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Digital Literacies and Learning: Designing a Path Forward

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The William & Ida Friday Institute for Educational Innovation at the North Carolina State University College of Education

Table of Contents

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*"Today our schools must prepare all students for college and careers--
and do far more to personalize instruction and employ the
smart use of technology."*

Arne Duncan
US Secretary of Education

Executive Summary

Since technological advances are driving much of the change that we see in information and communication, researchers and educators are attempting to answer two important questions: What does it mean to be literate in the 21st century? How do we design instruction that enables educators to cultivate digital literacies for themselves as well as their students? This white paper addresses the redefinition of literacy skills that enable students to be successful in today's digital world and the implications this redefinition holds for their teachers.

Digital literacy should be positioned as an entitlement for students that supports their full participation in a society in which social, cultural, political, and financial life are increasingly mediated by digital literacies (California Technology Assistance Project, 2008). In the same way that readers must acquire skills in navigating textual and graphic features of the traditional informational textbook, readers must acquire sophisticated reading skills with online environments in order to be academically and professionally competitive.

One way to think about digital literacy is to organize the related cognitive and social processes into three categories: (a) locating and consuming digital content; (b) creating digital content; and (c) communicating digital content. The capacity to evaluate information in terms of its credibility and reliability is also essential, as is the ability to make judgments about when and how to apply information to solve problems and share new knowledge. Teachers are confronted with the challenge of teaching students to become productive readers within a constantly evolving digital environment.

The Friday Institute for Educational Innovation at North Carolina State University recently examined K-12 teachers' knowledge of and professional practices with digital literacies (Spires & Bartels, 2011). Results from the Levels of Technology Implementation (LoTI) survey indicated that only 12% of teachers who completed the survey fully integrated digital tools and resources in a learner-centered approach, placing an emphasis on student action and higher-level thinking. None of the teachers employed a learner-centered technology approach where there was no disconnect between instruction and technology in the classroom. Interestingly, teachers reported that integrating digital literacies and 21st Century Skills was the highest priority at their school, followed by student achievement on end of grade tests.

To prepare teachers to cultivate their students' digital literacies, the North Carolina State Board of Education (NCSBE, 2012) recently adopted the North Carolina State Literacy Plan that establishes the expectation of digital literacies for students and their teachers. This plan with its five priority action steps combined with the Common Core State Standards Initiative will provide high expectations and a road map for increasing students' digital literacy performance. The action steps include:

1. Ensure that implementation of the revised standards includes literacy strategies in each content area, focuses on digital literacy and that all Pre K-12 teachers have an in-depth understanding of the K-12 College and Career Readiness Anchor Standards and the Common Core Literacy Standards for Science, Social Studies, History, and the Technical Subjects and how they apply to each content area, specific grade-level content requirements and the 21st Century Skills and Themes.

2. Continually update the student assessment processes to provide open-ended and performance assessments. Assessments should be Internet-based and provide data for teachers to diagnose and address student literacy problems. Focused interventions for individualized education should serve as a guide for each student to receive appropriate assistance.

3. Provide opportunities for leadership development for principals, central office staff and literacy coaches, using the online blended model of professional development when appropriate.

4. Enhance preparation and professional development for pre-service and in-service teachers.

5. Analyze the need(s) for policy revision and development.

Becoming digitally literate is not an option. As a matter of economic development, North Carolina needs to ensure that learners of all ages have the skills needed to navigate in this new literacy landscape.

I. Introduction

Since technological advances are driving much of the change that we see in information and communication, researchers and educators are attempting to answer two important questions: *What does it mean to be literate in the 21st century? How do we design instruction that enables educators to cultivate digital literacies for themselves as well as their students?* Contemporary literacy demands and opportunities extend beyond the traditional practices of reading and writing to incorporate facility with new genres of media and information technologies. Students currently use a variety of tools and social media, including Facebook, Twitter, video games, instant messaging, virtual worlds, wikis, and blogs to discuss issues and problems, to seek ideas and answers, as well as to entertain themselves. However, classrooms rarely capitalize on these resources or help students manage them in ways that promote higher level thinking.

Linguists use the term *deixis* ("dike-sis") for words whose meanings change quickly depending upon the time or space in which they are used. Accordingly, Leu et al. (2009) argue that contemporary literacy is a deictic term since the forms and functions of literacy rapidly change as technologies for information and communication change. Emerging technologies require new skills and strategies on the part of the user. For example, searching for information online requires new kinds of literacy skills. A learner may be skilled with using search engines but lack the critical expertise for selecting reliable information from the vast number of links that are available. In the same way that readers must acquire skills in navigating textual and graphic features of the traditional informational textbook, readers must acquire sophisticated reading skills with online environments in order to be academically and professionally competitive—not to mention civically engaged. As technology alters the literacy experience, the task of literacy learners increasingly will become *to learn how to learn effectively* while adapting to rapid changes (Coiro, Knobel, Lankshear, & Leu, 2008; Dede, 2008). The latest statistics claim that one sixth of the world's population, 2.3 billion individuals, now use the Internet to read, write, communicate, learn, and solve important problems online (Internet World Stats, 2011). By all indications, these numbers will continue to increase.

As a matter of economic development, North Carolina needs to ensure that learners of all ages have the skills needed to navigate in this new literacy landscape. Successful learners will be users of technologies that foster the creation of content and the sharing of information, thoughts, and ideas central to active and effective participation in society. An individual's ability to read, write, do math, problem-solve, work as part of a team, think critically, and use information and communications technologies is essential to education and workforce preparation, employment success, as well as civic participation. Becoming digitally literate will not be an option; it will be a necessity.

Digital literacy should be understood as a wide-ranging set of practices that enable students to create, share, and understand meaning and knowledge in an increasingly digital age. Fieldhouse and Nicholas

(2008) claim that digital literacy requires students to have critical thinking skills for "determining how credible information is and to contextualize, analyze, and synthesize what is found online" (p. 57). Digital literacy should be positioned as an entitlement for students that supports their full participation in a society in which social, cultural, political and financial life are increasingly mediated by digital technologies (California Technology Assistance Project, 2009). In a recent Futurelab digital participation project, the authors asserted that digital literacy: (a) can be developed alongside subject knowledge in all classrooms across the curriculum at both primary and secondary levels; and (b) can be important not only in supporting students to become independent, critical learners but also in narrowing the gap between students' experiences inside and outside of school (Hague & Payton, 2010).

II. What Does it Mean to be Literate in the Digital Age?

The Internet is undoubtedly the most important technology of this generation. In an era where it is possible to "Facebook™" and "Skype™" friends as well as "Google™" just about any topic imaginable, the Internet offers both challenges and profound promise for education. There is an increasing trend in Internet usage, particularly among children and adolescents. In fact, in the United States the National Center for Educational Statistics (2009) reports that the percentage of instructional classrooms with access to the Internet and web-based learning tools has increased from 51% in 1998 to 94% in 2005. On average, 8- to 18-year-olds spend a total of 10 hours and 45 minutes in a typical day using various media forms (e.g., movies, video games, music, audio) (Kaiser Family Foundation, 2010). In most cases, out-of-school technology use is outpacing in-school technology use (National School Boards Association, 2007). These statistics suggest that students are becoming increasingly dependent on the Web as a primary resource for information gathering in and out of school settings.

In a recent study conducted in the US with 4000 middle grade students in a North Carolina statewide after-school program (Spires, Lee, Turner & Johnson, 2008), students reported high frequency usage of video and online games, music services, email, instant messaging, and cell phone services out of school. The main distinctions that emerged between in and out-of-school technology use related to the intent of the technology use and the actual devices being used. Outside of school, students were using technologies for communication and entertainment purposes. They also were more likely to use smaller handheld and gaming devices outside of school. Inside of school, students were using desktop computers for Web-based research, word-processing, and other productivity purposes. The surveys suggested that students' technology use inside school is often less creative and meaningful to them than their technology use outside of school. The divide between informal and formal learning environments can be a huge disconnect for today's learners. Interestingly, research suggests that while they are frequent users of technology tools, students typically lack information literacy skills and their critical thinking skills are often weak (Oblinger & Oblinger, 2005). Contemporary students may be "digital natives" (Prensky, 2007), but they do not necessarily understand how their use of technologies affects their ways of learning.

Digital literacy should be positioned as an entitlement for students that supports their full participation in a society in which social, cultural, political and financial life are increasingly mediated by digital technologies (California Technology Assistance Project, 2009).

Due to the proliferation of the Web, teaching students to become strategic readers with informational text is becoming increasingly challenging for educators. The massive explosion of online information and the increasing reliance on these resources for educational purposes combine to create a shift in what it means to be literate in today's global knowledge-based society. Today's readers must of course know how to decode, but they must also know how to effectively comprehend in complex Web reading environments. In this new digital context, reading comprehension not only includes skills traditionally associated with processing print-text, but also includes locating information on the Web, critically evaluating that information, and synthesizing information for a desired learning outcome (Goldman, 2004). Additionally, contemporary readers must expand their understanding of print text to reflect the characteristics of digital text, which are nonlinear, multimodal, highly visual, interactive, and possess unclear authority and authorship (Dalton & Proctor, 2008).

III. What is Digital Literacy?

In order to define digital literacy, we first need a working definition of literacy. In his book, *What Video Games Have to Teach Us About Learning and Literacy,* James Gee defines literacy as the ability to "recognize (the equivalent of 'reading') and produce (the equivalent of 'writing') meanings in a domain" (2007, p. 20). In 1997, Paul Gilster claimed that digital literacy was the "ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1). Thus, digital literacy involves any number of digital "reading" and "writing" techniques across multiple media forms. These media include words, texts, visual displays, motion graphics, audio, video, and multimodal forms. In the same way that literate individuals can negotiate print text through the processes of reading and writing, literate users of technology are able to consume and produce digital compositions. As media scholar Henry Jenkins (2011, para. 9) said: "Traditionally we wouldn't consider people literate if they could read but not write. And today we shouldn't consider people literate if they can consume but not produce media." The literacy of the future rests on the ability to decode and construct meaning from one's constantly evolving environment. The capacity to evaluate information on the issues of credibility and reliability is essential, as is the ability to make judgments about when and how to apply information to solve problems.

Terms like "literacy," "fluency" and "competency" can all be used to describe the ability to steer a path through digital environments to find, evaluate, and accommodate information (Fieldhouse & Nicholas, 2008, p. 50). Literacy theorists Lankshear and Knobel (2006) believe that "the more a literacy practice privileges participation over publishing, collective intelligence over individual possessive intelligence, collaboration over individuated authorship . . . the more we should regard it as a 'new'

literacy" (p. 60). These skills allow working collaboratively within social networks, pooling knowledge collectively, navigating and negotiating diverse communities, and critically analyzing and reconciling conflicting information in order to perform desired tasks. Obviously, the ability to work differently leads to different social and work practices; thus, we have distributed teams across the world and more people working from home.

Complex digital literacy environments present challenges for students who are shifting to "reading to learn" around third grade (Chall, 1996). As students progress through school and content demands increase, literacy demands also increase. Students are expected to read and write across a wide variety of disciplines, including science, math, history, and literature. Negotiating texts with increasing sophistication and perspective is a key marker of academic success and a prominent feature of the Common Core State Standards Initiative (CCSSI). Students must be fluent in recognizing technical vocabulary, thinking critically and evaluatively, monitoring their comprehension, and reading flexibly for a variety of purposes. Even more importantly, students must maintain the will and motivation to continue to read, write, and learn as they progress through school in preparation for college and career contexts.

One of the intriguing aspects of online reading is that it provides a literal and physical dimensionality for "constructing" text that previous textual forms have not afforded. On the Web the reader is literally constructing a text by the choices he or she makes and thus weakening the authority of the author and the dominance of the text. There are myriad cognitive processes at play, along a continuum from *consumption* to *production* when a reader is immersed with digital content as well as with print-text. The digital context is particularly challenging for the developing reader due to the fluid nature of the Web and the demand for critical judgments as the reader makes decisions about how to locate information as well as the credibility of that same information.

Proposed Definition of Digital Literacy. We offer a simplified way to think about digital literacy by ordering the cognitive and social processes into three categories: (a) locating and consuming digital content, (b) creating digital content, and (c) communicating digital content (see Figure 1). For purposes of discussion we are separating these practices; in authentic digital literacy contexts, however, users traverse among these practices in a recursive manner. Additionally, the learner must acquire an evaluative stance as he/she navigates digital content, and this disposition is essential in order to maintain accuracy and integrity within the process. Without critical evaluation, the learner may become lost in a sea of information with the technology driving the learner rather than the learner directing the inquiry.
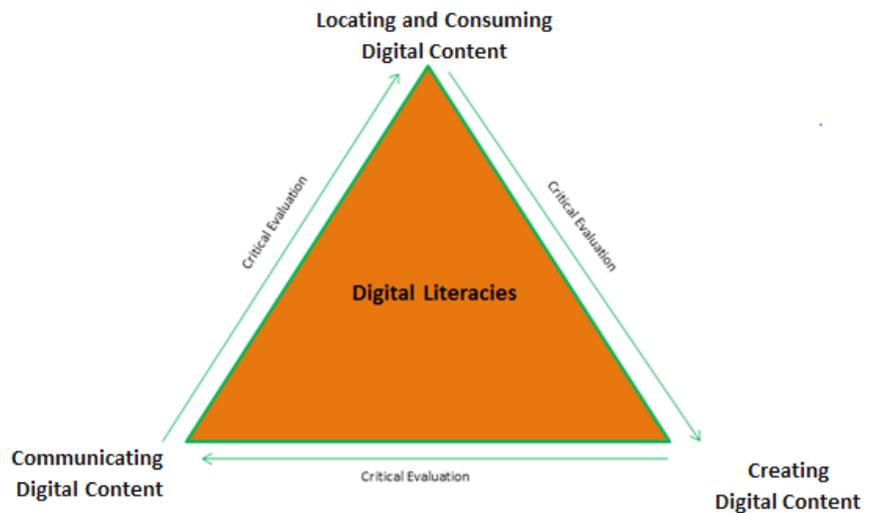
Figure 1. Digital literacy practices involve the ability to locate and consume, create, and communicate digital content, while simultaneously employing a process of critical evaluation.

Locating and consuming digital content. Having the mental models to locate, comprehend and consume digital content makes navigating the Web easier for users. Effective use of the Web involves strategically searching for information and evaluating its accuracy and relevancy (Leu et. al., 2008). There is consensus that effective Web search skills must be developed for educational success in a digital society, and instruments such as The Teaching Internet Comprehension to Adolescents (TICA) checklist can ensure that students have the necessary prerequisite Web search skills (Leu et al., 2008). However, there is little consensus with regard to how to incorporate the effective teaching and development of Web search skills in the classroom (Moraveji, Morris, Morris, Czerwinski, & Riche, 2011). Nevertheless, some important skills are considered necessary for locating and using digital content: domain knowledge, a working knowledge of how to use search engines, basic literacy skills, and a general knowledge of resources available on the Web (Moraveji et al., 2011). In addition to building on the ability to craft productive Web search terms, search lessons should involve direct modeling of the use of Boolean search techniques, differentiating between domain names (e.g., .com versus .org), and querying sites for accuracy and transparency.

Creating digital content.   Digital content is easily created by teachers and students alike through multiple media and a variety of Web 2.0 tools. The implementation of digital content in the classroom may be an important and effective method of enhancing teacher-learning (Bakkenes, Vermunt, & Wubbles, 2010), enabling them to embrace the 21st century skills that students are expected to master. Digital resources can also free up teachers, allowing them to spend more time facilitating student learning and less time lecturing. Allowing students to create and consume digital content in the classroom may increase engagement while also encouraging the development of skills needed for a technological society. Although the creation of digital content is becoming increasingly simple, personalization of learning will require

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teachers to locate and utilize a variety of digital resources to meet the needs of every learner. Personalization will also put a heavier emphasis on asking students to show mastery of learning by producing digital content and sharing outside the classroom walls.

Communicating digital content.   Digital content must be communicated effectively in order to be a useful educational medium. Using social networking sites like Facebook and Twitter is one method of communicating digital content, because using these sites requires the ability to understand and use information in multiple formats from a wide range of sources. Web 2.0 tools are social, participatory, collaborative, easy to use, and are facilitative in creating online communities. Even simpler, yet effective means of communicating digital content exist, such as using email as a means for children to communicate information digitally to their teachers (Merchant, 2003). The use of e-mail to communicate in and out of school contexts has been found to enhance children's narrative and writing skills by not only enriching their print-based literacy skills, but also by encouraging students to implement new and more sophisticated means of writing and communicating to more diverse audiences (Merchant, 2003).

Being able to communicate digital content using mobile devices such as cellphones and tablets provides convenience and immediacy to the communication process for teachers and students. Additionally, it provides access to an infinite set of people and digital content resources globally to enrich the learning experience. This type of communication affords the possibilities of more customization and personalization for individual learners' interests and needs, which may in turn optimize student engagement.

Essential to preparing students for the digital literacy demands of contemporary society is having a teacher workforce that has the knowledge and skills to teach accordingly. Effective professional development is an essential element for supporting the implementation of digital literacies across the curriculum (Spires, Wiebe, Young, Hollebrands, & Lee, 2009). As a foundation to designing an appropriate professional development model for digital literacies across content areas, it is important to assess what teachers currently know in terms of digital applications, as well as how they perform using digital literacies. As technological change transpires at a phenomenal rate, teachers in the United States are under increasing pressure to integrate new technologies into their instruction (National Educational Technology Plan, 2010). It is important for teachers to use the technologies not only because students expect it, but also because educational systems need to stay abreast of the changes in online research, communication, and social media in order for students to be prepared for 21st century work and citizenship (Trilling, & Fadel, 2009). New teachers entering the field often are more adept at using technologies since they have grown up with them; however new teachers still have the challenge of using technologies in meaningful ways that enhance learning. Meanwhile teachers who have been in the field for some time confront the dual challenge of acquiring a disposition that accommodates ongoing change as well as 're-learning' how to teach using contemporary technologies (Darling-Hammond, 2010). Understanding where we are with teachers' use of digital literacies is paramount to devising a plan to move forward.

IV. Research on Teachers' Use of Digital Literacies in North Carolina

"Once you have technology, it's hard to imagine not teaching with it."
North Carolina 10th grade teacher

To respond to the need for additional information about teachers' digital literacies and practices, researchers at the Friday Institute for Educational Innovation at North Carolina State University recently examined K-12 teachers' knowledge of and professional practices with digital literacies (Spires & Bartels, 2011). The aim of the project was to answer two questions: (a) What are the digital literacy practices of NC teachers? (b) How do teachers view digital literacy? Researchers utilized an exploratory mixed methods design which enabled the researchers to use qualitative results from focus groups to explain and build upon initial quantitative survey results, as well as to enhance the knowledge base for the theoretical framework that guided the study (see Creswell & Plano-Clark, 2007). The researchers used stratified sampling to randomly select two school districts from each of North Carolina's seven Economic Development Regions for this two-part study.

A total of 452 K-12 teachers (74 males, 378 females) completed the survey. Approximately 1% of the participants were American Indian, 1% were Asian, 7% were African American, 88% were Caucasian, 1% were Hispanic and 2% were identified as Other. Roughly 62% of the participants held bachelor's degrees, 37% held master's degrees, and 1% held doctoral degrees. Twenty-one percent of the sample had taught less than five years at the time of the study, 27% had taught 5- to 9-years, 33% had taught 10- to 20-years, and 19% had taught more than twenty years.

Participants were asked to complete the online Levels of Teaching Innovation (LoTi) survey in order to identify teachers' knowledge levels pertaining to digital literacies, as well as their practices related to digital literacies. LoTi, a valid and reliable survey (for original content, construct, and criterion validity, see Moersch, 1995), provided the framework for personalized digital-age development profile identification of specific levels of technology implementation. See Table 1.

Table 1. *LoTi levels of technology implementation*

Level	Description
Level 6	**Refinement**: An entirely learner-centered technology approach with no disconnect between instruction and technology in the classroom.
Level 5	**Expansion**: Use technology for learner-centered approaches; multiple technologies are used but are not entirely incorporated to where there are no limits.
Level 4b	**Integration Routine**: Use technology for learner-centered approaches but are not incorporating multiple technologies.
Level 4a	**Integration Mechanical**: Use technology for applied learning; teachers have shifted to a learner-centered approach but have not yet fully integrated digital tools and resources in the classroom.
Level 3	**Infusion:** Use technology to complement selected lessons, provide detailed exposure to content, and to stress higher-level thinking.
Level 2	**Exploration**: Use technology to supplement the curriculum and underline lower level thinking.
Level 1	**Awareness:** Technology is used mostly by the teacher; information is delivered in the form of lectures.
Level 0	**Nonuse:** Technology is not used in the classroom and is viewed as unrelated to student achievement.

These levels range from Nonuse (Level 0), Awareness (Level 1), Exploration (Level 2), Infusion (Level 3), Integration Mechanical (Level 4a), Integration Routine (Level 4b), Expansion (Level 5), to Refinement (Level 6). Teachers responded to items using a Likert scale. The survey includes items such as (a) I model and facilitate the effective use of current and emerging digital tools and resources (e.g., streaming media, wikis, podcasting) to support teaching and learning in my classroom; and (b) I promote global awareness in my classroom by providing students with digital opportunities to collaborate with others of various cultures.

Survey Results

Results indicated that teacher knowledge and professional practices of digital literacies in the classroom fluctuated within our sample; however, the majority of teachers indicated that their pedagogical emphasis was on teacher-directed tasks. Specifically, digital tools were added to instructional content rather than integrated within it. Based on LoTi scores, factors such as teachers' highest level of education, number of years experience, gender, ethnicity, and urbanity had little impact on teacher understanding and implementation of technology.

Multiple one-way analyses of variance (ANOVA) were conducted on LoTI scores. Some factors were found to have a significant association with LoTI scores, namely grade (F (2, 447) = 4.65$, p$ <.01) and subject taught (F (8, 442) = 4.7, p < .01). On average, elementary (M= 3.0, SD= 1.0) grade teachers scored higher on the LoTI scale than both secondary (M= 2.6, SD =1.3) and intermediate teachers (M= 2.7, SD=1.2). Teachers who taught multiple subjects (M=2.97, SD=1.07) scored higher on the LoTI than English/Language arts teachers (M =2.52, SD=1.03). No other pairwise comparisons yielded significant differences.   The mean scores for both grade and subject taught, however, were in level 3 (Infusion), where classroom instruction was by and large teacher-directed and digital tools were used in a supplementary fashion.

A frequency analysis was conducted in order to investigate teacher understanding and implementation of digital literacies in practice. Survey results indicated that the majority of the teachers in the sample fell within the range of level 2 (Exploration) and level 3 (Infusion) users. Level 2 users (29% of teachers) used technology to supplement the curriculum with lower level thinking activities, whereas level 3 users (32% of teachers) used technology to complement selected lessons, provide detailed exposure to content, and to stress higher-level thinking. (See Figure 2.)
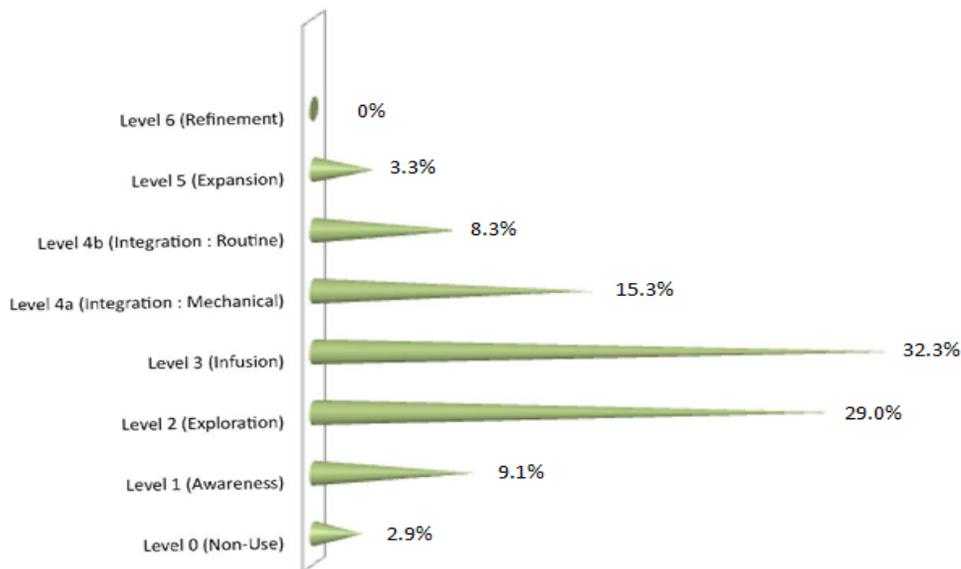
Figure 2. Frequency scores by LoTi level.

Level 4a users (15% of the teachers) had shifted to a learner-centered approach but had not yet fully integrated digital tools and resources in the classroom. A total of 12% of teachers fully integrated digital tools and resources in a learner-centered approach (levels 4b – 6), placing an emphasis on student action and higher-level thinking. None of the teachers reached the level of Refinement (level 6), an entirely learner-centered technology approach where there was no disconnect between instruction and technology in the classroom.

Survey results showed that digital literacies and integrating 21st Century Skills (32%) were considered the highest priorities for K-12 schools in the upcoming school year, followed by student achievement on high stake tests (29%).

Teachers were asked to choose what they perceived as their school system's highest priority in the upcoming school year. Those teachers who responded as having integrated 21st century skills/themes did not score differently than those who chose an alternative answer. LoTI survey results showed that digital literacies and integrating 21st Century Skills (32%) were considered the highest priorities for K-12 schools in the upcoming school year, followed by student achievement on high stake tests (29%). (See Figure 3.)
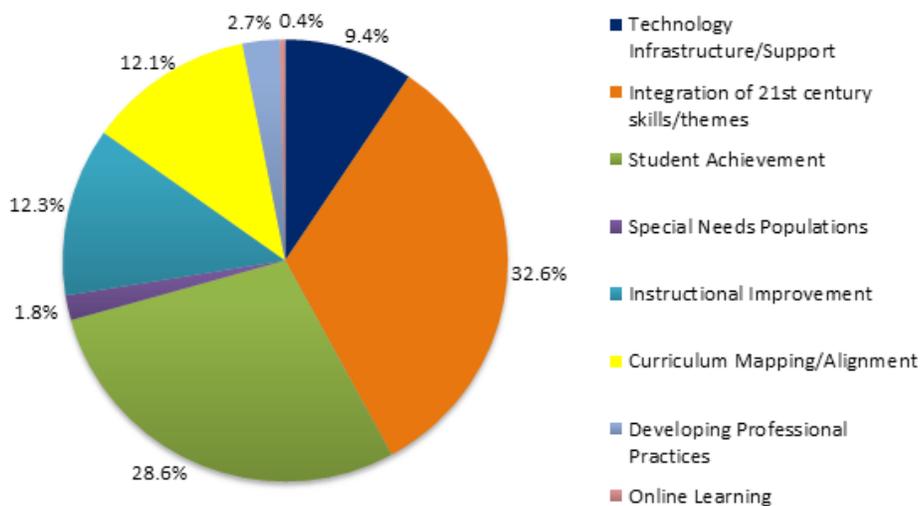

Figure 3. Frequency of highest priorities for K-12 schools in the upcoming school year.

Focus Group Results

Using a purposive sampling procedure, researchers targeted the 52 teachers who scored in the upper levels of the LoTI (4b-Integration, 5-Expansion, 6-Refinement). Of the 52 teachers in this subgroup, 13 were randomly selected to participate in a focus-group session. LoTI levels 4b – 6 indicated that the respondent was: (a) fully integrating technology, in varying degrees; (b) focusing on applied learning with authentic issues; (c) collaborating with the community; and (d) shifting to a more learner-centered approach where the classroom was driven by student generated questions focusing on problem-solving.

Of the 13 teachers who participated in the focus group, the majority were female (n = 11). Two participants were elementary teachers, 3 were English/language arts teachers, 3 were science teachers, and 5 were social studies teachers.   Of these teachers, 3 identified themselves as early career, 5 as mid-career, and 5 as seasoned professionals.

First, a semi-structured focus group session was conducted to elicit elaborations and member check understandings of digital literacy knowledge and practices from the survey. Next, teachers were randomly placed into two focus groups (one group of 7 teachers and one group of 6 teachers) that were led by two researchers and lasted approximately one hour each. Both groups followed a semi-structured interview process that was audio recorded and transcribed for qualitative coding and analysis.   Focus group data from both groups were combined and aligned based on semi-structured questions. Two researchers independently read the focus group transcripts and identified initial topics for coding data based upon the frequency with which teachers mentioned specific topics. Data was then clustered into relevant themes based on the research topics and teacher responses that aligned with the particular theme. Four final themes emerged from the teacher focus group:

(a) *"Our roles as teachers are changing."* Teachers' viewed their roles as educators as continuously changing. They felt the need to take on the role of facilitator and coach by allowing their students to engage in peer teaching and assessment. One teacher noted that students sometimes learned better from their peers and suggested that teachers need to be willing to learn from their students.

(b) *"We need technology and sustained professional development in order to be technology savvy."* Teachers felt it was essential to have reliable high-speed Internet connections as well as up-to-date resources and equipment. Teachers expressed the need for intensive, sustained professional development in order to stay abreast of the latest trends and practices related to digital literacy and technology integration. One teacher reflected, "Once a school buys a program, we are required to learn the program on our own. It would be more helpful if the content was presented when the technology was introduced." Others agreed by stating that programs should be tailored to the subjects they are teaching and to the programs that work best for the content they are teaching. Teachers felt that they learned technology best through face-to-face and hands on training rather than when they were "talked at" by instructors. Additionally, they expressed a desire to collaborate with business, which they considered to be "an untapped resource."

(c) *"Our students need different skills today."* Teachers emphasized the need for students to know how to reason and to be higher order thinkers along with knowing when and how to use different tools for a variety of purposes. They also noted that students need to (a) be able to locate information; and (b) know what information is reliable. One teacher explained, "Students don't read. They find a picture and read the caption. If it is not quick or flashing they can't find it. They need to know how to read, how to find information on the Internet and to know if it is valuable or not." All of the teachers agreed that students must be able to collaborate and communicate well with others in order to be successful in future educational and career contexts.

(d) *"We have serious challenges to implementing technology in our classrooms."* The teachers acknowledged two key challenges they face while implementing technology in the classroom. First, teachers expressed their need for access to mobile technology (e.g., laptops, tablets, I-pads, cell phones) and high-speed Internet connections. Many of the teachers stated their concern over having limited access to technology resources and related connectivity problems. One teacher called her computer "a dinosaur" because it was missing keys, but mentioned that at least it was her computer. One school made the exception to the school rule by allowing students to bring their cell phones to class to compensate for the school's technology limitations. One teacher commented: "We have used student cell phones for Google searches, taking pictures and even as a stopwatch because our school does not have the appropriate equipment." Second, teachers reported that too much emphasis was placed upon the current assessment system. They expressed their concern that mandatory practice testing encompassed approximately 6 weeks of class time, during which students needed to memorize material in order to reach optimal test scores. In general, teachers felt that testing and online/digital literacies did not coincide and that currently there was no connection between technology and standardized testing. Meanwhile, teachers indicated that by using technology, students were in fact better prepared for standardized tests. The teachers believed that student ability would be better assessed through project-based tests, allowing resources for specific applications to be used to demonstrate their performance-based knowledge. "We use resources in our classroom, just like in the workforce, but we are prohibited from using resources during testing," one teacher explained. Teachers felt strongly that students need to be able to use digital resources within testing contexts to approximate authentic use and application of information.

V. Connections Among Digital Literacies, Common Core Standards and Assessment In North Carolina.

Results of this study clearly indicate that educators must have more support in making the digital shift and that the support needs to be systemic throughout the educational enterprise. The survey and follow up interview data illustrate the disparity between what is expected of students and their teachers in terms of mandated curriculum and the related assessments and what is now understood to be required in 21st century skills development. The NC Department of Public Instruction is in the process of addressing this critical gap as it plans for the adoption of the Common Core Standards.

The National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO) collaborated to form the Common Core State Standards Initiative (CCSSI) to create a set of standards specifically focused on addressing the learning needs of students today (National Governors' Association, 2009). The Common Core defines today's learners as students who:

> .... tailor their searches online to acquire useful information efficiently, and… integrate what they learn using technology with what they learn offline. They are familiar with the strengths and limitations of various technological tools and mediums and can select and use those best suited to their communication goals (CCCSI, 2011, p. 7).

In addition to the online dispositions needed to accomplish the behaviors described above, a seamless integration of information is also an expectation set within the Common Core. This emerging definition of literacy is not a matter of a digital shift alone, but it also includes a different approach to consuming and producing information made possible through new technologies. An example of the new approach is seen in the Common Core Standards for English Language Arts, which takes an interdisciplinary stance towards literacy rather than treating it as an isolated content area. This constitutes a significant curricular change for teachers and their students as they acquire knowledge through thematic problem-based inquiry set within a digital landscape that encourages the fluid exchange of ideas and information.

The expectation that students learn and make new meaning within an interactive digital landscape presupposes that their teachers also can function digitally and that measurements of learner outcomes can take place within a Web 2.0 environment. To further these elements of the digital shift, North Carolina is participating in the Smarter Balanced Assessment Consortium to help develop a more balanced assessment system with a new focus on formative and summative assessment. Formative assessment is considered an integral part of the curriculum adoption and will be facilitated as a district and statewide collaboration of educators using a Web 2.0 based delivery platform. It is believed that understanding the uses of formative assessment and being able to design these ongoing learning tools within digital media will create the instruction needed to empower teachers to cultivate digital literacies for themselves as well as for their students. All educators regardless of their location across the state will be able to receive online formative assessment training and learn how to set up virtual professional learning communities (PLCs) to further their own digital literacies by creating professional online cohorts of instructors. The PLCs will then use Web 2.0 technologies to collaboratively create formative assessments to guide and inform their instruction. Having all of the training online is a significant shift for many educators who have limited experience in socially constructed information networks and represents a challenge in professional development delivery for the state. The online formative assessment training is the signature offering of the NC Formative Assessment Learning Community's Online Network (NCFALCON).

Effective teaching with technology requires TPACK, or an ability to integrate content, pedagogy and technology flexibly during the act of teaching.

Although this system is in the early stages of implementation, it has potential to close the gap between the 20th century world of paper-and-pencil expectations and the Web 2.0 world of today. The goal of this system is to enable teachers to learn and grow as professionals by having them use digital tools similar to those they will be using with students.

VI. Recommendations for Teacher Professional Learning

Mishra and Koehler's (2006) technological pedagogical content knowledge (TPACK) framework (see Figure 4) is one tool that can be used to support teachers as they develop new digital practices. Building on Shulman's (1986) time-honored concept of pedagogical content knowledge, Mishra and Koehler asserted that effective teaching requires the ability to integrate content, pedagogy and technology flexibly during the act of teaching; they describe TPACK as the "thoughtful interweaving of all three key sources of knowledge" (p. 1029). Ongoing research using TPACK has demonstrated positive results with in-service teacher professional development (Harris, Mishra & Koehler, 2009, Spires, Hervey, & Watson, in press). Although TPACK is not a specific professional development program, it encourages a way of looking at how technology relates to content and teachers' pedagogy. More specifically, TPACK provides a framework for thinking that allows teachers to design their lessons to appropriately teach digital literacies. Margaret Niess has suggested "tomorrow's teachers must be prepared to rethink, unlearn and relearn, change revise and adapt" (2008, p. 225). TPACK provides one tool to help teachers navigate the new digital literacies landscape as part of a professional learning community.

> It is imperative to implement a coherent and sustainable plan for teacher professional development - a multifaceted plan that targets student learning and achievement as its ultimate outcome.
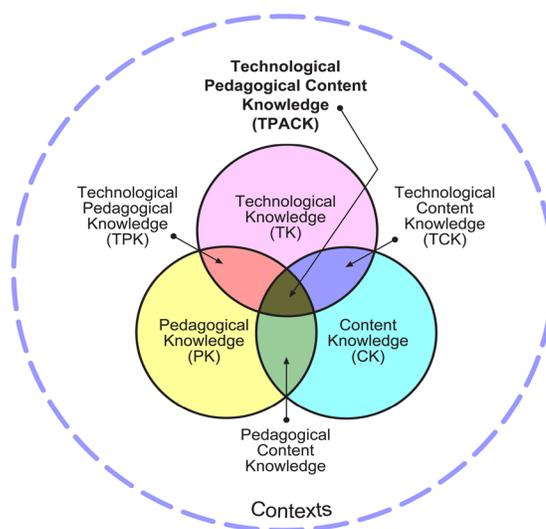

Figure 4. Mishra & Koehler's (2006) Technological Pedagogical and Content Knowledge (TPACK). Rights free image from http://tpack.org/

It is also important to clearly define the outcomes of professional learning communities that help teachers model and incorporate digital literacy within their disciplinary content and learning environments. Thinking about teacher professional learning in three phases may be

helpful: (a) Experience is the most basic structure with the lowest level of expectation. This phase provides support when teachers are not aware of what exists or the new learning that needs to take place; (b) Training involves the expectation that teachers will change their practice; and (c) Professional Development/Growth is the most complex type of professional learning with the expectation to change teacher practices in order to significantly improve student achievement.

Using the TPACK framework and creating a system of professional development that allows growth in all three phases would support teachers in fully implementing the NC State Literacy Plan recently adopted by the North Carolina State Board of Education (NCSBE, 2012). The new plan reasserts the State's goal of ensuring that "all students will possess the research-based digital and literacy skills necessary to live and work successfully in a global economy" (p. 29). The plan's specific action steps include:

1. Ensure that implementation of the revised standards includes literacy strategies in each content area, focuses on digital literacy and that all Pre K-12 teachers have an in-depth understanding of the K-12 College and Career Readiness Anchor Standards and the Common Core Literacy Standards for Science, Social Studies, History, and the Technical Subjects and how they apply to each content area, specific grade-level content requirements and the 21st Century Skills and Themes.

2. Continually update the student assessment processes to provide open-ended and performance assessments. Assessments should be Internet-based and provide data for teachers to diagnose and address student literacy problems. Focused interventions for individualized education should serve as a guide for each student to receive appropriate assistance.

3. Provide opportunities for leadership development for principals, central office staff and literacy coaches, using the online blended model of professional development when appropriate.

4. Enhance preparation and professional development for pre-service and in-service teachers.

   • access to high quality, online professional development using the blended model,
   • additional literacy coaches
   • consistent emphasis on teaching research-based reading foundations in all teacher preparation programs.

5. Analyze the need(s) for policy revision and development.

   • foundations knowledge for initial and continuing licensure,
   • a system of extra help and assistance to struggling readers, especially middle and high school students,
   • revisions in requirements for license renewal,
   • K-12 assessment in a balanced assessment system,
   • teacher preparation competencies
   • the role of education partners and trained volunteers in meeting professional development needs in reading. (p. 30)

The NC State Literacy Plan aligns with the research findings from this white paper in terms of what it means to be literate in the 21st century. Clearly, the plan's definition "literate students use technology and digital media strategically and capably" (p. 16) must be applied to teachers as well.

Leveraging Web 2.0 capabilities to establish a networked professional development platform could be used to provide teachers opportunities to develop their TPACK within an extended professional online learning community of practitioners. This would enable teachers to design instruction to cultivate their own digital literacies with the ultimate goal of creating instruction that positively impacts student learning and achievement. Given the research results reported in this white paper on the current lack of digital practices among NC teachers and the priorities set through the newly adopted NC State Literacy Plan, it is imperative to implement a coherent and sustainable plan for teacher professional development—a multifaceted plan that targets student learning and achievement as its ultimate outcome.

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