

TPACK and Web 2.0:

Transformation of Teaching and Learning

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Humanity and industry are becoming more and more dependent on creative innovation to make advancements in everything from medicine to entertainment. Advanced creative thinking is often the product of collective knowledge, the result of individuals sharing ideas and knowledge freely in order to achieve the best possible results. Knowledge that is collectively shared continues to grow and change as a result of continuous questioning and improvement through the combined efforts of its contributors. In his recent speech on the economy the President of the United States, Barak Obama, discussed the need for inventors and creative production and mentioned the importance of “our best and brightest committing themselves to making things” (Obama, 2009). Societal progress is dependent on its peoples’ ability to construct new knowledge. It has been suggested that knowledge building, or the development of new ideas, is also the foundation for education (Scardamalia & Bereiter, 2003).

Web 2.0 technologies support creative and collective contribution. Additionally, any individual with an Internet connection may utilize collaborative technologies. Professionals, experts, students, and the general public may contribute to content-specific wikis, join social networks, create digital videos and music, contribute to blogs, etc. The results of combined and peer edited knowledge are such that the sum is greater than the individual parts. The success of shareware and online collaborative knowledge projects like Wikipedia (<http://en.wikipedia.org>) suggest that improvements and knowledge

building occur through active engagement and collaboration. Current collaborative efforts seek to improve and create knowledge.

Expert teachers have long understood that engaged learners develop a deeper understanding and relationship with content. Learning is meaningful when students co-create and develop their own knowledge. McCombs and Whistler (1997) suggest students take ownership of their learning when they are provided with opportunities to interact with content, make connections and form new meanings. Constructing knowledge is relevant to students’ lives when teachers facilitate learning through skilled pedagogy. Students are naturally motivated through effective pedagogical and technological use. Internet and Web 2.0 technologies afford students opportunities to seek information, collect their own material, communicate, make meaning, and evaluate end products (Nelson, 2007). When thinking about the potential for developing learners who value and contribute to the global knowledge, several questions surface. What value are Web 2.0 technologies to K-12 teachers and students? How does Kohler and Mishra’s technological, pedagogical, and content knowledge (TPACK) framework influence teaching and learning with Web 2.0? What support systems are needed for teachers to integrate the latest Internet technologies to facilitate meaningful learning?

We suggest integration of Web 2.0 technologies, utilized by skillful teachers, can promote student learning and facilitate the development of lifelong skills such as collaboration, creative thinking and knowledge construction. We do

not imply that these important skills cannot be taught without technology, but how much more rich and deep are the experiences to be gained from collaboration with students from diverse backgrounds? Furthermore, creative, higher order thinking and knowledge construction can be encouraged through well-designed application, production, and publication. Web 2.0 technologies afford teachers and students with creative and collaborative choice.

Knowledge Building and the Internet

In the fall of 2005, nearly 100 % of public schools had Internet access (NCES, 2006). More recent research conducted by the National School Boards Association in 2007, found that Internet use among students had increased and 97% of the 9-17 year olds surveyed use the Internet for social networking. "With words, music, photos and videos, students are expressing themselves by creating, manipulating and sharing content online" (NSBA, 2007). Furthermore, 59% of the social networking students spent time in discussions related to educational subjects such as college planning, school work, politics, religion, etc. The research suggests that the number of students using the Internet for school, social, and creative purposes has increased dramatically (NCES, 2006 & NSBA, 2007). Our youth "live with Web 2.0 tools, but schools must help them use the tools to acquire new skills, not just play with them" (Soloman & Schrum, p 19).

Knowledge building "results in the creation or modification of public knowledge—knowledge that lives 'in the world' and is available to be worked on and used by other people" (Scardamalia & Bereiter, 2003). Teachers facilitate deeper levels of understanding by providing opportunities for students to actively connect with the curricular content, peers and expert research. Although educational content is prescribed by school curricula, schools and teachers are often afforded some flexibility in how the content is delivered and learned by students. Given that "there has been explosive growth in creative and authoring activities by students on social networking sites in recent years" (NSBA, 2007) schools have a unique opportunity to harness students' interests, skills, and abilities to network, author and publish new information related to curricular content.

In previous years, students had limited access to educational software outside school buildings. Web 2.0 tools make it possible for students to access Internet applications and content from Internet connected computers (Bull & Ferster, 2005). Using the newest Web 2.0 technologies, students and teachers can assemble multimedia presentations from scratch or combine online content in mashups. There are hundreds of free

and user friendly Web 2.0 tools available for public use. For instance, Jing (<http://www.jing-project.com>) and CamStudio (<http://camstudio.org>) are used to record audio and screen casts. Students use interactive comic strip tools like Toondoo (<http://www.toondoo.com>) to create digital stories. Text, slide shows, and spreadsheets can be collaboratively developed using online office applications such as Google Docs (<http://docs.google.com>) or Zoho (<http://zoho.com>). Social bookmarking and educational networking sites like Diigo (<http://diigo.com>) and iEarn (<http://iearn.org>) provide students and teachers with opportunities for global collaboration. Publishing collective works online is not just possible; it is plausible, using free web page development tools and wikis. The possibilities for collaborating and constructing knowledge using the Internet are limitless.

Collaboration and Transformation in Thinking and Learning

There is irrefutable truth in the phrase *children are our future*. Given the global nature of economy and industry, educators must teach our children to think and creatively solve problems with the intention that youth are prepared for innovation and the advancement of society. Necessity dictates that we cultivate the development of creative, skilled, life long learners. Whether physical or online, students who actively engage with content take responsibility for their own learning (Scardamalia & Bereiter, 2003). True knowledge is not attained through passivity, nor is it isolated and disseminated from experts to learners (Bull et al., 2007). Knowledge is continuously changing and growing. In order for young people to develop new ideas, teachers must design learning activities which encourage "creative solutions and products" (Koehler & Mishra, 2008). Skilled practitioners use their knowledge of pedagogy, content and technology (TPACK) to make the most of available resources. They facilitate learner-centered experiences in order to promote deep understanding through the construction of new knowledge. In other words, teachers who integrate Web 2.0 technologies in meaningful ways have well developed TPACK. Such teach-

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ers have a deep understanding that learning must be transformative. Teachers with strong TPACK also recognize that a large chunk of our contemporary environment is online and that children best learn how to learn by interacting with the environment. Technology therefore, provides opportunities to learn about, alter, and modify our environment (Borko, Whitcomb, & Liston, 2009).

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Teachers well versed in technology, pedagogy, and content no longer ask themselves “How do I use this technology?” Research recommends that teachers ask, “Why do I want to use this technology?” (Gooding & Morris, 2008). Technological Pedagogical Content Knowledge (TPACK), is a conceptual framework designed to illustrate the characteristics of teacher knowledge and technology integration in education. In 2006, Mishra and Punya built on Shulman’s concept of Pedagogical Content Knowledge by extending the framework to include not only Content Knowledge (CK) and Pedagogy Knowledge (PK) but also Technology Knowledge (TK), and the intersections of content, technology and pedagogy (e.g., TPK, TCK, PCK and TPACK). The TPACK framework is grounded in an understanding that quality teaching and learning do not occur when the three knowledge bases exist separately, but that meaningful and engaged learning happens when there is an interplay and relationship among the three.

TPACK is “a way of thinking about the knowledge teachers need to understand to integrate technology effectively into their classrooms” (Mishra & Koehler, 2008). Teachers who exhibit best practices with technology are “characterized by the creative, flexible, and adaptive ways in which they navigate the constraints, affordances, and interactions within TPACK framework” (Mishra & Koehler, 2008). True technology integration is a thoughtful approach in which teachers understand how to relate concepts with technologies, demonstrate creative pedagogical practice, and facilitate technology use in ways to teach content and skills with a student centered approach. “Tech-savvy teachers have well-developed TPACK” (Borko, Whitcomb, & Liston, 2009).

“The mere introduction of technology in schools will not have the desirable outcomes,

that is technology in and of itself is not a transformation mechanism or vehicle for change. Rather it is a tool invoked by its users to reconstruct the subject matter from the knowledge of the teacher in to the content of instruction” (Angeli & Valanides, 2008). Since technology availability does not necessarily equate to learning, teachers who have strong TPACK make the most of current technologies by adapting appropriate tools and resources to fit the goals and objectives of their classrooms and curricula. To teachers who have well developed TPACK, Web 2.0 is an additional set of tools and resources to be used when facilitating student learning.

Web 2.0 technologies afford teachers and students with the capability to easily access and interact with tools and global information. The ubiquitous and flexible nature of Web 2.0 tools and the directed projects that are collaborative in nature, promote deep understanding, solve problems creatively, and transform thinking using the technologies and tools that are task appropriate. Teachers and students may also appropriate new uses for technologies according to specific content needs and curricular goals.

When integrating Web 2.0, teachers should create well-designed Internet activities that focus around the curriculum standards and not the tool itself. Internet activities such as social bookmarking, digital storytelling, or blogs should be applicable to specific curriculum standards, support students’ deep understanding of a concept and its meaning to their lives, contain ownership of choice, and provide time for student and teacher assessment and reflection (Nelson, 2007).

Teaching and Learning with Web 2.0

Murugesan (2007) describes Web 2.0 as a usage as well as a technology paradigm. It is an overarching term surrounding many contemporary web technologies. Digital resources are plentiful and web-based education has changed the public’s thoughts about teaching and learning (Wang et al., 2007). Students can develop new ideas and knowledge when their teachers are TPACK proficient. Web 2.0 technologies are some of the tools teachers may utilize to plan and facilitate student learning. We will briefly discuss Web 2.0 technologies (i.e., blogging, social bookmarking, and digital storytelling) and describe three well-designed scenarios directed by the TPACK framework.

Blogging. Blogging sites such as Edublogger (<http://www.edublogger.org>) and Wordpress (<http://www.wordpress.com>) give teachers and

students opportunities to generate and document classroom content, activities, experiences, and reflections. According to Wang et al. (2008), blogs provide instant Internet publication and encourage interaction between the writer(s) and readers. Open communication guides learners to a deeper understanding of the topic and allows bloggers to take ownership for their constructed knowledge. Teachers and students can post comments to create a platform for analyzing and synthesizing content. Educational uses of blogs vary depending on the instructional content. Blogs can expand on student collaboration and reflection, allowing for ideas and discoveries to emerge as higher level thinking unfolds. RSS (Really Simple Syndication) feeds allow readers to subscribe to content specific articles. The success of blogs has proven the importance of collaboration and communication in a technology-rich learning environment.

TPACK and blogging. Mr. Walker, a biology teacher, has some experience with blogging and he is interested in creating a blog for his high school biology class (TK and CK). He attended a professional development workshop on blogging in the classroom. With the knowledge he gained from the workshop and his own blogging experience, Mr. Walker decides to set up a blog to allow his students an opportunity to highlight class reflections, practices, experiences, and outside resources (TK and PK). Knowing that collaboration can develop life long skills such as cooperation, flexibility, understanding, and team work, Mr. Walker's goal is to promote collaboration among students, parents, teachers, and administrators. He also aspires to create an effective tool for assessment and reflection (TK and PK). At the beginning of the semester, Mr. Walker and his students explore various educational blogs and create the general layout using a district approved blogging site (TK). Students are divided into small, heterogeneous groups and requirements are addressed. Website evaluation, appropriate writing and content, plagiarism and copyright infringement are discussed and reviewed (PK). Throughout the semester, each group is responsible for researching and posting information about their assigned topic. Students post examples of classwork and content related readings and activities. In addition, Mr. Walker posts thought provoking questions and students analyze the content by writing reflections in the comment section (CK). Weekly entries are posted and time is allocated for making connections and searching for deeper understanding. Mr. Walker uses a rubric to assess the students' understanding from the posts and comments.

Social Bookmarking. Social bookmarking has many effective uses for teaching and learning and can be a powerful bridge between the classroom and Internet. Incorporating bookmarking into teaching and learning provides visual cues for students and supplies meaningful literacy material via the Internet. In addition, bookmarking can increase time on task, decrease search time, enhance the curriculum, and enable students to locate the best resources (Forbes, 2004). Tagging permits users to collect, organize, and share web-based resources. Tags allow teachers and students to search, analyze, and locate identified educational resources with distinctive keywords. Sites like Delicious (<http://www.delicious.com>) and Diigo (<http://www.diigo.com>) are popular social bookmarking sites used by educators and students.

Social Bookmarking and TPACK. Ms. Gonzales, a middle school language arts teacher, is teaching a unit on the different styles of poetry. Before she begins the poetry unit, Ms. Gonzales researches the Internet for valuable and content-rich websites (CK). With the aid of Diigo, she bookmarks each site and assigns specific tag names. In the comment section, Ms. Gonzales adds important information about the site and includes the project directions. On each site, she highlights the most vital information and adds discussion questions on virtual sticky notes next to the text. When she has finished bookmarking, she shares the group sites with her language arts class (TK, CK, and PK). Together, Ms. Gonzales and her students log on to the Diigo group and review the curriculum standards, activities, and bookmarks (TK and CK). Once the students become engaged in the poetry unit, they refer to the Diigo bookmarks and respond to the teacher's discussion prompts by adding their feedback in the group's forum. Through active research, the students were able to demonstrate critical thinking, discover new information, create new connections, interact with text, and work together to create a group report.

Digital Storytelling. VoiceThread (<http://voicethread.com>) and Bubble Share (<http://www.bubbleshare.com>) use images, text, and audio and video clips to tell a story. Digital storytelling can enhance student learning and higher order thinking skills. Kajder et al. (2004) acknowledge created content opens the door to multiple communication levels similar to popular media. Digital storytelling allows students to be actively engaged in their work, play a part in literacy communities, and delineate themselves as readers and writers. Teachers

and students are able to visualize, comprehend, and communicate meaning through the use of digital storytelling.

Digital Storytelling and TPACK. Ms. Williams, a third grade teacher wants to use VoiceThread to facilitate communication, learner research, and organization skills and to assess her students' content knowledge (PK and CK). Ms. Williams joined the Voicethread for Educators Ning group and has been researching different types of storytelling and applicable examples and ideas to integrate into her lessons (TK). She determines that the best way to utilize this technological resource is to allow her students the opportunity to create a story about a historical event. She breaks her class into small groups (PK). Each group begins writing a story or a script and creates a storyboard. Once the story is created, Ms. Williams guides the students to specific websites to locate images, drawings, or other artwork that reflect the idea of the story (TK). Students build the digital story by selecting music and recording voice-overs or video clips. When the projects are complete, Ms. Williams and her class watch each video and contribute written and verbal feedback about the historical content. Based on the feedback and a teacher-created rubric, Ms. Williams is able to assess the students' knowledge of the historical content, collaboration skills, and higher order thinking. Lastly, Ms. Williams uploads her students' digital stories on VoiceThread and shares them with parents and teachers.

Support Systems

The teacher's own philosophy affects how Internet technologies are used in classrooms. The educator who encourages collaborative projects and authentic activities, whether online or otherwise, often characterizes him/herself as a facilitator, coach, and resource to support student learning. These teachers often have constructivist philosophies and work to motivate students to take responsibility for their own learning. Cooperative student projects, discussion, debate, and freedom to explore the content are all vehicles for student learning when teachers and students successfully make use of Internet and Web 2.0 technologies. Teachers who are uncomfortable with less direction and prefer more control may be less likely to allow students the freedom to interact in online communities and explore the content (Alagabe & Lemlech, 1998). On the other hand, simple existence of interactive technologies and online communities does not equate to collaboration and creative knowledge construction. The teacher's role is vital to facilitate student learning and responsibility

(Turvey, 2006). "Technology transforms learning; in short, this means a changing role for teachers and students, changes in teaching style, and changes in the social milieu of the classroom (Alagabe & Lemlech, 1998)." Teachers who have demonstrated success with Internet-infused learning are often flexible with instruction but keep curriculum goals in mind at all times. They usually exhibit comfort with technology and want to help students make connections between the real world and curricular content (Spudic, 2001).

The shift of the teacher from the dispenser of information to facilitator requires professional development opportunities to provide teachers with experiences similar to those expected for their students. Teachers must also "explore, create, define and express" in professional development settings (Alagabe & Lemlech, 1998). Professional development, however, must go beyond workshops designed to enhance the knowledge bases within the TPACK framework. Kholer and Mishra indicate that TPACK development is "suggestive of a new kind of literacy—beyond specific knowledge of particular disciplines" (2008). Since technologies are rapidly changing, a teacher's understanding of technology is constantly in a state of growth and reinvention signifying a need for ongoing professional development.

Internet and Web 2.0 Integration Challenges

Web 2.0 technologies support creative and collective contribution in the classroom. We recognize however, that teachers face significant challenges when designing technology-rich learning environments. Many Web 2.0 technologies are free but because of school district initiated filters, Internet tools and resources can lose educational value when they are not classroom accessible (Ash, 2008). Other challenges teachers and students encounter when teaching and learning with technology include:

- Safety issues such as online predators, web-based bullying, and inappropriate content
- Restrictions on social networking and social software
- Online privacy and copyright infringement
- Lack of professional development opportunities

Summary

Web 2.0 technologies provide possibilities for sharing and building knowledge. Teachers who facilitate collaborative and interdisciplinary projects build on the unique strengths of individual students and encourage the sharing of ideas. In

essence, they are teaching students to be life-long learners. The Internet and Web 2.0 technologies afford teachers ready access to collaborative, authentic opportunities for students to engage in meaningful experiences related to the curriculum. TPACK-competent teachers exhibit best practices in pedagogy, content, and technology. They understand the true nature of effective teaching and learning with technology. New and veteran teachers alike may see it as a challenge to learn new technology and design authentic, curriculum-based lessons that make the most of Internet learning opportunities. Until school districts and teacher preparation programs recognize the value of TPACK and initiate widespread curricular use of Internet technologies, educators may spend extra time and effort to learn about and organize meaningful, collaborative and technology-rich learning opportunities for their students.

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