K-12 STUDENT USE OF WEB 2.0 TOOLS: A GLOBAL STUDY

By

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ABSTRACT

Over the past decade, Internet use has increased 445% worldwide. This boom has enabled widespread access to online tools and digital spaces for educational practices. The results of this study of Web 2.0 tool use in kindergarten through high school (K-12) classrooms around the world will be presented. A web-based survey was sent out through online social networks (e.g., Twitter, Nings, and blogs). From a list of 25 types of digital tools, 189 participants chose the online tools that their K-12 students used in educational settings. The data analysis identified tool-use across grade levels and trends based on teacher demographics. At all four levels students most frequently used wikis, blogs, and multimedia presentation tools. Further analysis revealed six categories that described how teachers were designing instruction for students to use online tools.

Keywords: Online Tools, Web 2.0 tools, Digital tools, Participatory Web, K-12 Education.

INTRODUCTION

With a 445% increase in Internet use over the past decade (Miniwatts Marketing Group, 2010), the nature of the World Wide Web (web) has changed drastically. The web was initially a tool for pulling information that was created and maintained by web experts. The next iteration, frequently referred to as Web 2.0, is an interactive environment that enables anyone with access to push out information into the network. The participatory nature of Web 2.0 tools has vast implications for learning as educators are empowered to expand the walls of their classrooms, and as students are enabled to connect, create, and collaborate with their peers anywhere in the world.

Online technologies have increased in popularity over the past few years, providing a vast array of opportunities for student learning. As far back as 2005, O'Reilly saw that these tools would have a part in reshaping education. Shortly after O'Reilly's claim, literature began to reveal that teachers were expanding their classroom practices by employing Web 2.0 applications, resulting in creative, motivational, challenging, and stimulating learning environments for their students (Williams & Chinn, 2009; Barlow, 2008; Thomas & Li, 2008; Keller, 2008). Crooke (2008) questioned this assertion when he stated, "Yet while there is a groundswell of enthusiasm for adopting Web 2.0 practices in education, there is little evidence that uptake is happening to any significant degree" (p. 5). In contrast, Gooding (2008) viewed teachers as taking advantage of Web 2.0 technologies due to the ease of access that enable activities that "incorporate technology, to increase critical thinking, and to promote substantive conversation in the classroom" (p. 45). In light of these contrasting points of view, this study was designed to determine the extent to which K-12 educators were embedding online tools into their students' learning experiences.

Published annually, the Horizon Report: K-12 Edition provides a prediction of emerging technologies, tools, and strategies that are likely to be adopted and hit critical mass within one to five years. The authors of the report support the notion that these technologies influence the way K-12 students are learning and being taught. In 2009 the report indicated that collaborative environments and online communication tools would be the trend in one year. By 2012-2013 they projected that mobiles and cloud computing would be dominant themes for learning and teaching (Johnson, Levine, & Stone, 2009). In the 2010 report cloud computing and collaborative environments were projected to be adopted by mainstream K-12 students to provide "students tremendous opportunities to interact with peers and mentors, experience other worldviews, and model the kinds of work patterns that take place in an increasing number of professions" (Johnson,

Levine, & Stone, 2010, p. 6). Game-based learning and mobiles were predicted to be mainstream in 2-3 years. The latest report, published in May of 2011, listed cloud computing and mobiles as being adopted within the next twelve months, game-based learning and open content in the next two to three years, and learning analytics and personal learning environments by 2015-2016 (Johnson, Levine, & Stone, 2011). The findings of this current study support the emerging uses of collaborative environments, online communication tools, and cloud computing mentioned in the three reports.

The data in this study were collected to discover if K-12 teachers were introducing these tools to their students as well. The National School Board Association (2008) explored the use of technological tools among 250 9–17 years old. One key discovery revealed that these students were using social networking tools nine hours weekly; almost as frequently as their ten hours of television watching. While students are well connected with their personal learning networks, data was needed to see if students were using their social connections and digital tools to enhance their learning in schools.

PBS (2011) surveyed PreK-12 teachers to determine how they were using technology to enhance their teaching. They found that 97% of the teacher participants were using digital media in their classrooms, with video streaming and downloads being the most frequently used. While teachers valued the use of technology for many personal and instructional uses, this study did not explore how students were engaged in the use of the participatory web. Teachers stated that wikis, blogs, and social networking sites were three of the six least valuable digital resources they used.

With the emergence of the participatory web, learning options have expanded the potential for student engagement in generating knowledge and creating products of learning. Klamma, Cao, Spaniol (2007) provided a comparison of the traditional web (Web 1.0) and the participatory web (Web 2.0). They indicated that traditional uses of the web pulled content into the classroom, where Web 2.0 pushed learners out to participatory interactions on the web. Table 1 delineates the pull (Web 1.0) and push (Web 2.0) activities of these types of interactions.

The Web's second generation provides additional opportunities for teachers to embellish their students' educational experiences. Browser-based tools such as blogs and wikis, slide shows, videos, and photos, and programs that plan lessons link to curriculum standards, deliver content, and monitor student performance. They all contribute to each teacher's instructional repertoire (A Tool for Its Time, 2010).

O'Neill (2007) found that online interactions between international elementary students can help them develop social interaction skills that transfer to the face-to-face classroom. In addition, the activities can enhance the students' reading and writing skills. Lam (2009) found that as Grade 8 students used Web 2.0 applications their levels of intrinsic motivation to learn were increased. Klamma, Cao, and Spaniol (2007) found three knowledge management processes that occurred with blogging: idea creation and sharing, community forums, and knowledge spreading. These processes are not unique to blogging; many other Web 2.0 tools provide the same types of processes.

Online tools enable learner participation in knowledge creation. Boyd (2007) mentioned three affordances of Web 2.0 tools that engage learners: conversational interaction, social feedback, and social networks based on relationships. Crooke described twelve categories of Web 2.0 activities: trading, media sharing, media manipulation, data/web mashups, conversational arenas, online games and virtual worlds, social networking, blogging, social bookmarking, recommender systems, collaborative editing, wikis, and syndication (2008, pp. 9-15). The literature reveals that many teachers are using these tools to engage their students in learning activities. This study was designed to identify how many different tools teachers used with their students, and how widespread is the use of

Web 1.0	Web 2.0
Britannica Online	Wikipedia
Personal websites	Blogging
Publishing	Participation
Content Management	Wikis
Directories (taxonomy)	Tagging ("folksonomy")
Stickiness	Syndication

Table 1. Comparison of Web 1.0 and Web 2.0

Web 2.0 tools in K-12 schools.

Methods and Procedures

Participants were recruited through Twitter, blogs, and Ning networks. Over a 60-day span, the researcher sent 27 messages on Twitter (Tweets), and others in the researcher's network sent out an additional 6 Tweets. The survey produced 189 complete data sets of teachers in four grade groupings: K-3, 4th-6th, middle school, and high school.

The use of professional and social networking tools for the call for participation was designed to identify teachers who were likely to be using online tools in their classrooms. Targeting teachers who participated in the digital network resulted in identifying those who were technologically proficient. These teachers were deemed more likely to engage their learners in the use of digital tools for learning.

The Instrument

A researcher-created survey was constructed to identify the online tools that teachers included in their students' learning experiences. An initial list of tools was compiled from the literature (Crooke, 2008; Alexander, 2006; Mejias, 2005; O'Reilly, 2005) and from educational technology experts' websites (Churches, 2010; Couros, 2010; Davis, 2010; Schrock, 2010; Summerford, 2010, Carrasco, 2006). In addition to listing the functions and types of tools, specific examples were provided for each tool type to help define the tools. The survey consisted of two parts: the Personal Data Questionnaire (PDQ) and a listing of 25 online tools types. Three educational technology experts evaluated both sections of the instrument for content validity. Three rounds of evaluation produced the final version of the instrument used in this study. From the listing of 25 online/Web 2.0 tool types, participants identified all of the tools that they embedded in their students' learning experiences.

Participants

Participants in this study were predominantly female (84%) classroom teachers in the United States. The data sets were comprised of 85 K-3 grade teachers, 33 4th-6th grade teachers, 31 middle school teachers, and 40 high school teachers. The incidences of male teachers was found to increase with the age of the students, where the fewest number of males taught at the K-3 (4) and 4th-6th (4) grade levels, and the largest number (13) taught at the high school level. Over fifteen percent of the respondents were located outside the United States; the largest groups were from Canada (6%) and Australia (4%). Nine other countries were represented in the study (see the Google Map: http://snipurl.com/27sccm).

Although much is written regarding the adoption of technology by digital natives vs. digital immigrants, it is interesting that 52% of the participants were 45-59 years of age and 35% were 25-39 years old. The majority (59%) of the respondents indicated that their highest level of education was a master's degree; 37% earned a bachelor's degree, and 1% earned a doctoral degree. The largest group of teachers taught at the K-3 level (45%). The remaining 55% of the respondents were fairly evenly dispersed between 4th-6th grade (17%), middle school (16%), and high school (21%). In looking at the size of the communities where teachers worked, it was found that student online tool use was the most frequent in areas with populations of 25,000-50,000 (19.05% of the tools were used by this group); those in areas greater than 1,000,000 comprised 13.76 %, while areas of 50,000 were 13.23% of the tool use. Most surprisingly, over 11% of the online tool users were in cities with less than 5,000.

Data Analysis

It was the purpose of this study to identify the online tools that teachers embedded in their students' learning experiences. Online tool usage was measured in grade level groupings to determine the frequency and differences of tool use by student grade level. A descriptive analysis of the data provided insights into the frequencies of different tool use.

Teacher Career Stages

Podsen (2002) analyzed teacher movement through different career stages by identifying four teacher career stages: teacher inductee, teacher specialist, teacher leader, and teacher steward. Each represented the aspirations, stresses, and goals of teachers in the different stages. Teacher inductees were beginning educators who might be young teachers fresh out of college, or teachers

returning to work after deferring their career goals. Teacher specialists tended to concentrate on their area of specialization attempting to establish their career goals by becoming strong teachers in their content or grade levels and contributing substantially to the school community. Teacher leaders moved outside of the walls of their own classrooms and schools to have concern for the community of learners becoming expert teachers who could mentor others. Teacher stewards were seasoned teachers who felt fulfillment in their career and wanted to contribute to the profession, often by moving to different levels of responsibility within the school system.

We chose to group our teachers' years of teaching into these four career stages for analysis of their use of tools with students. Table 2 shows the number of tools used by students for these 189 teachers organized by their teacher career stage.

Teacher career stages were a positive predictor of technology tool use by students. Consistent with Prensky's (2010) views of digital natives and digital immigrants, the longer teachers had been in teaching, the fewer the number of tools they were expected to use. The exception to this was found in teacher inductees, or beginning teachers. If most teacher inductees are digital natives, it would be expected they would engage their students in learning activities using digital tools more than any other teacher group. This was not found to be the case; teacher inductees only used an average of five tools in their classes. It may be that while this group of teacher inductees is learning the "ins and outs" of teaching, they use digital tools for socializing and gaming in their personal lives, but not for teaching and learning in their classrooms as much as other teacher stages.

The results of teacher specialists (5.6 tools) and teacher leaders (5.3 tools) were consistent with teachers who are focusing on their content and determining methods for engaging learners in positive experiences. Teacher stewards may be more concerned with sharing with others what they have learned throughout their careers, as well as moving into new positions. They may not focus on learning new technologies, thus explaining their use of an average of only 2.9 tools with their students. While they had chosen to engage their learners in the use of technology for learning, they consistently used the same tools for their activities.

Years in education	Total Participants N=189	Total Numbers of Tools Used N=992	Average Number of Tools Used
Teacher Inductee (1-5 years)	15	75	5.0
Teacher Specialist (6-15 years)	90	505	5.6
Teacher Leader (16-30 years)	70	371	5.3
Teacher Steward (31-38 years)	14	41	2.9

Table 2. Number of Tools By Students by Teachers' Career Stages

Tool Use by Grade Groupings

The data analysis showed that three types of online tools were consistently highlighted for used by students at all grade groupings: wikis, blogs, and multimedia presentation tools. While wikis and blogs were used most by middle and high school students, multimedia presentation tools were the most popular in the lower grades. Figures 1-3 demonstrate specific percentages of use for each tool type by grades groupings.

Teachers in three of the grade groupings reported using wikis the more frequently than other tools. Figure 1 shows the use of wikis by students in the study participants' classrooms at each grade grouping.

The 4th-12th grade teachers chose wikis as the most frequently used tools by their students - 65% at middle and high school and 61% at 4th-6th grade levels. The use of wikis by K-3 teachers (38%) was third among their top three choices. Wikis, which provide a digital space for content creation, compilation, and collaboration, may be more developmentally suited to older students.

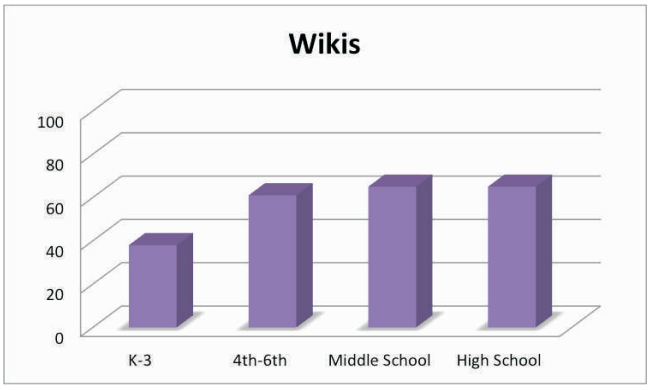

Figure 1. Percentage of Classrooms in which Wikis were being used by Students

Teachers reported that blogs were also used frequently. Figure 2 presents the use of blogs by students in the study participants' classrooms at each grade grouping.

Blogging ranked second in frequency of use at every grade level. It was used by 39% of K-3 students, 58% of 4th-6th grade students, 61% of middle school students, and 60% of high school students. Similar to wikis, blogs require higher levels of reading and writing literacy, explaining the less frequent use in the lower grades.

Also in the top three frequencies for each grade grouping were multimedia presentation tools, shown in Figure 3.

The use of multimedia presentation tools was the favorite of K-3 teachers (45%), and tied with wikis (61%) as the first choice of teachers in 4th-6th grade grouping. Multimedia presentation tools, which enable younger students to easily create expressions of their learning, were the most frequently used tool of K-3 and 4th-6th grade teachers. Middle school and high school teachers indicated that multimedia presentation tools were the third most frequently used.

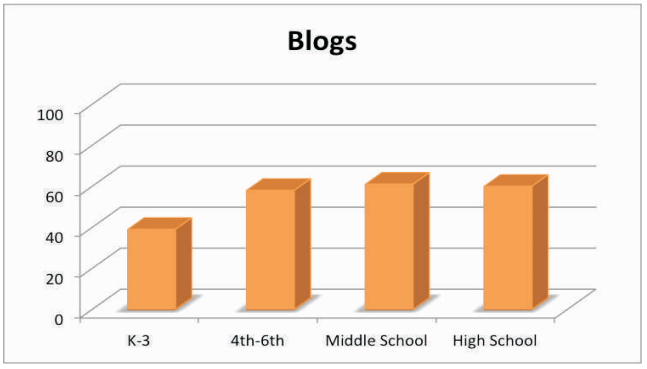

Figure 2. Percentage of classrooms in which blogs were being used by students

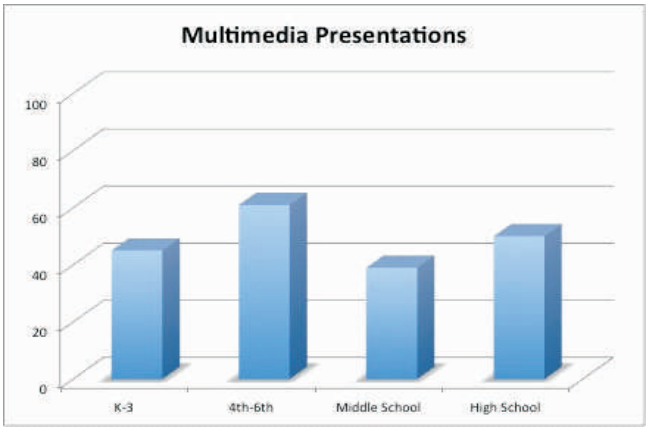

Figure 3. Percentage of classrooms in which multimedia presentation tools were being used by students

The three types of tools that dominated the top three positions, wikis, blogs, and multimedia presentation tools, could be seen as indicating an evolution of skills that paralleled developmental abilities. Wikis and blogs require relatively high levels of reading and writing abilities, while younger students (with the help of their teachers) can use multimedia presentation tools, such as VoiceThread and Animoto, to share their drawings and verbal comments.

A look at the fourth and fifth most frequently used tools indicated a much broader array of choices and did not reveal any commonly used tools across grade groupings. K-3 teachers indicated their students used video conferencing (27%) and start-up pages (26%) as the next most frequent technologies. In the fourth and fifth places teachers in 4th–6th grade used storytelling (42%) and photo sharing (39%). Middle school teachers had their students use a wide variety of tools, including polling (36%), document creation and collaboration (36%), social bookmarks (36%), and web-based presentations (32%). Finally, high school teachers used photo sharing (48%), start-up pages (48%), and calendars (18%).

The average number of tools used by each grade grouping provides insight into the variety of tools used at each grade level. Table 3 summarizes this data.

K-3 teachers reported using an average of 3.68 different technology tools with their students. Given that the top three tools were reported to be wikis, blogs, and multimedia presentation tools, it can be assumed that these dominated most of the time students were engaged with technology. This may be pedagogically sound for K-3 teachers as they help students demonstrate learning without too many new technology tools confounding the experience.

While the other three grade groupings indicated that wikis, blogs, and multimedia presentation were the top choices

Grade Grouping	N	Total Tools Used	Tools Used Per Classroom
K-3	85	313	3.68
4th-6th	33	206	6.24
Middle School	31	178	5.74
High School	40	311	7.78

Table 3. Average tools used per classroom by grade grouping

among student technology use, at each grade level students were integrating three to five additional tools in their learning experiences. This would parallel the developmental stages of intermediate elementary, middle, and high school students who should be able to embed different tools in their work.

Categories of Tool Usage

The 25 tool types were analyzed and placed into the following six categories based on their functionality:

- *Connecting*: Networking to create educational relationships with others in the same classroom, school, or other locale.
- *Participating in the Conversation:* Joining in with others in the virtual network to publish, conserve, and transform knowledge around certain themes.
- *Collecting:* Gathering, organizing, and cataloging resources found on the web.
- *Creating Content and Collaborating:* Generating and synthesizing knowledge; working with others to create a product that is greater than one could create alone.
- *Presenting:* Communicating learning and understanding to others; sharing a product.
- Planning and Organizing. Personally using online tools to provide structure and organization.

These categories of tools are presented in Figure 4.

While blogs, wikis, and multimedia presentation tools were the most frequently used tools, it was found that these tools could serve different purposes in student work. Wikis could be used as repositories, showing a collection of student work, or as a workspace for students to synthesize knowledge learned through creating and collaborating. In addition, wikis could be used as a digital space for students to present what was learned to the teacher or to the class. Blogs and multimedia presentation tools had similar multiple uses. Further research would provide greater insight into the ways these Web 2.0 tools are being used by students for learning, but that was not included in the purpose of this study.

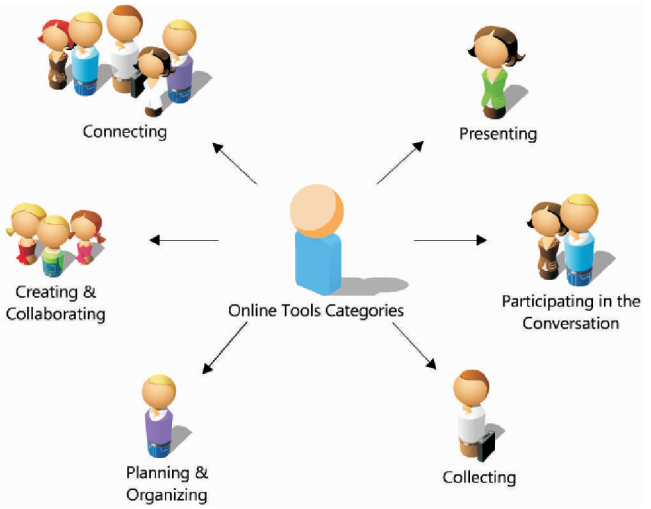

Figure 4. Categories of Tools

Figure 5 provides a mind map visualization of the tools that were included in each of the six categories.

If one simply looks at the three most frequently used technologies, students were engaged in creating and collaborating, presenting, and participating in the conversation while using wikis, blogs, and multimedia presentation tools. Connecting, planning and organizing, and collecting may include technological tools that teachers may want to learn to use more consistently with their learners if technology is to become a ubiquitous part of the learning process.

The percentage of technological activity by students in each of the six categories by the four grade groupings is presented in Table 4.

As would be predicted by the use of wikis, blogs, and multimedia presentation tools, creating and collaborating and presenting were the two top skill groups used by students overall. Connecting and participating in the conversation were next. A further breakdown of the data by

Tool Category	K-3	4th-6th	MS	HS	Total
Connecting	52 (16%)	35 (23%)	26 (13%)	59 (16%)	16.40
Presenting	103 (32%)	10 (6%)	49 (24%)	72 (20%)	22.31
Collecting	29 (9%)	23 (15%)	21 (10%)	46 (13%)	11.34
Creating and Collaborating	67 (20%)	50 (32%)	55 27(%)	92 (25%)	25.17
Participating in the Conversation	45 (14%)	27 (17%)	36 (18%)	60 (16%)	16.02
Planning and Organizing	30 (9%)	10 (6%)	15 (7%)	37 (10%)	8.77
Totals	326 (100%)	155 (99%)	202 (99%)	366 (100%)	

Table 4. Percentages of learners by grade level using tools in each category

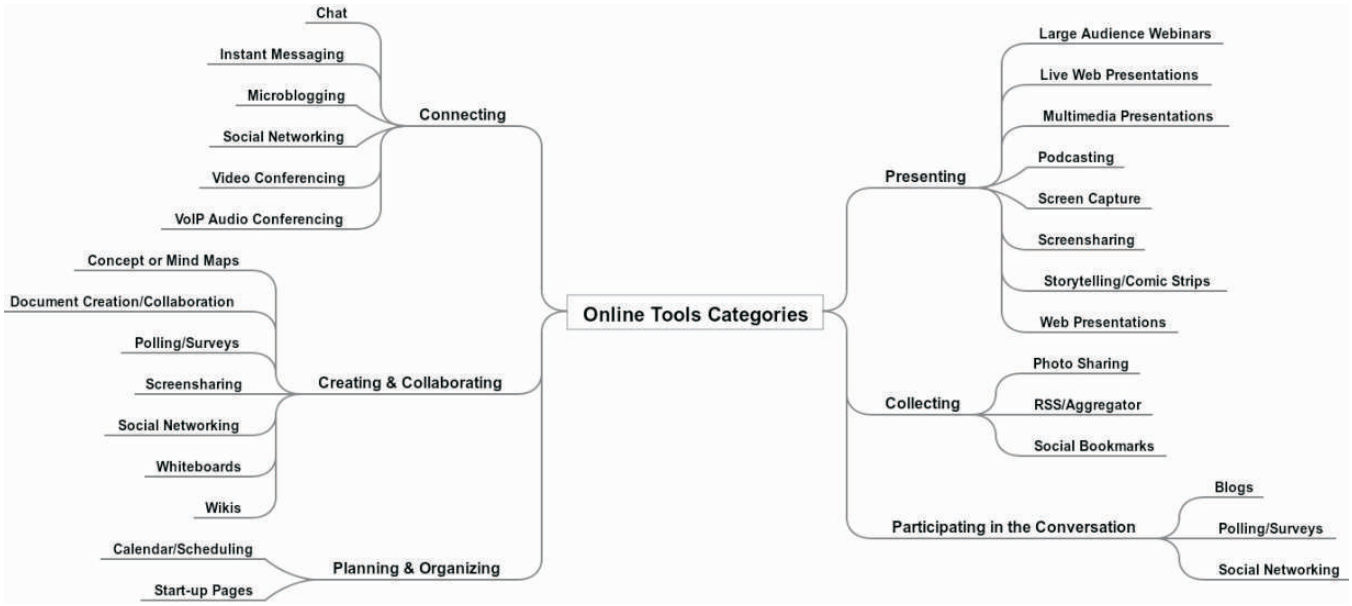

Figure 5. Mind Map of Tools in Each Category

grade groupings revealed an anomaly among 4th-6th grade learners - only 6% of the different tools were used for presenting. Creating and collaborating, along with presenting were the most frequently used tool categories for K-3, middle school, and high school. For 4th-6th grade, connecting and creating and collaborating were the most frequently used.

Blogging is a primary tool for participating in a conversation about ideas and concepts. It was not as well-used as we had supposed for this purpose, and this category came in fourth overall. Students may be using blogs to present ideas and products, but not to engage in an open discussion of ideas.

Collecting was found to be only 11% of the tool usage by students, which might indicate that teachers continue to be the controllers of the information and content being taught. Students may not be using online resources and search engines to locate information for synthesis. The presence of barriers that limit the use of online tools due to policy constraints and website restrictions may provide insight into this lack of use (Johnson, Levine, & Stone, 2009, p. 4).

Implication and Conclusion

The participating K-12 teachers, contacted through Twitter, blogs, and Nings, provided insight into Web 2.0 tools used by their students. These teachers were targeted for the study due to their frequent online engagement in digital spaces, and the assumption that they would be innovators and early adopters of technologies with their students. The insights gleaned from these teachers demonstrated that particular technologies are becoming staples in K-12 classrooms as reflected by their frequent use across grade levels.

Wikis, blogs, and multimedia presentation tools were the top three technologies used by students in all four grade groupings. These three technologies can be used in a variety of ways, and as students become facile in their use, technology will become a greater part of their learning tools and processes. As individual teachers enable pedagogically sound and frequent use of online tools, learners as well as schools will be transformed.

One very important finding from the data confirms many anecdotal reportings that seasoned teachers, not new teachers who happen to be Digital Natives, are the ones who are active in creating learning environments for their students that rely heavily on the use of online/Web 2.0 tools. New teachers (teacher inductees) are much more likely to be negotiating their classroom practices and honing their content skills than looking for ways to create learning experiences for their students to use online tools.

Experienced teachers (teacher specialists and teacher leaders) are comfortable with their teaching methods and classroom management, so they are prime candidates for creating learning environments that enable their students to use Web 2.0 tools.

Many K-12 students are active in social networks for personal use outside the classroom spending over 9 hours each week, regularly using digital tools to connect with their friends. As they are able to bring these technologies into the classroom and apply their digital skills to their learning, education systems and processes will be affected. The 25 types of digital tools assessed in this study provided insights into six broad categories of tool use. Most frequently, teachers at all grade levels were found to be designing instruction for students to use online tools that enabled them to create and collaborate and present their learning using digital tools. Connecting and participating in the conversation followed, with collecting, and planning and organizing being the least frequently used tools. In looking at these results, we can see that teachers may be using digital tools strategies in the same ways they teach without technology - enabling students to work in groups to demonstrate and present their learning.

Moving to the second tier of online tool use is a bigger step for learners as they use networking tools to connect with others and communicate their ideas to a larger audience. These types of activities require openness in web access that may not be available in many schools yet. Finally, the last two categories of collecting and planning and organizing provided surprising data. Students who attend schools that block access to web sites are unable to gather new knowledge by surfing the web, resulting in teachers continuing to be the major controllers of the content being taught. Tools to help learners plan and organize their work using calendars and other tools seemed to be less important to these participants.

The good news is that the tools that had been predicted to hit critical mass by 2011 are emerging across all grade levels. As technologically adept teachers continue to engage their learners in the use of these tools, it is expected that these students will transfer their skills and knowledge to their next levels of education. And as these students join their innovator and early adopter teachers in Web 2.0 tool use, learning environments in schools will be transformed. Soon, we will see changes in educational systems and students and teachers alike will be taking advantage of the affordances of Web 2.0 tools to learn together and connect to others around the world.

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