

Web Literacy and Technology Integration: Moving Beyond TPACK with Student-Centered Instruction

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Abstract

Due to the abundance and availability of information throughout the world, students must be exposed to ways to navigate and discern online information. This exposure occurs through student-centered research opportunities, in which students apply Web literacy skills to acquire new knowledge. The purpose of this study was to examine teacher perceptions of teacher integration and Web literacy skills and to examine technology integration within this context using Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) model. Focus group participants in this study implemented Web literacy activities in their classrooms and shared their experiences. Findings regarding the TPACK and ways it applies to technology integration and Web literacy activities led to the consideration of a revised, student-centered framework for technology integration.

Introduction

According to the National Technology Plan, today's students need hands-on, collaborative learning experiences inside and outside of classrooms, using common technology and reliable Internet access (U.S. Department of Education, 2010). The changing nature of today's technology encourages educators to shift from a teacher-centered instructional setting, where content is delivered via technology, to a student-centered instructional approach, where teachers' facilitate student use of technology as a tool for research and construction of knowledge (Richardson, 2013). With this in mind, technology integration in this study included teacher design of Web literacy activities, in which student-centered learning occurred within an online, technology-based environment. Web literacy, required for reading, writing, and participating in an online environment (November, 2008; Mozilla, 2014), is important because

we know the Internet will “increase, not decrease, the central role teachers play in orchestrating learning experiences for students as literacy instruction converges with Internet technologies” (Leu, Kinzer, Coiro, Castek, & Henry, 2013, p. 1173). The purpose of this study was to examine teacher perceptions of teacher integration and Web literacy skills in order to gain insight about potential needs for teacher training. Mishra and Koehler’s (2006) Technological Pedagogical Content Knowledge (TPACK) model provided a foundation for investigating and expanding current concepts of technology integration.

Background

Web Literacy

In the 21st century, literacy skills increasingly reflect technology use and the abilities necessary to problem-solve, collaborate, and present information through multimedia formats (Coiro, Knobel, Lankshear, & Leu, 2008; International Society for Technology in Education, 2012). As technology becomes more readily available to all students, concepts of literacy evolve, and to “become fully literate in today’s world, students must become proficient in the literacies of the 21st century technologies” (International Reading Association, 2009, p. 1). The Department of Education used the term *digital literacy* in the National Technology Plan when presenting knowledge students should possess for 21st century learning (U.S. Department of Education, 2010). *Digital literacy* represents a broad category which consumes other terms related to technology use and online literacy activities (Bawden, 2008), including Web literacy. *Web literacy* falls under the heading of digital literacy and represents 21st century skills needed to navigate and acquire information encountered through online environments.

The teachers in this study received *Web literacy* training from the November Learning group. November Learning, led by Alan November, provides professional development focused

on Web literacy skills for the classroom (novemberlearning.com). November has been highly recognized in the field of education technology, was named one of the nation's fifteen most influential thinkers of the decade by *Technology and Learning Magazine*, and was listed as one of eight educators to provide leadership into the future by the Eisenhower National Clearinghouse (November Learning, 2015). For this study, a November Learning consultant provided a half day teacher training related the application of Web literacy skills in the classroom. The training, funded by an internal research grant, aligned with the International Society of Technology in Education (ISTE) standards regarding what it means to be digitally literate in an age of evolving technology. According to ISTE, "Today's students need to be able to use technology to analyze, learn, and explore. Digital age skills are critical for preparing students to work, live, and contribute to the social and civic fabric of their communities" (ISTE, 2012, para. 2). The training was also customized to align with November's (2008) book, *Web Literacy for Educators*, which was provided to participants as a resource for understanding Web literacy skills.

According to Bridget Dalton (2015), "Web literacy is huge. It's everything we do on the Web" (Dalton, 2015, p. 605). Web literacy, for instructional purposes, includes the knowledge and skills student use to locate, evaluate, synthesize, organize, and communicate information found online (November, 2008; Leu, Kinzer, Coiro, & Cammack, 2004). The application of these Web literacy skills includes opportunities for students to research content. For example, locating information in an online environment involves using knowledge regarding the best search engines for research as well as ways to narrow searches using Boolean terms (key words with operators to increase the specificity of search results), quotation marks, or search engines (November, 2008). Once information is located, students must evaluate the website and its

content. The student may read the URL to determine information about the source, and the student may critically examine online content for reliable information. This process may also include determining the author of the website or examining forward and backward links on the website to view other pages associated with the website (November, 2008). Once valid websites have been found, students must synthesize information. Synthesizing the information requires the student to determine important details, to summarize information (possibly presented in multimedia formats), and to reword content (November, 2008). Such skills are necessary in order to convey what has been learned about a topic, while at the same time avoiding plagiarism. Organizing information entails using online tools to organize vast amounts of online information. Finally, collaboration and communication require students to connect with others using online networks or Web 2.0 tools and to present a final product (November, 2008). Acquired content may be represented (or communicated) through a variety of formats, including video, podcasts, written reports, etc. As students conduct searches for information, teachers relinquish sole control of content delivery and become facilitators of student research. The success of the research may depend on the students' Web literacy skills.

TPACK

What knowledge do teachers need in order to facilitate student research? Understanding complex relationships among technology, pedagogy, and content with models like the TPACK framework may facilitate teacher growth in new literacies (Leu, Kinzer, Coiro, Castek, & Henry, 2013). Mishra and Koehler (2006) extended Shulman's idea of Pedagogical Content Knowledge and developed the TPACK framework to include technology integration in the classroom. Mishra and Koehler's TPACK framework (2006) represents three forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK). In addition to the primary forms of knowledge, the

framework emphasizes four additional forms of knowledge that emerge as content, pedagogical, and technological knowledge converge. The TPACK model (Figure 1) represents these four knowledge bases at the intersections of TPACK: Pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). “The interaction of these bodies of knowledge, both theoretically and in practice, produces the types of flexible knowledge needed to successfully integrate technology use into teaching” (Koehler, Mishra, & Cain, 2013, p. 13). The TPACK framework has been used to inform the field of teacher education (Archambault & Barnett, 2010; Archambault & Crippen, 2009), yet research does not clearly address ways the TPACK framework may be used to address teacher facilitation of student-centered activities within an online environment. In this study, the TPACK model provided a foundation for investigating and expanding current concepts of technology integration. The researchers studied the model (Figure 1), to determine how content knowledge differs when learning is student-centered. The relationship among content, pedagogy and technology becomes even more complex as teachers consider student research, where content is not provided *to* the student but searched for *by* the student. The TPACK framework was used in this study, not to measure knowledge, but to examine connections between TPACK and Web literacy classroom activities (Appendix A). Therefore, it enabled the researchers to consider how pedagogy evolves during Web literacy tasks and to develop new ways to think about technology integration.

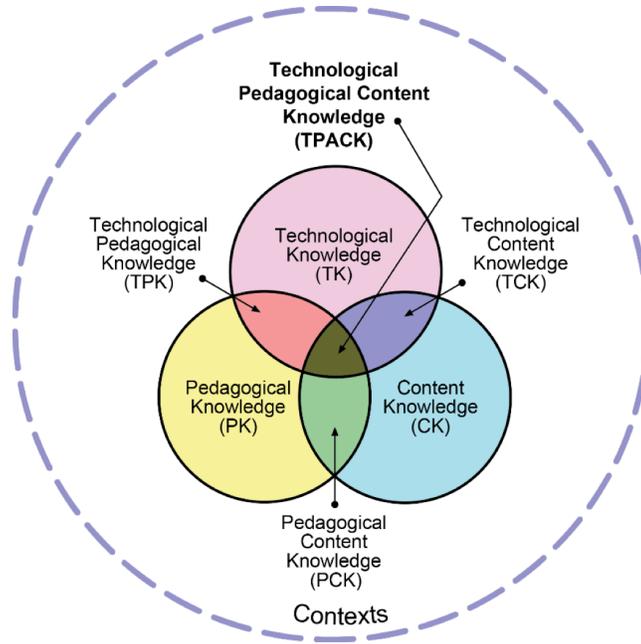


Figure 1. The TPACK model presents a framework by which to examine the overlaps in technology content knowledge, subject content knowledge, and pedagogy, Reproduced with permission of the publisher, © 2012 by tpack.org.

Methodology

The researchers collaborated with a network of private schools in South Texas during the 2014 academic year to study elementary and secondary teachers' perceptions about Web literacy and how perceptions affected technology integration decisions. Qualitative data were collected from inservice teachers participating in focus group sessions.

The following research questions guided the study:

1. What are teachers' perceptions of Web literacy skills?
2. What are teachers' perceptions of technology integration?
3. How does the TPACK framework reflect technology integration when learning is student-centered?

Participants

All elementary, middle school, and high school teachers in a South Texas private school consortium received personalized emails from the authors inviting them to participate in a Web literacy training conducted by a November Learning consultant. Approximately eighty teachers attended the workshop. Volunteers were solicited from the teachers attending the training to join a focus group for continued professional development. Eight teachers agreed to participate and signed consent forms. The teachers, five female and three male, averaged 13 years of experience with a range of two to 46 years. The teachers included one math interventionist at the elementary school level, one middle school technology teacher, and six high school teachers of various content areas (Latin, ESL and Russian, Religion, Speech and Theater, World Literature, and math support). Eight focus group participants joined the first focus group session, and five participants attended the second focus group session, where Web literacy projects were presented.

Focus Group Procedures and Data Sources

The first focus group session took place in February 2014 after the initial November Learning training. During this session, participants discussed Web literacy as it related to their personal and classroom experiences. Qualitative data were collected from teacher responses to open-ended questions designed to provide insight into teacher perceptions of Web literacy and technology integration (Appendix B). At the end of session one, participants were tasked with applying knowledge gained from the November Web literacy training to their classroom instruction. Appendix C includes the instructions provided to the focus group.

After completing a Web literacy task, teachers returned for a second focus group in May 2014. This session provided each participant an opportunity to share with others and to discuss their experiences implementing the Web literacy activity. Both focus group sessions were digitally recorded, transcribed, and analyzed for themes. The classroom products developed by the teachers were also examined as qualitative data.

Data Analysis

The Web literacy training focused on skills required for students to conduct an Internet search, which included skills related to locating, evaluating, synthesizing, organizing, and communicating information. Therefore, data analysis initially utilized deductive coding in order to incorporate skills/research associated with the November Learning training. Using NVivo computer software, qualitative data were analyzed and categorized using a coding system where themes were developed to reflect teachers' perceptions of Web literacy and technology integration. Through the coding process, the researchers concluded with six themes that represent teacher perceptions/concerns about Web literacy skills and two themes that represent teacher perceptions about technology integration. Themes related to Web literacy skills include

locating information, evaluating information, synthesizing information, organizing information, communicating information, and digital citizenship. Themes related to technology integration include adaptive abilities (for teachers and students) and student engagement.

The researchers then addressed technology integration within the framework of TPACK. The TPACK model is frequently used to represent teacher knowledge of technology integration. The model was analyzed systematically to determine its application in student-centered Web literacy activities. Examination of TPACK in this way required the researchers to consider ways focus group teachers implemented Web literacy activities and how implementation related to TPACK. While analyzing technology integration discussed in the second focus group session, the TPACK framework provided a lens for understanding the relationships between technological, pedagogical, and content knowledge and student-centered learning. Connections between the Web literacy activities and TPACK were analyzed to understand and extend ways of thinking about technology integration.

Findings

Teachers revealed concerns about Web literacy skills, which contributed to common themes. A major finding was that these concerns influenced the development of teacher CK related to Web literacy skills and decisions about technological pedagogical design (TPK). Focus group participants sought to improve their pedagogy through intentionally addressing and scaffolding students' weak Web literacy skills. This section is divided into two major parts: 1) evidence and examples of themes related to teacher perspectives about Web literacy and technology integration, from focus group session one, and 2) evidence and examples of pedagogical decisions affected by Web literacy concerns and the affordances of technology, primarily from focus group session two.

Teacher Perceptions

During the first focus group session, questions prompted participants to discuss Web literacy skills and ways teachers can promote these skills in their classrooms. Teachers' perceptions about Web literacy skills related to the five predetermined categories and one subcategory. These categories include: locating, evaluating, synthesizing, organizing, and communicating information and a subcategory of communication, which included digital citizenship.

Web literacy skills. Research question one was: *What are teachers' perceptions of Web literacy skills?* All focus group participants agreed students demonstrate a lack of Web literacy skills and that these deficiencies must be addressed through classroom instruction, regardless of the content. For example, teachers agreed students lack skills required for locating and evaluating information: "I think of the Internet more than anything and how kids utilize it and how we utilize it and how kids utilize it wrong and get the wrong information and don't truly know how to search." Another participant added,

We don't really know how to search the Web and we find all this junk. . . I go to all these websites and I think, 'Can I put another word in that could narrow it down? Or do a Boolean search a better way?' So when I think of Web literacy, I think of knowing it, and using it, and being able to search intelligently, and being able to find good resources. . . there's a lot of junk out there, you know that's not accurate. . . I experienced wrong information coming from kids in projects. I was like, 'Where did you get this?' And they were just searching. It was an honest search and they thought that the information was good . . . Kids can do it. . . they just don't know it yet.

Participants also understood that Web literacy includes “helping students discern if it (information) is credible.” Participants acknowledged that information evaluation is neglected by both teachers and students. One participant commented, “I feel guilty because I feel like I don’t do that very well.” Students’ abilities to synthesize information reflected a significant concern for teachers, and several comments related to ways students falsely synthesize information. “When they learn how to search, afterwards, they have to learn how to take notes because they don’t know how to take notes.” Plagiarism, a huge concern of all participants, also related to synthesizing information. A couple of participants focused on the problem of students cutting and pasting from websites: “They put down everything they find—the whole sentence and they end up plagiarizing.”

They’re going to take the laziest route of handling it. I don’t mean to be cynical. It’s just the path of least resistance. If all I have to do is ‘cut’ from Google on the first site and then copy, paste it, and take that to my poster board, I did the project. (Participant)

Another participant elaborated on the process,

He will do his research, he will find five different websites, he will cut and paste the sections he thinks are relevant into a word document . . . and then they keep a list for their bibliography and sources and then he pieces them together and changes pieces of it. (Participant)

Participants shared concerns regarding communication, which were broad and encompassed issues ranging from social networks to incorrect use of grammar during online discourse. The popularity of social networks with students arose in discussions as a concern as well as a stereotype: “I think we do them [students] a disservice when we think that all that Web literacy is, is get out your phone and do a Facebook thing.” The use of grammar and

communication skills elicited participant comments, “Yes, grammar still matters in all these things. There is a time when text speak is appropriate and there is a time when it is not...and we have really stopped teaching them . . .” and “We’re immersing first graders and seventh graders into Photoshop design... but they don’t know how to send a basic email...”

When discussing communication, the conversations often focused on students’ understanding and use of formal and informal communication appropriate for audience, social network platforms, and digital citizenship. Digital citizenship, sometimes referred to as “netiquette,” was a significant concern for participants and was identified as a subcategory of communication because online behavior applies directly to student involvement with online media. The email comment above could fit under digital citizenship because digital citizenship encompasses skills required for global learning in a digital world in order to “advocate and practice safe, legal, and responsible use of information and technology (ISTE, 2007, p. 2). One participant conveyed that digital citizenship should be a class students take:

Don’t be the person that is making fun of somebody else and don’t be the person that disregarded everything that you’ve ever been taught in English class or Spanish class... digital citizenship is definitely one of the classes that should just be like English...should be just that much of a mandatory class. (Participant)

Discussions also encompassed ways social networking behaviors get students into trouble, “...on your Instagram, on your Facebook, you need to make sure ...[nothing] inappropriate.” “It’s privacy settings and not diluting yourself because it’s totally real.”

Technology integration. Research question two was: *What are teachers’ perceptions of technology integration?* In addition to concerns about Web literacy, in the first focus group session, teachers shared concerns about technology integration. Teachers’ perceptions about

technology integration reflected two main themes: adaptive abilities (for teachers and students) and student engagement. Because technology changes often, teachers and students alike must know how to adapt to changing technology. This realization aligns with Koehler and Mishra's (2009) TPACK framework, as they maintained that technology knowledge includes being able to continually adapt to changes in information technology. Participants agreed that technologies will continue to change, and students must be taught how to adapt to that change. Seven teachers expressed the need for learners and teachers to adapt to technology. One participant commented,

How to adapt to that [technology], and something that I have personally very much struggled with...if you are going to use the technology, how are you going to have the skill to use the next version when they change it on you. (Participant)

Another participant referred to adaptive abilities as a skill, "You do you have to sort of play with it to figure it out...that's a skill as well." Discussion indicated this is a skill that cannot necessarily be taught to students.

Schlechy (2011) defined student engagement as behavior demonstrated by students who are attentive to their work, committed to their work, and enjoy their work. Participants in this study, though advocates of technology use in the classroom, viewed off-task student behavior as a problem for teachers integrating technology into instruction. However, as discussion evolved, participants concluded that utilizing engaging tasks would help lessen off-task behaviors.

Therefore, student engagement became a theme reflecting ways technology can benefit the classroom and improve off-task behaviors, when implemented correctly.

It would take a lot of preparation, which is why I have never even thought of doing this, but if we're going to do an activity where everyone is united and working on their phones and stuff...whatever the assignments is...we have to create an atmosphere where they

have to respect the assignment not just be texting...because it's so easy to not pay attention. (Participant)

Comments like this led to conversations in which the participants considered technology as a way to keep today's students engaged. One participant replied, "Very interesting activities...and if they are every interesting, they [the students] will engage with them." Other teachers mentioned specific technology tools for technology integration: "...pick tools that have that built into them, like Socratic" and "the one where we take over their iPad with our iPad-Nearpod. As an educator...as a teacher, we are the ones that ought to be thinking of this, how am I going to keep them on task?" One participant indicated that students engage with technology not only because they enjoy it but because they are familiar with the digital environment,

...by taking the Socratic app or something, I think they engage more because it's an environment that they are familiar with already... I think that is where the results come from ...the world is at your fingertips... I think they're just more comfortable doing that than raising their hands and saying something. (Participant)

Finally, it is important to mention that teachers cautioned against mistaking technology tools for good teaching, "...my fear is that the expectation is going to be, use social media because that's what teaches them...no, we are the ones that put it [instruction] together and teach them, this is simply a tool."

Pedagogical Decisions

Research question three was, *How does the TPACK framework reflect technology integration when learning is student-centered?* Teacher concerns about Web literacy and technology integration impacted pedagogical decisions. During the second focus group session,

participants shared Web literacy tasks they implemented in their classrooms, and researchers found participants intentionally designed Web literacy activities to scaffold Web literacy needs of students. In other words, even though participants could have implemented any Web literacy activity, they selected technologies or instructional strategies (TPK) related to areas of expressed concern.

All participants utilized Web literacy skills in which students used the Internet to locate and examine content related to course objectives. In each case, pedagogical decisions related to the activity involved Web literacy skills (TK) and ways to scaffold those skills (PK). The content objectives were determined by the teachers (CK), but student-centered activities focused on research led students to this knowledge. However, in analyzing Web literacy activities, researchers found that Web literacy activities are related to technology, content, and pedagogy in unique ways. It appeared that student-centered instruction, in particular, led to an overlap in knowledge, which reflects the complexity of TPACK.

Students engaged in online searches in order to find content related to the task at hand. Teachers promoted ways to help students effectively locate, evaluate, and communicate information. Techniques used to improve Web literacy skills relate to instructional design (or pedagogy). Existing studies provide some insight into teachers' rationales for technology integration decisions. Some researchers suggest technology integration aligns with planning (Harris and Hofner, 2009; Niess, 2005), where teachers would determine content, then learning activities, and finally technology to support the chosen activity. Manfra and Hammond (2008) propose pedagogy drives teacher's decisions, as teachers make pedagogical decisions about the nature of learning experiences. This section highlights ways teachers planned for Web literacy activities, considering content, technology, and pedagogy. Teachers' pedagogical decisions

about Web literacy became a primary focus as they planned instruction. The examples below highlight participants' pedagogical decisions related Web literacy skills and the use of strategies to support those skills during research activities. Table 1 summarizes projects implemented by three teachers participating in focus group sessions.

Table 1

Sample Web Literacy Projects

Teacher Example	Content/Grade	Web Literacy Applications	Pedagogical Tools
Teacher One	Latin/Secondary	Locate Synthesize Evaluate Communicate	Research guide for website evaluations
Teacher Two	Religion/Secondary	Locate information Synthesize information Evaluate information Communicate information	Social Networks
Teacher Three	ELL/Secondary	Locate information Synthesize information Evaluate information Communicate information	Goanimate.com

Example one: High school Latin teacher. Teacher one shared concerns about plagiarism during the initial focus group session. The teacher noticed students had cut and paste from websites to construct a product they submitted as their own work. As the teacher shared his Web literacy project during the second focus group meeting, he reiterated these concerns and discussed how he designed his project to reflect and improve upon these concerns. He implemented a project from the previous year, but he included improved designs to scaffold students' literacy skills. The students conducted research about gladiators and presented the information in class. The teacher used knowledge gained about Web literacy as well as concerns about student skills to build additional features into the assignment. For example, students were required to use websites to find the information, but they were required to evaluate the websites using guided questions. On the provided research guide, students had to submit reasons why they believed the website was credible, and they had to synthesize information found online. Overall, students used many Web literacy skills: information location, evaluation, synthesis, and

communication. An unintentional effect the teacher noted related to the aspect of the assignment where students summarized online information. The teacher found that during presentations, only one student had to look at hand-written notes. All other students had internalized the information through the research process. In other words, they learned more when they were not cutting and pasting information.

Example two: High school religion teacher. Teacher two shared concerns about a potential over-emphasis on technology and about technology integration for the “sake of using technology.” However, she implemented a project that utilized social networks, as well as many other aspects of Web literacy. She wanted graduating seniors to develop a personal mission statement. In order to complete the assignment, students were required to research companies (both public and private) to examine company mission statements. After finding sample statements, students wrote their own statement, which had to be posted online using social media. Students were able to select the social platform. Twitter, Facebook Pinterest, and Tumblr were among the social networks students used for the assignment. Finally, statements were shared and discussed in class, which instigated a round of responses to postings.

As the teacher shared her Web literacy project during the second focus group meeting, she discussed student reactions to sharing personal information on social networks, which enabled discussions related to digital citizenship and online behaviors. The teacher was pleased with the results of the assignment and admitted to working outside of her comfort zone. The teacher used knowledge gained about Web literacy. Once again, students used many Web literacy skills: information location, evaluation, synthesis, and communication.

Example three: High school English as a second language teacher. Teacher three shared concerns about communication skills in her classroom during the initial focus group

session. She voiced concerns about Internet searches using native languages versus English. She also voiced concerns about off-task behavior during technology-based lessons. She felt engagement was the key and wanted her students to communicate effectively. The teacher selected a Web literacy activity in which her students studied various topics, synthesized the information, and created avatars using goanimate.com. The students collaborated to create avatars relaying a synthesis of their researched information.

As the teacher shared her Web literacy project during the second focus group meeting, she discussed ways students engaged in the avatar project. While the translations demonstrated a need for continued development, students were engaged and enjoyed the project. The teacher used knowledge gained about Web literacy. Once again, students used many Web literacy skills: information location, evaluation, synthesizing, and communicating.

Other Web literacy projects also reinforced teacher application of Web literacy as it related to their concerns and to the task at hand. Perceptions about Web literacy drove pedagogical decisions. Findings indicated effective Web literacy classroom instruction depended on both technological and pedagogical knowledge (TK and PK). Teachers' knowledge of Web literacy skills strengthened their ability to address effective Web activities, where students located, evaluated, synthesized, organized, and communicated information.

Discussion

The transition from print to Web-based media has transformed skills necessary for success in the 21st century, where methods of locating and analyzing information have changed and are impacting classroom instruction. According to November (2008), "the rules of research have changed with society's move from paper to digital information" (p. 6), and there is an urgent need for students to develop Web literacy skills. Some research suggests teachers lack

knowledge regarding ways to facilitate learning experiences for students as literacy instruction converges with Internet technologies (Leu et al., 2013). Yet, teachers in this study recognized a need for Web literacy improvement and designed their instruction to facilitate improvement through technological pedagogical knowledge (TPK).

Web Literacy and TPACK

Findings regarding the TPACK and ways it applies to teacher knowledge of technology integration and Web literacy activities led to the consideration of a revised framework for technology integration, which would reflect technology integration in a student-centered environment. Web literacy activities require a complex set of skills within the context of a student-centered environment. With the Web literacy activities implemented, students conducted research according to the teacher's instructions. Content delivery varied from a traditional approach and was directly affected by students' Web literacy knowledge. The primary technology tool focused on the Internet for searches, and again, this was impacted by both teacher and student knowledge of Web literacy applications. The pedagogical approach in each situation was designed to scaffold Web literacy skills. Just as reading teachers use comprehension strategies to scaffold reading, all teachers may need understanding of Web literacy strategies in order to scaffold learning in online environments.

Koehler, Mishra, and Cain (2013) realized the complexities of teaching in the digital age. As they considered an approach to thinking about technology integration through the use of the TPACK model, they considered "context," represented by a dotted circle (see Figure 1). The context depicts specific learning and teaching contexts. The authors noted that the context depends on the situation, which affects how teachers can structure their lessons and activities.

Koehler, Mishra and Cain (2013) stated “seeing technology, pedagogy, and content as three interrelated knowledge bases is not straightforward” (p. 17).

Findings from this study reinforce the above statement that the interrelated knowledge bases are not straightforward. In considering the context in which Web literacy activities occurred, it seemed the student-centered approaches used with research assignments impacted the instructional design and TPK. The current TPACK model presents a framework for teacher-centered instruction with an emphasis on the teacher’s instructional design. Findings of the study at hand present a need to re-examine the TPACK model from a learner perspective. Do the affordances of technology used by teachers to transform learning, in addition to the context of the learning objectives, vary the integration of CK, PK, and TK in a student-centered model? Student-centered instruction requires a different way of thinking than traditional forms of content delivery as teaching paradigms shift. Kereluik, Mishra, & Koehler, (2011) reported teachers must be willing to experiment and put their technical literacy to work as deliberate designers of technology. These authors advocated the use of the TPACK as a way to design instruction. “Clearly an approach, that places TPACK at the center of teachers’ training, and offers opportunities for deep-planning and creativity are the need of the hour” (p. 18). However, Web literacy knowledge must be considered during planning and implementation of classroom research activities. Therefore, a student-centered TPACK reflects TK, PK and CK in very different ways. Appendix A presents TPACK “un-PACKED,” where the model is re-examined to represent student-centered perspective of the TPACK framework.

Web literacy skills are likely to be used in elementary and secondary classrooms through research activities similar to those our focus group teachers presented. According to the International Society for Technology in Education (ISTE), “Today’s students need to be able to

use technology to analyze, learn, and explore. Digital age skills are vital for preparing students to work, live, and contribute to the social and civic fabric of their communities” (ISTE, 2012, para. 2). A shift in pedagogy may need to occur in order for this to happen, as learning should be student-centered while empowering students to guide their own learning which is often absent from traditional classrooms (U.S. Dept. of Education, 2010). Teachers must adapt instruction and embrace constructivist approaches to prepare students as citizens in the 21st century.

However, many issues continue to prevent change in K-12 education. For example, “even K-12 institutions that are eager to adopt new technologies may be constrained by school policies, the lack of necessary human resources, and the financial wherewithal to realize ideas” (NMC, 2013, p. 9). Problems with implementation include a lack of technology support, connectivity, vision, time, and professional development that includes, but goes beyond, technology tools.

Accountability and high stakes testing contribute to the pressures teachers face in meeting the demands of curriculum and vast content (Coffey, 2012,). Other challenges for teachers include safety issues with online privacy for children, restrictions on some internet sites, and a lack of professional development opportunities (Nelson, Christopher, & Mims, 2009). Regardless, technology and frameworks of educational practice must be addressed for future implementation.

Implications and Future Directions

Findings from this study provide positive insight into teacher decision-making. Teachers acknowledged weaknesses in student (and teacher) skills and designed instruction to meet student needs. In a sense, they focused on TPK. Participants expressed the benefits of their decisions and commented they would “continue to improve.” In this case, it appeared opportunities for technology integration and reflection benefitted teachers. Although continuing professional development for teachers is a current practice through workshops, it may not be

effective nor directed toward 21st century skills. Professional development should utilize a mentoring model in which teachers who are skilled in instructional technology are available to guide an “iterative process of planning, execution, feedback, and continued planning” (Rotherham & Willingham, 2009). More robust training and assistance with planning could include the improvement of previously prepared content specific lesson plans. Technology integration with Web literacy skills requires a more student-centered approach to instruction. Implementing a new learning method requires the teacher to approach classroom instruction differently. Although student-centered methods are perceived as effective, teachers are not using them widely (Rotherham & Willingham, 2009). In addition, perhaps the student-centered aspect of PK needs further consideration, as online research adds to the complexity of the learning environment and the relationship between the CK, PK, and TK. As researchers utilize the model with preservice and inservice teachers, the importance of student-centered Internet tasks should be addressed in order to reflect 21st century learning.

Focus group participants agreed their students exhibit weak digital literacy skills. This holds important implications for professional development and teacher education. Educators must stop dwelling on students’ weak digital literacy skills and start providing instruction that improves these skills. Future research is needed in the area of Web literacy. Although current research, funded by the U.S. Department of Education, is underway to develop online reading comprehension assessments (ORCAs) for adolescents (University of Connecticut, n.d.), research is lacking in the area of pedagogy required of teachers as they provide instruction on Internet searches. In the examples above, teacher created their own “checks and balances” for student searches. The strategies created by the teachers were intended to scaffold student success.

Research should further investigate such strategies in order to determine what resources teachers might use to facilitate student research.

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Appendix A
 TPACK Un-PACKED: A Student-Centered Perspective for Web-Based Instruction

Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
<p>TK Technology Knowledge</p>	<p>Locate Communicate</p>	<p>“Knowledge about certain ways of thinking about, and working with technology, tools and resources, and working with technology can apply to all technology tools and resources. This includes understanding information technology broadly enough to apply it productively at work and in everyday life, being able to recognize when information technology can assist or impede the achievement of a goal, and being able continually adapt to changes in information technology.” (Koehler & Mishra, 2009, p. 64)</p>	<p>Student Technology Knowledge involves the students’ abilities to locate information in an online environment. Web literacy knowledge promotes successful use of technology and effective online search skills. Additional knowledge about the use of technology tools, programs, and applications allow students to communicate acquired information in various formats (i.e. PowerPoints, Prezis, multi-media presentations, videos, etc.).</p>
<p>PK Pedagogy Knowledge</p>	<p>Organize Collaborate Communicate</p>	<p>“Teachers’ deep knowledge about the processes and practices or methods of teaching and learning. They encompass, among other things, overall educational purposes, values, and aims. This generic form of knowledge applies to understanding how students learn, general classroom management skills, lesson planning, and student assessment.” (Koehler & Mishra, 2009, p. 64).</p>	<p>Student Pedagogical Knowledge refers to the methods selected and applied to the learning and research process which include communicating instructional needs and decisions. The students’ abilities to succeed with the use of instructional technology depend on the teacher’s methods of supported research skills and the students’ own metacognition with regard to understanding their learning process. Self-evaluation of the credibility of source material is grounded on learned web literacy skills. Students should not rely on the teacher to determine validity of content.</p>

Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
<p>CK Content Knowledge</p>	<p>Evaluate Synthesize Collaborate Communicate</p>	<p>“Teachers’ knowledge about the subject matter to be learned or taught. The content to be covered in middle school science or history is different from the content to be covered in an undergraduate course on art appreciation or a graduate seminar on astrophysics... As Shulman (1986) noted, this knowledge would include knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge” (Koehler & Mishra, 2009, p. 63).</p>	<p>Student Content Knowledge is potential subject matter which must be acquired through online searches (student-centered). Students’ knowledge about the content to be learned is influenced by their related background knowledge; their schema. This knowledge provides a foundation for developing concepts, theories and organizational frameworks. New content knowledge acquired from online resources may be accurate or inaccurate; the student must be able to evaluate the content appropriately. This entails reviewing multiple sources, evaluating for credibility, and synthesizing the varied resources while deepening content knowledge. Additionally, students must understand how to apply disciplinary literacy skills to the varied types of online information accessed. Content knowledge includes the ability of students to synthesize information to find the most important/relevant content.</p>
<p>PCK Pedagogical Content Knowledge</p>	<p>Evaluate</p>	<p>“Consistent with and similar to Shulman’s idea of knowledge of pedagogy that is applicable to the teaching of specific content. Central to Shulman’s conceptualization of PCK is the notion of the transformation of the subject matter for teaching. Specifically, according to Shulman (1986), this transformation occurs as the teacher interprets the subject matter, finds multiple ways to represent it, and adapts and tailors the instructional materials to alternative conceptions and students’ prior knowledge. PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy” (Koehler & Mishra, 2009, p. 64).</p>	<p>In alignment with Shulman’s conceptualization of PCK for teachers, Student Pedagogical Content Knowledge is the notion of the transformation of the content for learning. Online resources may be electronic formats of printed text but may also be interactive; thus allowing the learner to engage with the content (imbedded links, videos, auditory components, etc.) as their learning needs and interest command. While the teacher PCK is dependent on the teacher’s interpretation of important content, the student PCK allows the teacher to assess what the student is learning and HOW the student is learning and making connections. Formative assessment opportunities amass as the student is involved in the design of the learning process as a first-hand participant; rather than a recipient of selected content and process.</p>

Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
<p>TCK Technological Content Knowledge</p>	<p>Locate Evaluate Synthesize Collaborate Communicate</p>	<p>“An understanding of the manner in which technology and content influence and constrain one another. Teachers need to master more than the subject matter they teach; they must also have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology—or vice versa” (Koehler & Mishra, 2009, p. 65).</p>	<p>Student Technological Content Knowledge is an understanding of the appropriate selection of specific technologies (online formats, programs, applications, etc.) to acquire and communicate subject-matter information from a learner’s perspective. Just as a hammer and a screwdriver are both tools, but used for different purposes, the variety of online publication tools are most effective when used for the correct communication purpose. Students demonstrating TCK understand multimodal information, including the purpose of different online media such as blogs, articles, personal webpages, and organizational webpages. These students also recognize when an author has utilized the incorrect technology for the intended purpose. This allows students to understand they are accessing opinions, research-based findings, interpretations, and primary/secondary sources.</p>
<p>TPK Technological Pedagogical Knowledge</p>	<p>Locate Evaluate Synthesize Collaborate Communicate</p>	<p>“An understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies” (Koehler & Mishra, 2009, p. 65).</p>	<p>Student Technological Pedagogical Knowledge is an understanding of how teaching and learning can change when particular technologies reflect student choice of research tools, topics, and websites. The pedagogical affordances of web-based instruction enable the student to acquire information beyond that typically introduced by a teacher. However, teacher support of web literacy skills is critical. In addition, student dissemination of learned content should contribute to the overall learning of the class. Therefore, students must understand that the appropriate selection of specific technologies (online formats, programs, applications, etc.) to communicate subject-matter learning to the intended audience.</p>

Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
TPACK	Locate Evaluate Synthesize Collaborate Communicate	“Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones” (Koehler & Mishra, 2009, p. 66).	Student-centered TPACK is the basis of effective learning with technology requiring an understanding of the content, format, purpose, and pedagogical considerations that make technologically-based materials learning resources. Students are involved as active participants in their learning experience as the teacher facilitates instructional delivery.