriate for both learning theories, low threshold applications allow the teacher and student to focus on the content and not the tool. For example, based in Oliver's (2007) work, in one of our preservice teacher education courses, we have students create self-paced instructional units with Trailfire (see Figure 1), a social bookmarking service that generates linear sequential sets of bookmarks, or trails, around a selected topic. A student can follow a trail a teacher has created with annotations or critical thinking questions displayed on each Web site. Through a Web browser plug-in, teachers can simply add new bookmarks to a trail by assigning the same title to each bookmark. The focus of the assignment for future teachers is then on locating the best sources of content and adding annotated comments to the trail for students to consider. Similarly, we have had students create self-paced instructional units with WebSlides powered by Diigo.

Figure 1. A self-paced instructional unit using Trailfire.

In an online teacher education course, we have provided minimal instruction for Web 2.0 tools. As such, the return on investment as a teacher and a student is high. As teachers, we have had to provide little upfront instruction about how to use the tools and little subsequent support. As students, they are able to move forward with building a learning artifact without having an introductory type of assignment to learn the tool. As suggested by Gilbert (2002), very little training and follow-up support is required with low threhold applications. For example, Weebly is a Web site authoring tool with a drag-and-drop interface; no HTML programming is required (although it is possible). When using this with preservice and inservice teachers, it has been unncessary to teach how to use Weebly. Likewise, Rieber (personal communication, 2008) described similar results with Google Pages/Sites in a preservice teacher education course at The University of Georgia.

Particular to constructivism and critical to Sade's (2005) recommendation, low threshold applications allow for the creation of multiple representations of knowledge and a variety of learning artifacts. These tenets are most strongly rooted in constructionism (Harel & Paper, 1991; Kafai & Resnick, 1996) and project-based learning (Grant, 2002; Moursund, 1998). Constructionism as a learning theory and project-based learning as an instructional model afford learners the opportunity to represent their learning in personally meaningful methods. Low threshold applications like Trailfire, Weebly and Google Pages/Sites very often provide an avenue for accomplishing this.

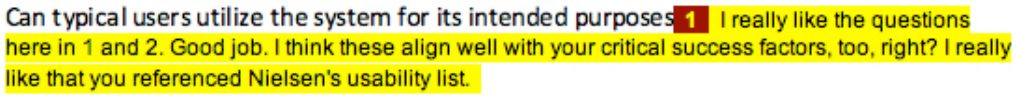
Variety of Tools and Models

Mental models can be considered functional schemata. Driscoll (2005) suggests that mental models "guide and govern performance" (p. 130) during learning or problem solving. When using a Web site or software application, we have preconceived notions about how to accomplish a task within the system. User interfaces, the communication point between the designer and user, however, are what a designer considers to be the best tool, and users to a large extent are expected to adapt to the interface (Brusilovsky, 2001; Inan & Grant, 2008). In contrast, van Dam (2000) asserts that the aim of interface design should be to complement human abilities, including cognition.

But in the past, teachers and students have primarily used the productivity tools typical of all-in-one office suites (e.g., Becker, 2001). As such the opportunities to select a tool that matches an individual's mental model has been limited. Instead, the choices have been primarily constrained to those with ubiquity. This requires that teachers and students adopt or adapt to these models of accomplishing tasks. Hallmarks of these large packages include unnecessary features and just-in-case features (e.g., Pogue, 2007).

In comparison, Web 2.0 applications are small, niche tools. At 37 Signals, which is widely recognized for developing Web 2.0 tools such as Basecamp (a Web-based project management tool), Ta-da List (a Web-based to-do list manager) and the Web application platform Ruby on Rails, Dimon and colleagues (37 Signals, 2006) have advocated for reduced features. They have also recommended focusing on the interface and core content or function first. As such they are adamantly creating smaller applications. So across the Internet, a number of compact applications have been constructed often with different mental models, or different methods, of how to accomplish a task. For example at the time of this writing, 13 concept mapping applications were listed at the directory Go2Web20.net. Likewise, Fleck, Jumpknowledge and Diigo allow textual annotations on bookmarked pages. Of the three, Fleck is the most graphical; Jumpknowledge is strictly text-based (see Figure 2). Diigo and Fleck include social networking, while Jumpknowledge simply shares via email or hyperlinks. DrawHere, however, allows drawings and diagrams to be saved to a Web page as an annotation, and then shared. So, not only is it possible to parallel a mental model, it may also be possible to address preferences (i.e., visual, textual, audile, etc.) for learning.

Figure 2. Textual annotations with Jumpknowledge.



The implications for teaching and learning to choose from a variety of small Web 2.0 applications are considerable. Instead of an all-in-one suite, teachers and students can selectively adopt tools that are most intuitive. Expressly appropriate to secondary students, preservice and inservice teachers, it

may be inessential to select a single tool for use with an assignment. This is intimately related to the cognitive load of low threshold applications. Because a teacher or student can select a cognitively compatible tool, fewer cognitive resources may be dedicated to learning how to use the tool, increasing the efficiency of learning. The choice of tools also dovetails with Sade's (2005) constructivist criteria for selecting tools to integrate into a curriculum. Learners can represent their learning in a variety of ways and through an array of applications.

Access to Tools & Knowledge

Not only are there myriad Web 2.0 tools from which users can choose, these technologies are available at little or no expense making them widely accessible. Chris Anderson (2008) describes an emerging business model called *freeconomics*, where with the rapidly decreasing costs of digital technology, it is best to give them away for free. This helps build awareness of a tool and a loyal user base. In addition, there has been a commitment by Internet citizens to providing knowledge and expertise openly. For example, Wikipedia relies of the expertise of individuals to create the content. Similarly, Curriki is committed to providing high-quality curricula for K-12 teachers and students. At the time of this writing, Curriki's management are paying for individuals to develop units and courses. The state of California is also exploring the creation of an online textbook for World History using Wikibooks, a popular free wiki. These opportunities result in teachers and students having greater access to tools and knowledge.

With the limitations related to access and expense greatly diminished, learners are able to try multiple tools while there is little time lost. Since the applications are Web-based, there typically are not downloads—only a registration process. Additionally for the teacher, it is easier and more accessible to use a variety of resources, such as embedding external media (e.g., YouTube, TeacherTube) or extending learning opportunities (e.g., external blog conversations). For example, in our online teacher education classes, we have embedded relevant videos, podcasts and slideshows into the learning materials. Moreover, Mims has incorporated blog discussions inside his course from within his own professional blog. These opportunities align well with constructivist learning.

Personal learning communities (PLCs) have also emerged as a result of the social aspects of many of the Web 2.0 tools. Learning is no longer confined to the physical classroom space or appointed meeting times. Access to experts and others interested in a topic of study is available through the social components of tools like Diigo, TeacherTube, Twitter, and blogs and wikis. This gives learners greater control over their learning, indicative of constructivist principles.

The community of expertise extends beyond the curricular content as well. There are typically active online support and development communities associated with Web 2.0 tools. This can be beneficial to teachers and learners as assistance is available when users encounter difficulties. In addition, developers consider user feedback in updating the technology. With members of his PLC, Mims participated in a recent vigorous discussion about features inside Diigo that spawned responses and quick changes from the Web application's developers. Consequentially, an alternative educational version of Diigo will be released to districts and schools. Similarly, Grant's email feedback to Jumptags, a social bookmarking service, resulted in developer responses. This mutually beneficial relationship leads to more effective, meaningful and user-friendly versions of and experiences with the tool.

LIMITATIONS AND IMPLICATIONS

The sections above have articulated the strengths of Web 2.0 applications. We have advocated for their uses given examples provided from our own work. Unfortunately, the promise of Web 2.0 is not without challenges. In particular, we will discuss five categories of limitations to using Web 2.0 applications and their implications for teaching and learning. These are (a) immature applications, (b) longevity of applications, (c) numbers of applications (d) unconsolidated services and (e) security and ethics. None of these are distinct nor isolated to one theory of learning. Instead, we present the following sections for teachers to consider as they progress through their instructional design processes. Moreover, it is left to the individual teacher educator and teacher to determine her position on the continuum of technology integration professional development stages (see e.g., Goddard, 2002) in order to gauge the personal impact of each of these limitations.

Immature Applications

One of the characteristics, or design patterns, O'Reilly (2005) aligned to Web 2.0 is termed *perpetual beta*. Rollett, Lux, Strohmaier, Dösinger and Tochterman (2007) describe Web 2.0 applications as "constantly evolving, never really leaving the beta state" (p. 91). While on the surface this may appear to be a strength, this can also be depicted as deploying immature, or premature, applications to users.

Because of this immaturity, the Web 2.0 applications have a tendency from our experiences to be susceptible to unexpected downtimes and software anomalies. For example, Zookoda, a blog post to email tool, was forced to suspend service after discovering it was being exploited by spammers (Murphy, 2007). Also, a number of applications we have used have had software inconsistencies, including unexpected errors, lost data and slow response times. Even popular Twitter has experienced recent fluctuations in stability (Twitter, 2008).

There is a well-known yet covert software axiom: Deploy a product and let the users tell you what is missing. Hence, the consumer advice: Wait for version point one or service pack one. 37 Signals (2006) suggests the user feedback that is consistently received every day represents the features to implement. Above, we explained how Web 2.0 developers were sensitive to their communities of users. They, in fact, rely on the users to determine many features. For many Web 2.0 applications, there seems to be an imbalance between listening and responding to a community of users versus literally banking on a community of users. The challenging element to this is the often lack of features that do exist, such as the inability to copy and paste items.

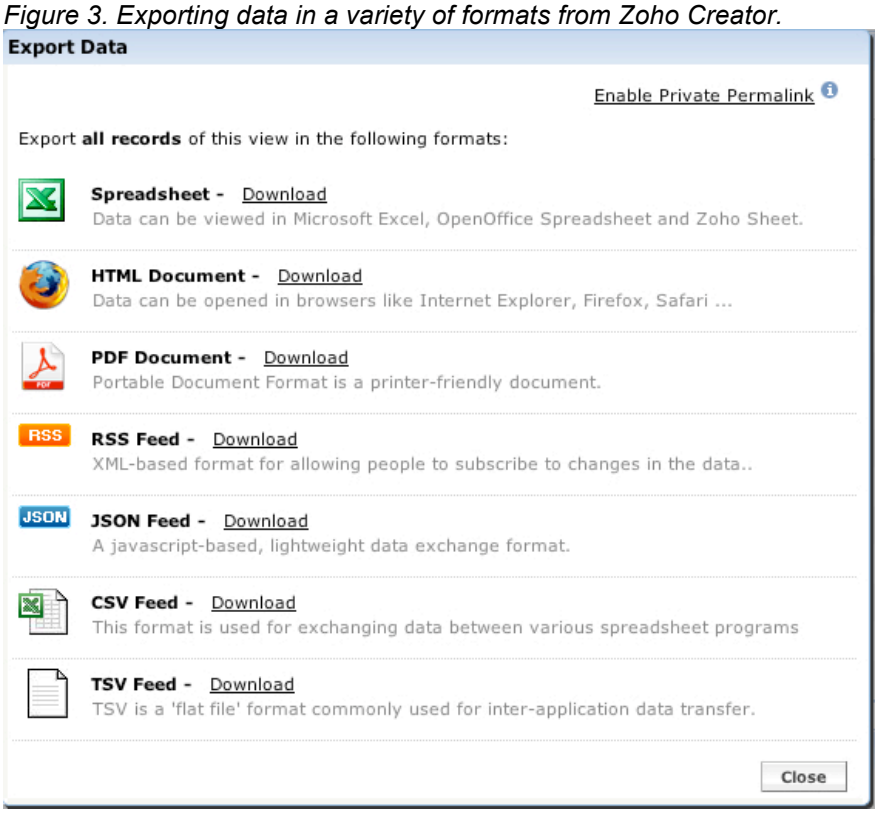
For teachers and students, the downtimes, software glitches and lack of features can lead to frustrations. When teachers plan lessons with these tools, there is an expectation for stability and reliability. The assumption that Web 2.0 tools are always available has been transferred from desktop applications. However, it may in fact be a faulty premise.

Longevity of Applications

As described earlier, many of the Web 2.0 applications did not exist two years ago and most tools within four years (Waters & Nuttall, 2008). With this chronology, it is simply impossible to determine which companies and tools will survive. As such, teachers and teacher educators should be reticent to recommend tools that do not at least have some reputation, whether through our PLCs or through reviewing sites, such as Buzzshout, Cnet Reviews or AppAppeal. LaMonica (2006) is suspicious of a “dot-com-like bubble” materializing (Boom or bubble? section, para. 1). In a similar fashion, Waters and Nuttall (2008) report a belief that many Web 2.0 companies will perish. How do we proceed with these inauspicious predictions?

Certainly, the concern for teachers and students is investing significant development time in a product that may not persist. One method to combat this is to leverage Web 2.0 applications' widespread compatibility features. In many cases, the application will allow you to export your data into a variety of formats or download complete archives of files (see Figure 3). These can often be reused or imported into another similar service. For example, social bookmarking services Delicious and Jumptags will allow export and import of bookmarks. PBwiki and Weebly allow compressed downloads of Web sites. Still, this is not a solution but a workaround. The skills to successfully transfer data across system may be more than we should expect teachers and students to do. In addition to the small niche applications, should we consider the transient potential of these applications as a defining characteristic and regard our data to be just as fluid?

Figure 3. Exporting data in a variety of formats from Zoho Creator.



Furthermore, some Web 2.0 applications are still struggling to determine an appropriate business model (Waters & Nuttall, 2008). At the time of this writing, popular Twitter is one that has yet to create a revenue stream. However, in July 2008 Twitter purchased search engine Summize, which may offer an advertising platform and business model (Kafka, 2008). Other tools that offered free services in some instances have created limits or applied fees to their services. For instance, two of our favorite applications to use with teachers and teacher educators, Zoho Creator and Weebly, added business or professional plans, placing limits on their free accounts. Naturally, the appeal to teachers and students is the widespread low to no cost of these applications. Freeconomics and freemiums (Anderson, 2008) are new business models to attract customers. The fallacy is that teachers or students may be dependent on a service that then moves to a business model, making the tool unfeasible.

Number of Applications

Unlike the Web browser and search engine wars, which time has distilled to a few, there are currently a massive number of Web 2.0 applications to review and from which to select. At Go2Web20.net, a respected directory of applications begun in 2006, the number of listed applications was 2,626 as of August 15, 2008. Similarly, the Center for Learning and Performance Technologies lists the number of tools for creating, delivering and managing technology-supported learning at over 2,400. While we discussed earlier the advantages of niche applications, this explosion has created a thick register of possibilities for teacher educators and teachers. While a few tools have moved to the forefront, such as Wordpress, Blogger, Wikipedia, delicious, Flickr and most recently Twitter, the litany of over 2000 possible tools remains daunting. Time has yet to create *defacto* tools.

The implications of this many applications for teaching and learning are similar to the challenge of locating meaningful sites on the Web. Social bookmarking services, like Delicious, and review sites like those mentioned above can help distill the possibilities, similar to Nettrekker's review premise for Web sites. TeachersFirst Edge is one site that is attempting to provide this type of service.

Unconsolidated Services

Another challenge to using Web 2.0 applications is their dispersement across the Internet and different developers. In other words, tools and services are unconsolidated, where a blog may be hosted at Edublogs, a wiki created at WetPaint and presentations created at SlideRocket. The strength to all-in-one suites is their centrality and consistency across applications: Functions in one tool work identically or similarly in another. While Web 2.0 tools gain credibility for high usability and shallow learning curves, there is still a cognitive investment for teachers and students to learn each tool, which contributes to extraneous cognitive load.

Some companies have attempted to combat this limitation by creating or aggregating an all-in-one online suite. For example, Zoho offers approximately 20 different tools, including the standard office suite of a word processor, spreadsheets and digital presentations but also a wiki, a digital notebook and project management. Likewise, Google has launched Google Apps with an office suite and a Web site authoring tool among others.

By choosing an all-in-one suite, teacher educators and teachers lose the flexibilities described above for niche applications. However, sending teachers and students to different sites may be overwhelming or disorienting, particular to novices. Saving files in network spaces instead of personal hard drives will undoubtedly make some teacher educators and teachers nervous or skeptical. Moreover, it can simply be confusing to determine the correct URL for published work. For example, it is not uncommon for preservice teachers in our own classes to submit a URL to a password-protected space instead of the public address. Finally, each tool requires a separate user name and password, so keeping up with many logins is annoying at the least. OpenID, however, "a single sign-on mechanism for the Web," ("Major Tech Companies", 2008, para. 3) has the potential to reduce this challenge in the near future.

Security and Ethics

Security for student information and security of intellectual property persist as issues with the Web. Encouraging students to use blogs and other Web 2.0 tools requires significant investments in preparing students for protecting their privacy. Richardson (2006) recommends,

1. teachers follow state and district guidelines for publishing student information and photos on school Web sites;
2. teachers ask for parental permission to engage in publishing online;
3. teachers should be prepared to discuss what should and should not be published online; and
4. teachers determine protocols for publishing, such as using first names only, using pseudonyms or using anonymity. (p. 11-12)

These guidelines are important during information seeking and publishing but also for social software and networking sites where much of the content available is personal and public (Anderson, Grant & Speck, 2007).

Additionally, we must continue to teach children to respect copyrights and intellectual property of others. Students will illegally download text, images, music, videos and software, because they perceive it to be freely available and in the public domain (Rader, 2002). With the use of many Web 2.0 tools, it is easy to combine media from various sources with little regard to copyright. Plagiarism is synonymous with copyright infringement (Johnson & Groneman, 2003). In particular, Baron and Crooks (2005) warn against “cut and paste plagiarism.”

Finally, we must continue to remind students of information and media literacy skills. Identifying sources of information, as well as the quality of information sources, remains important. Some Web 2.0 tools—blogs and wikis in particular—are susceptible to questions of quality. Wikipedia (2008a) in fact lists updated possible copyright problems within Wikipedia's pages. Wikipedia (2008b) also maintains a page to help students to conduct research with Wikipedia. Interestingly, a recent study (Giles, 2005; “Nature’s response”, n.d.) found relatively similar levels of quality between Wikipedia and *Encyclopaedia Britannica*. To help students maintain ethics and quality, Warlick (2004) recommends four guidelines for teachers and students to follow when publishing and working online:

1. Teachers and students should be honest, fair and courageous in gathering, interpreting and expressing information for the benefit of others.
2. Ethical teachers and students treat information sources, subjects, colleagues and information consumers as human beings deserving of respect.
3. Teachers and students are accountable to their readers, listeners and viewers and to each other.

4. Information, in the Information Age, is property. Information is the fabric that defines much of what we do from day to day, and this rich and potent fabric is fragile. (p. 92-93)

CONCLUSION

Web 2.0 is not a panacea nor is it the end. In fact, many developers and technophiles are anxiously awaiting Web 3.0. Twine is one of the first applications that seems to begin to take advantage of the notion of the semantic Web, offering a basic artificial intelligence or recommendations-type strategy. While the tools may change, the need for teacher educators and teachers to have a firm understanding of learning principles to guide the use of the tools has not. Aldrich (2005) reminds us,

> There are strongly mixed reactions about the new technology. Some end users like it (and some love it), but professionals who built a lifetime of skills around the old technology are very suspicious, often undermining it. Even the advocates admit the technology often has to be cajoled into working....Invariably, people just did not realize how hard it was to pull it off. What seemed easy and obvious is in fact quite daunting. (p. xxxvi-xxxvii)

Web 2.0 or Web 3.0 will not attract every teacher educator or teacher. Admittedly, the technologies themselves may be easier and more accessible. But combining complex learning environments, learner characteristics, content, pedagogy and technology together creates a less distinct path to success. Skilled teacher educators and teachers are still key to meaningful student learning. Prensky's (2001) digital natives are using a variety of tools for entertainment, information learning and communication. Teaching and learning must respect the changes in learners and innovations. Changes in the current roles of teachers and students may be required in order to take full advantage of Web 2.0 applications and active learning.

RESOURCES

AppAppeal | http://www.appappeal.com/
Basecamp | http://www.basecamphq.com/
Blogger | https://www.blogger.com/start
Buzzshout | http://www.buzzshout.com/
Center for Learning and Performance Technologies Directory | http://c4lpt.co.uk/Directory/
Cnet Reviews | http://reviews.cnet.com/
Delicious | http://delicious.com
Diigo | http://www.diigo.com/
Draw Here | http://drawhere.com/
Edublogs | http://edublogs.org/
Fleck | http://fleck.com/
Flickr | http://flickr.com/
Go2Web20.net | http://go2web20.net
Google Apps | http://www.google.com/apps/business/index.html
Google Sites | http://sites.google.com/
Jumpknowledge | http://info.jkn.com/
Nettrekker | http://www.nettrekker.com/
PBwiki | http://www.pbwiki.com/
Ruby on Rails | http://www.rubyonrails.org/
SlideRocket | http://www.sliderocket.com/
Summize | http://search.twitter.com/
Ta-da List | http://www.tadalist.com/
TeachersFirst Edge | http://www.teachersfirst.com/content/edge.cfm
TeacherTube | http://www.teachertube.com/
Trailfire | http://trailfire.com
Twine | http://www.twine.com/
Twitter | http://twitter.com/
WebSlides | http://slides.diigo.com/

Weebly | http://weebly.com/
Wetpaint | http://www.wetpaint.com/
Wikipedia | http://wikipedia.org/
Wordpress | http://wordpress.com/
YouTube | http://youtube.com/
Zoho | http://zoho.com/
Zoho Creator | http://creator.zoho.com/home.do
Zookoda | http://zookoda.com/

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DEFINITIONS

Constructivism is based on the premise that learning is an active process and learners construct knowledge and understanding of the world by reflecting on their experiences.

Cognitive learning emphasizes strategies to meaningfully encode and decode knowledge to and from long-term memory.

Cognitive load theory highlights the specific limitations of working memory. Intrinsic, germane and extraneous cognitive loads are additive. Particularly relevant to technology-enhanced learning, too much extraneous cognitive associated with difficult software applications and poorly designed interfaces deleteriously affects learning.

Low threshold refers to how easily a tool—specifically, a technology-based tool—is to adopt and how easy it is to learn.

Perpetual beta is a design principle of Web 2.0 applications describing the constantly evolving nature of the tools, often making changes at the request of users.

Mental models are functional schemata, guiding and governing performance during learning or problem solving. Individuals have preconceived notions about how to accomplish a task within an electronic system.

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