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# **Aging, E-literacy, and Technology: Participatory User-Centered Design for Older Adults' Digital Engagement**

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## **Abstract**

Though information and communication technologies (ICTs) have increasingly changed peoples' experience of e-literacy learning practices in a contemporary digital environment, many researchers have identified that older adults have not considerably benefitted from such technologies. Therefore, to benefit older adults to a greater extent from ICTs, we need to promote intergeneration communication through which older adults, especially novice users, get an opportunity to gain a deeper understanding of how to use ICTs in their everyday life. I propose a participatory user-centered design model through which I seek to illuminate a pathway toward a potential involvement of older adults with ICTs innovation. Such an involvement, I argue, can be afforded by deploying usability in product design for older adults. I contend that participatory user-centered design can also substantially promote social justice as older adults continue reciprocal e-literacy learning practices for active civic engagement by bridging the digitally divided gap between information haves and have-nots in modern digital times.

Keywords: ICTs, e-literacy, intergenerational communication, social justice, digital divide, participatory user-centered design

## **Introduction**

Over the past few years, many, if not most, societies in the world are facing a demographic change due to increased life expectancy, relatively low birth rate, urbanization, advanced healthcare systems, and a relative increase of older adults (Schäffer, 2007; Moody & Sasser, 2015; Haux et al., 2014). According to Rodríguez et al. (2009), “The aging of population is a phenomenon faced by many nations” and “it is estimated that over the next decades, the old populations will significantly age as a consequence of birth cohorts during the 1950s and 1960s and a worldwide decline in fertility since the 1970s” (p. 610). Research has shown that birthrate in many developed countries has been dramatically declining and mortality rate is accelerating in a way that the populations of older adults would surpass the populations of younger adults within the next few decades. According to the report prepared by the United Nations Department for Economic and Social Affairs, Population Division (2014), “an important consequence of observed and anticipated changes in fertility and mortality is population ageing” (p. 30). More so, the report claims that though the number of young people has grown rapidly in recent decades, the number is expected to remain relatively stable over the next 35 years; on the contrary, the number and proportion of older adults are expected to continue rising well into the foreseeable future (p. 30). This means that older adults are the fastest growing populations, especially in the developed countries, where healthcare facilities, education, and technological innovation are newly available for quality of life and self-sufficiency.

The proliferation of information and communication technologies (ICTs) has played a key role in changing the lifestyle of many people, including older adults, in recent times. Interest in the study of technology and its impacts on older adults is growing in a range of fields and disciplines. For a few years, many researchers have begun to pay their attention toward older

adults to identify to what extent and in what ways new information and communication technologies have benefitted them. In some of the countries like Germany, Italy, and the USA, digital or ICT literacy for older adults has been taken as a central theme in the discourses of educational and communicational science. Adopting an analytical approach, Burkhard Schäffer (2007), for instance, studied how older adults are devoted to the concurrent international two “mega trends”: IT revolution, and the turning of demography in history, which is accompanied by a change in the structure of age and aging. By drawing attention to the relationship between literacy and older adults’ use of ICTs, Schäffer’s research reveals the significant differences with respect to the media use and media competence of older adults.

In order to know about older adults’ experiences of the Internet use, Naomi Bloch and Bertram C. Bruce (2011), on the other hand, conducted an in-depth interview with 18 participants in the Senior Odyssey (SO) program in the U.S.A. Interestingly enough, Bloch and Bruce found that many older adults view the Internet as “a one-way, transmissive information source, and as a supplementary means of communication, primarily with friends and family” (p. 1). Inasmuch as older adults did not know much about the benefits of ICTs, using ICTs for them, according to Bloch and Bruce, was just a “waste of time” because they did not know the value of new technologies for civic engagement, content creation, and empowerment through public expressions of their own voices. Even more so, the authors also identified how the existing social infrastructure determines older adults’ civic engagement—a high level of participation in social activities by maintaining social connections for a quality of life—in daily use of the Internet. Bloch and Bruce write, “as more and more agencies turn to the Internet to inform and communicate with the public, and open government policies gear heavily toward online civic engagement, serious consideration needs to be given to those left out of our online discourse” (p.

1). Thus, in exploring the issues of information behavior and literacy, the authors found that much attention is yet to be paid towards older adults to engage them in online discourse.

Essentially, along with the advent of networked technology, we must orient toward the rapid growth of older adult populations and their technology use for their active civic engagement by staying connected to other people and communities. While examining the impacts of networked technology on older adults' life, many researchers have indicated the deficit aspects of aging as a problem for learning practices (Morris, 2007; Scialfa, Ho, & Laberge, 2004; Bloch & Bruce, 2011). But inclusive attention to such aspects support the view that technologies is to be enjoyed by younger generations. Instead, I argue that designers should develop innovative approaches to developing information and communication technologies that support older adults' e-literacy learning practices to enhance their quality of life. In discussing aging and older adults' use of computer technology for e-literacy, my goal in this paper is to map a model that might resolve, at least, some of the consequences or pitfalls of ICTs, which are designed without paying attention toward older adults as potential users for late life e-literacy development and practices.

In order to enhance older adults' e-literacy learning practices, I propose a participatory user-centered design model that allows ICT designers to understand the needs, expectations, and preferences of older users. Adopting such a model ultimately helps ICT designers and developers work with, in Jesse James Garrett's (2011) words, "every possibility of every action the user is likely to take and [understand] the user's expectations at every step of the way through that process" (p. 19). Following Garrett, I argue that ICTs designers and developers have a rich role to support older adults for e-literacy learning practices. In what follows, I, first, define e-literacy to reinforce its difference from other similar terms such as digital literacy, technology literacy, or

computer literacy. Then, I focus on the need of ICTs for older adults to enhance e-literacy learning practices for socially integrated active aging in later life. This section is followed by the discussion of intergenerational communication that motivates older adults to participate in e-literacy learning practices in the digital world. Next, I point out the two key pitfalls—digital divide and social injustice—of designing ICTs without considering older adults as prospective users. I conclude by proposing and discussing a participatory user-centered design model to be deployed in ICTs in order to empower older adults to continue late life e-literacy learning practices for digital as well as civic engagement.

### **Defining E-literacy**

While e-literacy is understood as the knowledge and ability to use computers, the Internet, and related technology effectively and efficiently, digital literacy is defined as “the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computer” (Gilster, 1998, p. 1). Unlike computer literacy, which is about the knowledge of computer, e-literacy is what Cynthia Selfe (1999) calls “screen literacy,” the knowledge of reading and writing practices on computer. While computer literacy signals programming and advance problem solving or understanding the concepts, terminologies and operations that relate primarily to general computer use, digital literacy refers to “cognition of what [we] see on the computer screen when [we] use the networked medium” (Gilster, 1998, p. 2). In other words, digital literacy is heavily associated with digital or networked media. Technological literacy, on the other hand, is closely tied to the knowledge of accessing, managing, integrating, evaluating, creating, and communicating information. In other words, technological literacy means knowing how to work with basic tools like word processing and spreadsheets. Since all these terms carry layers of meaning that include skill or ability to use

technology, I use e-literacy not only to mean “knowledge of” or “ability to,” but also, broadly speaking, to infer social or local practices of using ICTs that enable users to access, use, and share information in a networked society. In the next section, I focus on the need of ICTs for older adults’ e-literacy learning practices and development to enhance and support their social connectedness and well-being.

### **ICTs and Older Adults’ E-literacy Learning Practices**

Information and communication technologies (ICTs) have become an integral component of everyone, including older adults, to continue education, health information, and online banking/shopping. Though recent research has shown that older adults are receptive to using ICTs (Czaja & Lee, 2007; Zickuhr, 2013; Berridge, 2014; Smith 2014), a commonly held belief is still prevalent that supports the idea that older adults are unwilling to use ICTs due to bodily and cognitive decline in working memory, attention, and spatial abilities. In “Perceptual Aspects of Gerontology,” Scialfa and Laberge (2004) discuss older adults’ difficulties of spatial vision (acuity and contrast sensitivity), slow visual processing, and poor visual sight and hearing loss (pp. 18-19). Their research primarily focuses on how modern technology is a problem for older adults. Offering some recommendations based on cognitive aging, Brett D. Jones and Ute J. Bayen (1998), in a different way, suggest that teachers need to design their course to compensate for older adults’ cognitive slowing, limited processing resources, and sensory deficits (p. 685). Owing to older adults’ perceptual, cognitive, and psychomotor decline, many researchers have found why older adults encounter a number of challenges while practicing e-literacy.

In their research findings, Anne Morris and Helena Brading (2007) identified that “many older people have some form of *cognitive impairment*” and “simple sites are often best and should be promoted because while they benefit all, simple designs are especially helpful for



people with *cognitive impairment*” (pp. 21-22, emphasis added). Though Morris and her colleague provide a number of positive reasons why older adults cannot involve in e-literacy learning practices, we must understand that “older adults as a group are very heterogeneous and individual differences are very prevalent throughout the life courses” (Czaja & Lee, 2007, p. 344). Despite the heterogeneity of this group, older adults are commonly faced with manifold challenges that influence their immediate life situations (Thalhammer, 2014, p. 48). Emphasizing the need of assistive technology for older adults with cognitive impairment, Martha E. Pollack’s (2005) states that assistive technologies should be developed to supplement human caregiving. Pollack claims that such technologies have the potential to improve the quality of life for both older adults and their caregivers (p. 9). While developing assistive technologies to enhance older adults’ quality of life, it is also important to acknowledge whether or not these products are designed from users’ perspectives to maintain usable quality.

Bloch and Bruce stress how we can work to improve cognitive or physical well-being among older adults with the growing commitment to the development of an “age-friendly” environment. Because many older adults comprise a population segment more vulnerable to social isolation during late life (Ihm, 2015), they are very likely to be excluded from the public or civic spheres, and are, thus, treated as a social problem to be addressed, but not as a necessary component of a healthy society. Bloch and Bruce (2011) write,

As more and more agencies turn to the Internet to inform and communicate with the public, and open government policies gear heavily toward online civic engagement, serious consideration needs to be given to those left out of our online discourse. Rather than allowing online media to further exclude the elderly, as is often the case today, we

might instead see it as a means to include them even more by overcoming barriers of mobility and physical limitations. (p. 1)

In exploring issues of information behavior and literacy, attention should (or must) be given to the older adults who do not increasingly benefit from the growing role of information and communication technologies. Thalhammer argues that “in view of rapid technological development it is also very important for all stakeholders (e.g. software engineers, education providers, and participants) to work together regarding the implementation and further development of [e-literacy learning practices] for older adults” (p. 57). However, to a larger extent, older adults are not adequately taken into account as potential users of technology, and, thus, many interfaces are designed without considering age-related changes in abilities (Czaja & Lee 2007). In effect, paying less or no attention towards the importance of late life e-literacy for older adults results in the digital divide, a pitfall that I discuss later, which is certainly detrimental to individual and society.

Since more and more information, personal communication, and business and financial news are conducted online in modern times, scholars such as Heidi McKee and Kristine Blair (2006) argue that older adults need to gain the valuable knowledge on their health issues and care. McKee and Blair write,

As more news and information, governmental business, and personal communications are conducted online, older adults who do not use the Internet are at an increasing disadvantage in terms of developing social relations, participating in civic discussions, and gaining valuable knowledge on issues such as health care. (p. 14)

While McKee and Blair find that older Americans are increasingly facing the digital divide, Fausto Amaro and Henrique Gil (2011) examine the divide being created by “the designers of

software and hardware,” who are usually young people and who often lack the opportunity “to know the [sic] ‘another perspective,’ the perspective of [older adults] . . . ” (p. 1026). It should come as no surprise that barriers to ICT use have resulted from the lack of attention towards older adults as potential users. At the same time, it is what Schäffer (2007) calls “a generation effect” that the older adults who “have made a habit of the media practice cultures they acquired during adolescence and approach modern technology from this perspective” face challenges while using computers to perform their desired tasks (pp. 38-39). To develop more useful and usable ICTs for older adults, the field of human factors should, therefore, seek to improve design for older adults by applying an understanding of what Janna Leikas and Pertti Saariluoma (2008) call “worth” and “form of life” (p. 306). Technical objects, products, devices, or services should be designed in a way that users must be motivated by the added value (i.e. worth), related to their form of life (i.e. lifestyle), the way of life, and life area.

In their research findings from Finland, Leikas and Saariluoma identified that well-being and health as well as daily living activities are the most valued life areas of older adults. According to Leikas and Saariluoma, the next most valued areas are “friends, relatives, and everyday issues” (p. 320). Among many factors involved, ICTs do play an important role in these valued areas. As demographic change continues to expand and older adults as online wish to act independently, it is urgent to recognize the importance of ICTs and e-literacy for them. From professional healthcare facilities to retirement benefits programs to communication with family members, friends, and other relatives in the current migratory phenomenon, older adults might need to go online in order to stay connected in the digital world. Certainly, Internet access and affordability are not sufficient enough to accomplish tasks if communication tools are complex to use. As Rodríguez et al. (2009) state, “Even though Internet access can become more

ubiquitous and affordable for older adults and a feasible alternative to support communication with family members abroad, its adoption will not change dramatically if the communication tools are not designed to serve their needs” (p. 610). I argue that the adoption of ICTs can change people’s life dramatically if de facto users are involved during the tool design process to identify users’ needs, expectations, and abilities. Inasmuch as societies, industries, and governments are looking for new technological solutions for supporting older adults’ different needs and for enabling them to cope with their loneliness, older adults need to develop e-literacy skills, and use those skills to know what benefits they can get from ICTs.

Now, tremendous progress has been made in healthcare services/systems such as eHealth/telemedicine and health enabling technologies as well as Internet use in information search and analysis. In effect, progress has been made worldwide with the development of new information and communication technologies that contribute to preserving and/or improving older adults’ quality of life, health, and self-sufficiency. For instance, to identify how ICTs contribute to enhancing older adults’ quality of life and health and to evaluate new techniques of ICTs for the design of environment for aging, a group of researchers in Germany ran a five-year research project from 2008 to 2013. Through this project known as “the Lower Saxony Research Network Design of Environment for Ageing (GAL),” the team learned how “multimodal and speech-based communication and human-machine interaction mechanism for persons with functional restrictions can implemented, and developed new methods and algorithms for identifying activities of daily life and for detecting acute events, such as falls” (Haux et al., 2014, pp. 173-174).

Since the demographic change in aging populations results in more and more older adults living alone, ICTs can support them to maintain their quality of life by their continual

involvement in e-literacy learning practices. For older adults who are homebound, Internet access, for instance, allows them to feel like they are out of the house, improves their connection with the outside world, and helps them avoid or reduce feelings of social isolation (Woodward et al., 2011). At the same time, programs that benefit older adults' e-literacy learning practices through intergenerational communication between older generation and younger generation should be launched. The next section discusses the need for intergenerational communication to motivate older adults for ICT-education that supports their social connectedness in the digital world. I believe that communication across generations would even help younger adults understand what it means to grow old in digital times. Through such communications, older adults also would perceive that incorporating ICTs into their lives would be increasingly advantageous and beneficial.

### **Intergenerational Communication**

Older adults with ICT skills can access online sources for important information needed to live an active late life. However, many older adults may face challenges in accessing information due to insufficient knowledge of e-skills and usage gap. To support and develop e-skills through e-literacy learning practices, intergenerational communication between older adults and younger adults can be beneficial. Clara Berridge (2014) also mentions that generational incompetence is one of the main reasons why the population of older adults is considered to be far behind the technological curve (p. 174). This concept of generations incompetence, according to Berridge, "is based on a nearsighted perception of technology development and adoption over the lifespan, as well as misperceptions about older adults' abilities and willingness to learn how to use new technologies if they perceive that incorporating them into their lives would be of benefit" (pp. 174-175). When older adults lose their work and

the social ties associated with it due to generational incompetence, they must develop alternative ways of finding social connections to develop a new, post-retirement lifestyle. Therefore, intergeneration communication for digital technologies knowledge development can function as a bridge between pre-retirement and retirement life stages as older adults can continually remain actively online for civic engagement when they have time, resources, and position to do so. Such an engagement can demonstrate that they are still productive and are contributing to society (Gasiorek & Giles, 2013). In fact, intergenerational communication can help people involved to make new contacts and extend their social ties.

The role of ICTs in the process of active late-life is particularly important for older adults and may in fact account for many of the social, cultural, and economic benefits of their digital engagement. Gasiorek et al. write, “As older adults retire and subsequently disengage from their professional networks, pursuing new social avenues becomes a means of staying connected to other people and the community more broadly, a factor associated with successful aging. . .” (p. 2665). Gasiorek et al. also propose that “insofar as older adults become more isolated as they age, social connections made through volunteering may be beneficial and correlate with successful aging” (p. 2670). To be sure, older adults have been the most active demographic in the United States in terms of volunteering (U.S. Department of Labor, 2014).

One of the motivating factors for volunteering engagement is social connections that influence older adults’ life in a number of ways. For instance, older adults, who offer volunteer services in various places such as hospitals and religious organizations, get communication opportunities with different people. ICT skills and e-literacy learning practices further enhance their social connectedness and companionships in such places. Moreover, knowledge about ICT use can open up other communicational channels through which older adults can gather

information about health, entertainment, and ways of living a better life. As Berridge puts it, “access and ability to use the Internet can open channels of communication for older adults, whether the purpose is to maintain existing social ties or build new ones, gather information about health or social services, or for entertainment or education attainment” (p. 176). To further boost e-skills and e-literacy learning practices of aging people, intergenerational communication should be promoted so that older adults, especially those who fear using ICTs, can build confidence in using web-based tools for effective communication.

Recent research has shown that older adults need social support and motivation to develop their confidence and ability in using ICTs. As Thalhammer (2014) observes, “Older adults usually decide for themselves whether they want to participate in further education or not on the basis of their motivation, learning experiences, health status, and interest” (p. 47). In their research findings, Minnamari Naumanen and Markku Tukiainen (2009) also noticed that though older adults are “capable of and enthusiastic in acquiring ICT-skills and of gaining knowledge,” (p. 1), motivation from younger generation encourages older adults to stay the pace of ICT-skills knowledge development. Moreover, their research suggested to consider the preference older adults give to practical and applicable skills. In addition, the authors found that the social mode of learning such as peer tutoring encourages older adults to participate effectively in e-literacy learning activities.

A similar research was conducted in Portugal by Maria Raquel Patrício and António Osório (2011) in order to find out and understand how “children and older adults think of lifelong learning and generational solidarity, particularly through organised training activities with the use of Information and Communications Technology (ICT)” (p. 224). The authors suggest that we need to encourage older adults to remain longer in the labor market by remaining

healthy, active and independent. Patrício and Osório envision that if the aging population is not supported for “intergenerational lifelong learning” through ICTs in general and the Web 2.0 (and perhaps the Web 3.0) in particular, this population might “suffer from a risk of exclusion of the benefits of the Information and Knowledge Society” (pp. 224-25). However, active aging and intergenerational solidarity are the common challenging issues in most of the countries where older adults are not supported by younger tutors or coaches.

It is through intergenerational knowledge sharing that both older adults and younger generations learn from each other, and learn how the innovation of new technologies provides new meanings of social connectedness in the digital world. For successful or active aging, older adults, therefore, should be engaged in e-literacy activities, which can help them keep their relationships with their distant family members, friends, and others. In other words, older adults’ active participation in contemporary society is necessary so as to involve them in opportunities for lifelong learning and “e-inclusion to bridge the digital divide and make e-Inclusion a reality” (Patrício & Osório, 2011, p. 226). Nevertheless, many older adults may still lack the realization of possible benefits which ICTs can provide.

To benefit older adults from e-world, social motivation can bring a significant change in their life. Socio-emotional and instrumentals or social- and classroom support (emotional and assistance support during the learning respectively) play an important role in using and navigating modern technologies (Naumanen & Tukiainen, 2009). Naumanen and Tukiainen argue that “there is also a strong need for flexible adjustment” and “age friendly pedagogy” (p. 2). To promote lifelong e-literacy learning practices, older adults should be provided an opportunity to work with the younger generation because, as Patrício and Osório (2011) posit, “Intergenerational learning provides a context that can improve both learning the specific



learning topics and the tacit knowledge and life experiences relating to them” (p. 226). In order to demystify the notion that older adults, especially novice older users of ICTs, cannot use modern technology, we need to work for them by running specific e-literacy learning and/or training programs which can motivate and encourage them to think of lifelong learning, interests, and need of ICTs. By actively participating in such programs, older adults can comfortably update and acquire new digital skills according to their interests, needs, and availability on the one hand, and younger adults as designers can “better pinpoint what needs to be emphasized in training program and instructional materials” (Olson, O’Brien, Rogers, & Charness, 2011, p. 142) on the other hand. Ultimately, such programs help older adults fight against socio-cultural and physical barriers by disseminating information and e-literacy knowledge education in an age-friendly manner. More so, we can also break the barriers by planning and implementing correct methodologies, strategies, and activities that are important and significant in the development of ICTs to support older adults’ lifelong e-literacy learning practices. Most importantly, ICTs designers and developers should take older adults into consideration to avoid the tensions between design and distribution of information and technology products. Indeed, inconsideration of older adults as potential users of ICTs results in two pitfalls— digital divide and social injustice. In the next section, I discuss these two key pitfalls of paying less or no attention towards the fast-growing population of older adults, who are the potential users of ICTs for e-literacy learning practices and development.

### **Pitfalls**

One of the main consequences of designing information and communication technologies without considering older adults as target audiences is the digital divide—the gap between those who use ICTs and those who choose not to use or do not have access to use them. When the

concept of digital divide emerged, it was primarily used to address the issue of inequality in the information society. Instead of one single divide of having access to a computer and the Internet, many divides have arisen with the new media technology at the turn of the century. Some other types of divides associated with an access to ICTs are “motivational, physical or material, skills, and usages” (van Dijk, 2005, p. 4). Van Dijk argues that “the digital divide is deepening where it has stopped widening” because “in the places where people are motivated to gain access and physical access is spreading, differences in skill and usage come forward” (p. 2). I find this gap still widening as many older adults face complex issues involved in using modern information and communication technologies, especially computer technology and the Internet.

To stop the widening digital divide without delay, ICT designers and developers should consider to adapt and adopt a more effective model that allows them to know about users’ needs and preferences. Though many usability scholars have advocated user-centered technology that emphasizes user-experience, user knowledge, and user-involvement (Nielsen, 1993; Johnson, 1998; Salvo, 2001; Brady, 2004; Norman, 2013), I propose the participatory user-centered design model through which designers get an opportunity not only to work for older adults, but also to work *with* them to produce systems from users’ perspectives by recognizing their conditions of living such as, in Moody et al.’s (2015) words, “social class, formal education, and occupational experience” (p. 2). In addition to allowing the designer to understand the needs and preferences of older adults’ ICTs use, the model will also, I hope, help avoid the potential pitfalls by enhancing older adults’ e-literacy learning practices for civic engagement in the digital world.

In order to increase older adults’ confidence in ICTs use, they should be regularly encouraged to use them, especially when they are suspicious about the reliability of going online to verify information. “Many older adults,” write Morrell et al. (2004), “do not use the Internet

because they do not know how to verify that the information that they find there is current and reliable” (p. 80). Though many older adults may not stay abreast of rapidly changing information and communication technologies, they should not be excluded with the assumption that older adults have cognitive and physical barriers, and, thus, get less benefits from adopting modern technologies. If they are deprived of using communication affordances such as computer technology and the Internet, they will eventually be alienated from the “information haves.” Consequently, greater digital inequities will appear in their abilities to critically engage in e-literacy learning practices in a networked society. Thus, focusing only on the younger generation for technological affordances and usability would foreground issues of social injustice, another pitfall of not designing information and communication technologies by considering older adults as prospective users.

Iris Marion Young (2000) defines social justice as “the institutional conditions for promoting self-development and self-determination of a society’s members” (p. 33). For social equity, all member, including older adults, should be involved in decision-making through their participation in the ICT development process and they must have equal opportunities to practice e-literacy for civic engagement. We can promote social justice when every citizen can enjoy social equality. By equality, I do not intend to mean the equal distribution of social goods. I mean primarily, in Young’s (1990) words, “the full participation and inclusion of everyone in a society’s major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realize their choices” (p. 173). We can, I hope, close the digital divide and establish social justice by launching different ICT-educational programs and trainings in which older adults are (or must be) included. Berridge (2014) also states that “attempts to close the digital divide include programs to enhance access and provide targeted education for

older adults, such as offering classes with peers who want to learn how to use technologies at a speed that does not assume lifelong or workplace computer experience” (p. 177). Participation in ICTs-educational and training programs for e-literacy learning practices allows older adults to keep pace with younger adults in the digital world. In other words, intergenerational communication would eventually maintain social justice as older adults and their younger counterparts get an opportunity to learn from each other.

Today, voices for social justice and equity are heard more frequently from divergent social spheres than a decade ago. If a certain group of people are left behind from using ICTs while others are substantially progressing, we must find the reasons why a segment of the population cannot exploit the potential benefits of ICT use for lifelong learning. A recent research conducted in six suburbs in the Chicago area indicated that socio-economic status plays a crucial role in the digital inequality among older adults, and their existing organizational memberships had very little influence on ICT access and use (Ihm & Hsieh 2015). Certainly, affordability should not be the key reason for depriving people of their rights for ICT use. At the same time, the way product is designed most not limit their access to information and communication. Many older adults still assume that ICTs are complex to use and difficult to understand and they also expect to face serious security threats and technical problems (Woodward et al., 2011; Friemel, 2014). Therefore, ICTs that provide usable interfaces for older adults can serve as bridges to reach family members, friends, and other relatives that are using standard tools (Rodríguez, 2009). More importantly, ICTs must be simple and easy for access, use, and engagement for older adults to live a better life in an inclusive society.

If designers do not consider older adults’ needs and expectations in the process of system design, exclusive society will be promoted as many users, especially older adults with

knowledge gap as well as usage gap, are left behind in digital exclusion due to poor system design. In addition to appropriate support provided by family and friends to use ICTs more effectively, technological improvements are necessary to address age-related barriers affecting older adults' ICT use (Friemel, 2014). Sara J. Czaja and Richard Schulz (2006) remind that by 2030, it is estimated that "people over the age of 65 will represent about 22 percent of the population in the United States, with the fastest growing cohort within this subgroup those 75-plus years of age" (p. 6). If such is the case, and older adults are not taken into account as potential users of ICTs, we may not be able to accomplish our commitment to establish a society of equity. To promote social justice, each citizen, including older adults, should, therefore, be able to use ICTs so that they can continue learning e-literacy skills in and outside of their home. To accomplish our mission of establishing a society of equity, I propose a participatory user-centered design model, which allows designers to develop information and communication technologies from users' point of view.

### **Participatory User-Centered Design**

In order to augment older adults' participation in e-literacy learning practices, I propose a participatory user-centered design model for technology design and development because the model allows designers and developers not to work for the users, but to work *with* them. Many usability specialists have advocated either participatory design or user-centered design, which, I believe, are not sufficient enough to design useful and usable technology for older adults because both participatory and user-centered design model are "guilty of not putting users in charge of design" (Agboka, 2013, p. 43). Following the path led by Donald Norman (1988), Pelle Ehn (1992), Nielsen (1993), and Johnson (1998), Michael J. Salvo (2001) argues for the need to consider users at the center of technology design. Applying the collaborative design method or

what he calls “user participatory method” to the design process, Salvo supports collaborative design which “not only relies on participant with users, but defines designer, expert, and user roles in innovative ways” (p. 274). Such a sentiment is echoed in Ann Brady’s (2004) “Rhetorical Research: Toward a User-Centered Approach,” in which she asserts the importance of usability and participant design theory. For Brady, human factors, usability, and participatory design factors increase the chance of reciprocity between researchers and participants-as-users in several ways.

Though participation of real users during usability testing has been advocated by many usability specialists, very little attention has been given to the need of older adults’ participation for usability in designing and developing of ICTs. The International Organization for Standardization (ISO) 9241 (1998) defines usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.” In Nielsen’s (2012) words, usability means “a quality that assesses how easy user interfaces are to use.” Despite its emergent presence in academia and the corporate world, usability is still often seen as an end-of-the-production-cycle affair (Johnson, Salvo, Zoetewey, 2007, p. 320; Salvo, 2001, p. 280). Instead of designing for usability, the approach to technological artifacts is still governed by designers’ skills and their involvement in the production process. However, a shift in perspective of user-centered design process to that of participatory design experiences is occurring. As E. B. N. Sanders (2002) writes, “It is a shift in attitude from designing for users to one of designing with users” (p. 1). In this new design movement, all people get an opportunity to offer to the design process and can express themselves through the products designed for them.

In participatory user-centered design model, end-users are, however, not only participating during product development process as passive agents, but they are, through collaborative work and interactions with designers, also actively involved in contributing to designing user-centered technology or what Garrett (2011) calls “user experience design” (p. 7). Garrett argues that it is user experience that determines the quality of products and services (p. 12). Even more so, as Agboka (2013) says, “the idea of ownership of design is important in bringing users into the center—rather than onlookers—in the design process, where communities of people own what they use” (p. 43). Interface-level accessibility, which is designed through a participatory user-centered design process at every level of the product development cycle, not only serves the majority users, it also enhances usability for older adults, the young, novice, and the disabled (Oswal, 2014, p. 15).

In participatory user-centered design, users, then, become a critical component of the process by participating directly and proactively in the design development process. If designers have enormous amount of collective influence through users’ real participation, they can better understand the ways of designing usable and useful products for end users. Essentially, a participatory user-centered design process assists older adults in engaging with e-literacy learning practices more meaningfully because technology designed in this way is more useful and usable for them. Even more so, participatory user-centered design experience allows designers to learn about older adults’ experiences of digital engagement for education and/or e-literacy learning practices.

Since we are living in what Naumanen et al. (2009) call an “e-permeated world”—the world permeated by digital technology—, there is a paramount importance of ICT use and e-literacy for older adults. From finding actual websites of their interest to sending emails and

entering into online business world, older adults might want to work independently for privacy and security reasons. Designers barely know if older adults can use ICT products self-sufficiently by maintaining their privacy and security concerns unless these audiences' characteristics, problems, and interests of using ICTs are identified. Therefore, if designers do involve older adults to assess usability quality during product design and development process, the outcome would not only benefit the users, but it would also help fill up the widening gap of digital divide between younger generation and older generation. Summarizing the research results of internet use amongst older adults in the UK, Morris and Brading (2007) assert that "encouraging more older people to go online, providing specialized training and suitable equipment, and making websites more accessible should help to combat the grey digital divide in the UK and reduce the information gap between the 'haves' and the 'have nots'" (p. 22).

Though there are other possibilities to encourage older adults for gaining e-literacy skills, I contend that their digital literacy trajectories may remain simply unproductive if they are not taken into consideration for participatory user-centered design. Because "it is fairly established that many technology products and systems are not easily accessible to older adults" (Czaja & Lee, 2007, p. 342), older adults must be involved during the product design and development process to better understand their needs, preferences, and abilities. Since there are innumerable possibilities for designing simple and usable technology, I suggest that designers who only consider a certain group of the population as end-users should be challenged to consider what kind of technical solutions they themselves would accept as an older adult in their everyday life and what kind of approaches they would expect from younger designers.

Technological development in the past century, as we know, has made fundamental improvements in many areas of our lives such as transportation, communication, healthcare, and



leisure activities; but at the same time we have witnessed how technological failures can have dire consequences (Rogers, Mayhorn, & Fisk, 2004). We should not forget that fact that technologies most often fail not because users are too dumb to use them, but because designers lack the knowledge of user experience design. As Rogers et al. (2003) write, “For older adults to benefit from the advances that technology brings, but not be harmed by the potential for technological failures, we must ensure that systems are designed with the capabilities and limitations of the older user in mind, proper training is provided, and the needs of older users are considered in the development of future technologies” (p. 1). When we listen to what people want, what technological issues they are concerned with, what culturally-adaptive interface can be designed, and how technology can be useful and usable for them, only then can we, in Yvonne Cleary et al.’s (2012) words, “give them opportunities for socialization and self-empowerment” in the digital world (p. 307). To resist the dominance of decline narratives related to aging and to promote social justice, ICTs should be designed and developed through participatory user-centered design processes for *human beings*, not just for certain age-group populations, so that every citizen, young or old, can join the digital world to perpetually impart their embodied experiences of growing old as they continuously invest in digital engagement through e-literacy learning practices.

## **Conclusion**

Information and communication technologies have extensively influenced our life in modern digital times. However, a segment of population of older adults are likely to be left behind to keep pace with younger generations because of knowledge/practice gaps, differences in technology uptake, complex product designs, and other factors such as lack of motivation and intergeneration communication. Though people’s lives within the context of regional, cultural,

and social domain influence their level of understanding e-literacy and its significance in their daily life, the way ICTs have been designed also determines whether or not older adults want to use it for late life e-literacy practices. Unless attention is oriented toward older adults' usability experiences, unless ICTs-education and training programs are run to empower older adults by overcoming the barriers of e-literacy learning practices, older adults might not benefit from ICTs and we might not be able to fulfil our civic duty and obligation for social justice. If older adults are left behind, who are "the most excluded group of citizens in terms of [e]-literacy" (Amaro & Gil, 2011, p. 1027), the world in the near future will perhaps be digitally divided not only between the population of older adults and their younger counterparts, but among older adults of "information have" and "have-nots." Therefore, to promote social justice by bridging the widening gap of digital inequality, I call upon ICT designers and developers to consider participatory user-center design as an alternative model to traditional design model to empower older adults by providing more usable ICT products for e-literacy learning practices in digital times. Ultimately, participatory user-centered ICTs allows older adults share their life experiences, accumulated wisdom, and their social connectedness with their distant family members, friends, relatives, and among others through their digital engagement at all times.

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## **From Solving a Health Problem to Achieving Quality of Life: Redefining eHealth Literacy**

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### **Abstract**

eHealth literacy is an emerging concept of scholarly interest that is seen as the extension of health literacy in the digital era. This study proposes a new definition of eHealth literacy to facilitate future research on this growing scholarly area. Based on the analysis of 14 definitions of eHealth, health and digital literacy, this study defines eHealth literacy as the interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of healthcare with the goal of maintaining or improving the quality of life throughout the lifespan. Researchers should now focus on developing operational measures to develop a valid and reliable means to measure eHealth literacy.

### **Keywords**

eHealth, eHealth literacy, digital literacy, health literacy, concept explication

## Introduction

Literacy is an attribute that every individual in a society is expected to have. At the most basic level, it is demonstrated by one's ability to read and write (Genlott & Grönlund, 2013; Sørensen et al., 2012). In addition people learn specific forms of literacies as a means to improve their quality of life (UNESCO, 2006). One important literacy is health literacy. According to World Health Organization (WHO), health literacy serves as a critical determinant of health and is the goal of health education (2013). In effect, having an adequate level of health literacy is critical to achieve positive health outcomes at the personal and community level (Nutbeam, 2008; Sørensen et al., 2012).

Along with health literacy, a growing body of empirical studies have also explored the concept of eHealth literacy (e.g., Brown & Dickson, 2010; Koo, Norman & Chang, 2012; Mitsutake, Shibata, Ishii, Okazaki, & Oka, 2011; Sheng & Simpson, 2013; Soellner, Huber, & Reder, 2014; van der Vaart et al., 2011). eHealth literacy is distinguishable from health literacy because it includes acquiring and using health information using digital technologies. It is an important area of research as people are increasingly accessing health information using digital technology, particularly the Internet. By 2012, one in two American adults accessed the internet to gather health information (Pew Internet, 2013).

To date, most studies in eHealth literacy use the definition proposed by Norman and Skinner (2006b). They define eHealth literacy as *"the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem."* Although this definition has been useful as a first step to conceptualize and operationalize eHealth literacy, it has been criticized by several scholars since it did not fully account other factors that are crucial to describe eHealth literacy (Gilstad,

2014; van der Vaart et al., 2011). In order to advance such concept, an encompassing conceptual definition is needed in order to develop an accurate operational definition that can guide the development of valid measures for eHealth literacy (Kiouisis, 2002). The lack of clear conceptual definition of eHealth literacy is also problematic as this hinder theory development. For instance, Mackert and colleagues (2014) suggests that more than 93% of published studies on eHealth and health literacy are not theory driven. It is only after understanding what eHealth literacy means that this area of research can create an impact to theory, and later, practice.

In order to understand eHealth literacy, it will be beneficial to examine it through concept explication. Proposed by Chaffee (1991), concept explication is a scholarly activity of critically theorizing a particular concept. Although it may seem to be part of an empirical study, the level of output produced from such activity is considered as a complete research project (Kiouisis, 2002). Aside from theorizing, this method is also a practical means to elucidate a vague concept. Therefore, the goal of this study is to come up with a new conceptual definition of eHealth literacy that can guide future research. To come up with a new definition, existing definitions of eHealth literacy as well as other related concepts will be reviewed.

### **General Background on eHealth Literacy**

The term eHealth literacy was first proposed by Norman and Skinner in their 2006 article *eHealth Literacy: Essential Skills for Consumer Health in a Networked World* (2006b). Their definition was developed by modifying the US Institute of Medicine's (IOM) definition of health literacy (2004). Norman and Skinner's definition was instrumental as it paved the way for scholarly interests on eHealth literacy as evidenced by empirical studies that used their definition (e.g. Brown & Dickson, 2010; Koo, Norman, & Chang, 2012; Mitsutake et al., 2011; Neter &

Brainin, 2012; Sheng & Simpson, 2013; Soellner, Huber, & Reder, 2014; van der Vaart et al., 2011).

Acknowledging that eHealth literacy is a concoction of multiple literacies, Norman and Skinner introduced the Lily Model (2006b) to represent the six literacy components involved in eHealth literacy: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy. Within the model, eHealth literacy can be divided in to two groups: analytic skills (traditional, media and information literacy) and context specific skills (computer, scientific and health literacy).

After developing the concept of eHealth literacy, Norman and Skinner operationalized it and proposed the eHealth Literacy Scale (eHEALS) (2006a). The eHEALS is an eight item self-report tool that can be administered by researchers and health professionals to determine the extent of a person's eHealth literacy. A high eHEALS composite score suggests high eHealth literacy. Aside from empirical studies conducted in English (Brown & Dickson, 2010; Neter & Brainin, 2012; Sheng & Simpson, 2013), eHEALS has been translated in multiple languages such as Chinese (Koo, Norman, & Chang, 2012), Dutch (van der Vaart et al., 2011), German (Soellner, Huber, & Reder, 2014) and Japanese (Mitsutake et al., 2011).

The abovementioned empirical studies using eHEALS show that the scale satisfies several measures of internal consistency and is a convenient tool to assess eHealth literacy. Although it may be a reliable tool, the validity of eHEALS has not been without any criticism. For instance, van der Vaart et al. (2011) found that eHEALS is not a valid measure of eHealth literacy since their study shows that perceived eHealth literacy (measured through eHEALS) did not predict actual eHealth literacy. Next, Gilstad (2014) criticized the eHEALS, the Lily Model and Norman and Skinner's definition since they were developed without taking into

consideration some social factors that might play significant roles in eHealth literacy. These social factors include a society's culture, norms, beliefs and values that are inherent to the individual that uses eHealth applications. Overall, these criticisms suggest that further research is needed to understand what eHealth literacy is. A well-developed definition of eHealth literacy may help guide future research. Therefore, a survey of the literature for related terms provides valuable insights into its multifaceted meaning.

### **Method**

To come up with a new definition, it is imperative to review several definitions that are directly and indirectly related to eHealth literacy. Aside from the definitions of eHealth literacy, this study reviewed prominent definitions of health literacy. Next, definitions depicting technology-related literacy were also reviewed. According to Morris (2007), this specific literacy has been conceptualized through various terminologies such as e-literacy, digital literacy, ICT literacy and technological literacy. Although there is no formal consensus on what terminology to use, the term digital literacy has been highly cited among the scientific community (e.g. Bawden, 2008; Eshet, 2004; Gilster, 1997; Lenham, 1995; Papert, 1996; Pool, 1997). As such, this study focused on searching definitions of digital literacy. Including this term as part of the search process will shed light on the 'e' component of eHealth literacy.

In summary, conceptual definitions of eHealth literacy, health literacy and digital literacy were reviewed. To obtain definitions, articles were searched using PubMed and Scopus. Manual search through Google was also performed to complement the database search. Keywords such as "eHealth literacy," "health literacy" and "digital literacy" were used as search terms. To avoid complexities in the search process, only unique and explicit definitions were reviewed. Sources were then reviewed whether it is the original source of a definition. If not, the article's references

were reviewed to find the original study in which the definition was first used. It is important to note that the definitions presented in this paper are not, by all means, exhaustive and must be viewed as a selection of readings.

## **Results**

### ***eHealth Literacy Conceptual Definitions***

The literature search yielded four definitions of eHealth literacy (see Table 1). The earliest definition was proposed by Norman and Skinner in 2006. Based on their definition, eHealth literacy can be seen as a process-oriented approach towards acquiring health information with the goal of solving a health problem. Norman and Skinner's view of eHealth literacy is similar to the definition proposed by Koss (2011) with the exemption that she viewed users as "consumers" of health information that are able to arrive at health decisions by themselves or with assistance. Going back to eHealth literacy as a mixture of literacies, Chan and Kaufman (2011) recognize that eHealth literacy involves "a set of skills and knowledge that are essential for productive interactions with technology-based health tools." Accordingly, the level of productive interactions (i.e. use of eHealth resources) is dependent upon the core skills that an individual possess. These include information retrieval skills as well as adequate comprehension of health concepts. In general, the definitions proposed by Norman and Skinner (2006), Chan and Kauffman (2011), and Koss (2011) are viewed from a micro level perspective as their focus is solely on the characteristic of the individual. Contrary to the first three definitions presented, Gilstad (2014) proposed a macro level view of eHealth literacy. Here we see an individual's relevant skills being integrated with his/her own cultural, social and situational context.

Table 1.

Chronological Order of eHealth, Health and Digital Literacy Definitions

Date	Source	Definition
<i>eHealth literacy (N = 4)</i>		
2006	Norman and Skinner	The ability to seek, find, understand, and appraise health information form electronic sources and apply the knowledge gained to addressing or solving a health problem.
2011	Chan and Kaufman	A set of skills and knowledge that are essential for productive interactions with technology-based health tools.
2011	Koss	The ability of consumers (directly or with assistance) to use computers and other communication technologies to find, read and understand health information to make personal decisions.
2014	Gilstad	The ability to identify and define a health problem, to communicate, seek, understand, appraise and apply eHealth information and welfare technologies in the cultural, social and situational frame and to use the knowledge critically in order to solve the health problem.
<i>Health literacy (N = 7)</i>		
1997	Kickbusch	Health literacy implies the achievement of a level of knowledge, person skills, and confidence to take action to improve personal and community health by changing personal lifestyles and living conditions.
1998	Nutbeam	Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.
2000	Ratzan and Parker	The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.
2005	Zarcadoolas, Pleasant and Greer	The wide range of skills, and competencies that people develop to seek out, comprehend, evaluate and use health information and concepts to make informed choices, reduce health risks and increase quality of life.
2006	Kwan Frankish and Rootman.	The degree to which people are able to access, understand, appraise, and communicate information to engage with the demands of different health contexts in order to promote and maintain good health across the life course
2010	US Congress	The degree to which an individual has the capacity to obtain, communicate, process, and understand health information and services in order to make appropriate health decisions.
2012	Sørensen et al.	Health literacy is linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course.
<i>Digital literacy (N = 3)</i>		
1997	Gilster	The ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers.
2006	Martin	Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process.
2007	Educational Testing Service	...using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society.



Judging from the reviewed eHealth literacy definitions, one may wonder if it should be viewed at the individual level or be integrated with external factors such as those arising from culture and society. Perhaps, reviewing definitions on health literacy can provide some answers to this question as well as provide guidance on what goal should eHealth literacy aspire. Nevertheless, these existing definitions provide a foundation for a more thorough conceptualization of eHealth literacy.

### ***Health Literacy Conceptual Definitions***

The definitions of health literacy obtained in the literature search provide a compelling view of what kind of actions are desired by being health literate. Table 1 lists seven prominent definitions of health literacy. Specifically, the definitions can be grouped in to two. First, health literacy is viewed as a means to arrive at appropriate health decisions. This view of health literacy reflects the definitions that were proposed by Ratzan and Parker (2000) as well as the US Patient and Affordable Care Act (popularly known as the Obamacare) (2010). Although the two definitions share the same end point, an interesting difference between them is that the latter frames its definition on the understanding of just ‘basic’ health information and having communication (i.e. being able to express/communicate health) as part of health literacy.

The second group of definitions views health literacy as a driver to attain favorable health outcomes. For instance, Kickbusch (1997) views health literacy as a means toward health and frames it not only at the personal level but as well as to community health in general. Next, Nutbeam (1998) as well as Kwan, Frankish and Rootman (2006) concludes their definition with the individual being able to promote and maintain good health through health literacy. Lastly, Zarcadoolas, Pleasant and Greer (2005) including Sørensen et al. (2012) views health literacy as a skill that leads to increased quality of life. Among these health outcomes, the concept of quality

of life has been the major endpoint of any health literacy campaigns (Nutbeam, 2008). As such, Norman and Skinner's view of eHealth literacy of just only addressing or solving a health problem may be short-sighted.

In summary, health literacy definitions remind us of what should be the goal of eHealth literacy. For eHealth literacy to be a major driver of health, its definition should not only be limited with making appropriate health decisions. Instead, it must be extended to indicate the attainment of positive health outcomes and, ultimately, an increased quality of life.

### ***Digital Literacy Conceptual Definitions***

To fully grasp the notion of 'e' in eHealth literacy, it is important to review some definitions on digital literacy. Table 1 shows three definitions of digital literacy that were retrieved from the search. In general, the definitions seem to reflect an individual's capability to appropriately utilize electronic and digital technologies to gather, manage and effectively use information.

Although appropriate usage is the central theme of these definitions, subtle differences are worth mentioning. For instance, Gilster's (1997) definition reflects the need to understand information from a variety of formats. This is important since the level of interactivity when using ICT devices today is much higher as compared before. From static text and images, information on the internet can now blend text, audio and image all at the same time. Next, the notion of societal contribution is expressed in the definitions proposed by Martin (2006) and the Educational Testing Service (ETS) (2007). Specifically, the Martin (2006) views digital literacy as a means towards constructive social action. On the other hand, ETS (2007) looks at digital literacy as a means to be able to function properly in a knowledge society. It is apparent that these definitions are grounded on the ideology of economic prosperity through a knowledge-based society that is enabled by technology (2008). Nevertheless, the concepts ingrained within

these definitions will be of great use to come up with a well-developed eHealth literacy definition.

### ***Redefining eHealth Literacy***

The literature search yielded 14 definitions of eHealth literacy ( $N = 4$ ), health literacy ( $N = 7$ ) and digital literacy ( $N = 3$ ). In order to fully grasp how each definition may contribute to the new eHealth literacy definition, keywords from the definitions were analyzed following Sørensen et al.'s (2012) systematic keyword clustering (see Table 2). As compared with the six clusters proposed by Sørensen et al. (i.e. competence, skills, abilities; actions; information and resources; objective; context; and time), this study yielded a seventh cluster designated as 'technology'. This cluster was added since the definitions of digital and eHealth Literacy are grounded with the use of technologies. Based on the synthesis of clustered key terms found in Table 2, a new definition of eHealth literacy is proposed:

*eHealth literacy involves the interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of healthcare with the goal of maintaining or improving the quality of life throughout the lifespan.*

Compared with Norman and Skinner's definition (2006b), the new definition highlights the following changes:

- Acknowledges the interplay of individual as well as social factors;
- Uses the term digital technologies rather than electronic sources;
- Includes 'communication' as part of the actions required;
- Changes the perspective from solving a health problem towards the application of information in different healthcare contexts (e.g. health promotion purposes);

- Recognizes eHealth literacy as a driver to improve or maintain quality of life; and
- Uses the phrase “throughout the lifespan” to denote that it is a continuous endeavor.

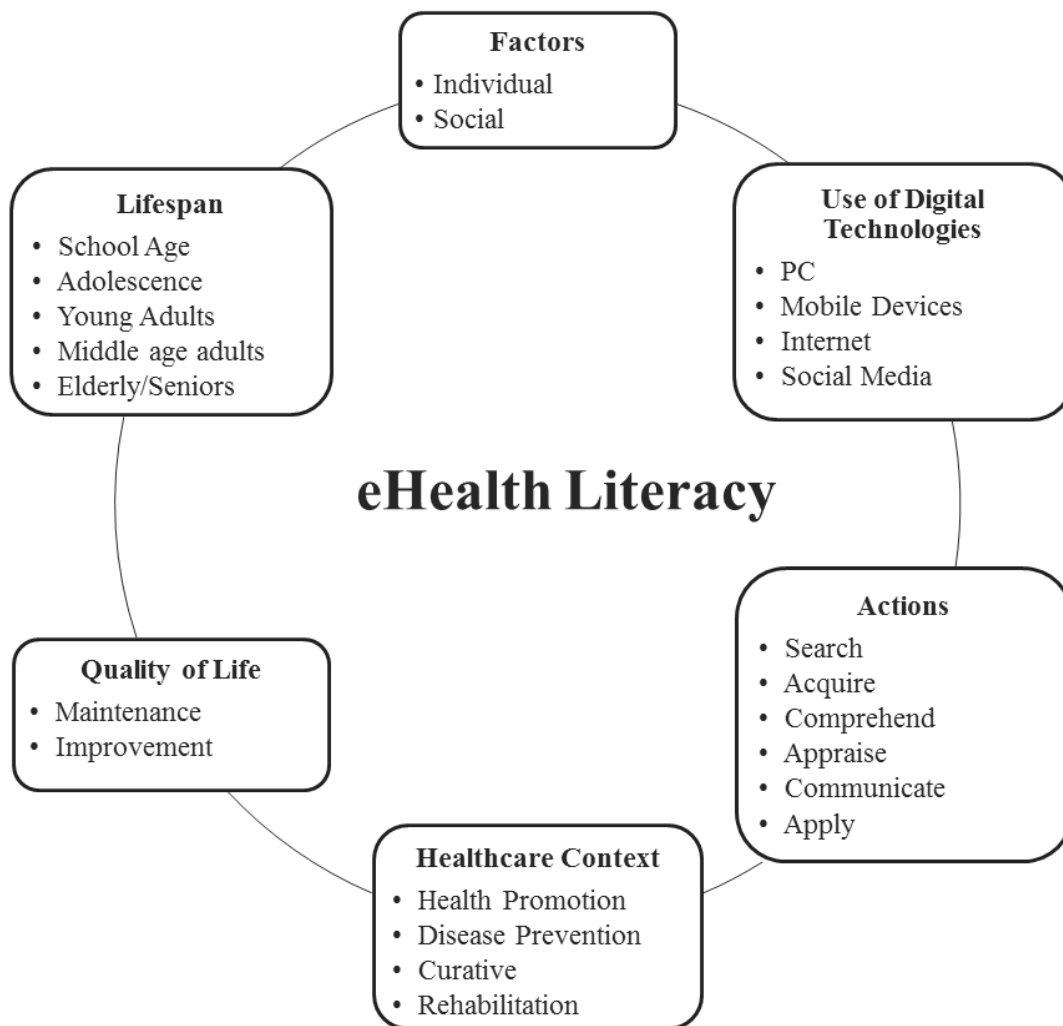
**Table 2.** Key Word Clusters

Competence/ skills/abilities	Action	Information	Technology	Objective	Context	Time
Ability	Productive	Health	Electronic sources	Increase	Cultural	Across
A set of skills	interactions	information	Computers	quality of life	Different	the life
and knowledge	To access	eHealth	Digital resources	Maintain or	health	course
Attitude	To analyze	information	Digital technology	improve	contexts	
Awareness	To apply	Health	Communications	quality of life	Disease	
Cognitive skills	To appraise	information	tools	Promote and	prevention	
Competence	To	and concepts	Multiple formats	maintain good	Everyday	
Confidence	communicate	Information	from a wide range	health	life	
Knowledge	To	Services	of sources	Reduce health	Healthcare	
Level of	comprehend		Networks	risks	Health	
knowledge	To create		Technology-based	Take decisions	promotion	
Linked to	information		health tools	To addressing	Knowledge	
literacy	To define a		Welfare	or solving a	society	
Motivation	health		technologies	health problem	Situational	
Person skills	problem			To enable	Social	
Social skills	To engage			constructive	Specific life	
The capacity	To evaluate			social action	situations	
Wide range of	To find			To function		
skills, and	To identify			To improve		
competencies	To integrate			personal and		
	To manage			community		
	To obtain			health		
	To process			To make		
	To read			appropriate		
	To seek			health		
	To synthesize			decisions		
	To take action			To make		
	To understand			informed		
	To use			choices		
				To make		
				judgments		
				To make		
				personal		
				decisions		
				To reflect upon		
				this process		

## Discussion

The newly proposed definition of eHealth literacy is comprehensive yet concisely elucidates several key aspects that are critical to improve its research agenda. To fully understand the definition, it will be appropriate to offer some insights on how each of the sub-concepts embedded in it can guide future research. A framework based on the salient points of the discussion section is presented in Figure 1.

Figure 1. Framework for eHealth Literacy Research



### ***Personal and Social Factors***

First and foremost, the definition recognizes the interplay between individual and social factors in eHealth literacy. Departing from a microlevel approach, the new definition views at both micro and macro level perspectives by looking at eHealth literacy as a “shared function of social and individual factors” (IOM, 2004). From this perspective, research on the antecedents of eHealth literacy should not only focus on individual factors but must also include social factors. Therefore, more studies are needed that synthesize both individual (e.g. cognitive factors) and social (e.g. health policies, socioeconomics) factors in the analysis. For instance, using the social-cognitive theory (Bandura, 1977) may shed light on both individual and social factors that affect eHealth literacy. Alternatively, personal and social factors can also be used as a basis of categorizing research respondents. For example, a research comparing eHealth literacy between Western and Asian societies will provide much needed knowledge on the role of culture in eHealth literacy.

### ***Use of Digital Technologies***

The definition also highlights the use of digital technologies as part of eHealth literacy. It is critical to acknowledge this term as this reflects the ‘e’ in eHealth literacy yet it does not only represent the term electronic. Instead, “digital technologies” is a term used to refer various technologies used such as (but not limited to) personal computers (PC), mobile devices (i.e. phones and tablets), the internet and social media (blogs, wikis and social networking sites). This means that an eHealth literate person has basic knowledge in using these technologies. In effect, when conducting eHealth literacy studies, it is critical to assess respondents’ use of digital technologies as this will greatly influence their eHealth literacy. Future research can operationalize technology use in general, such as using the Technology Proficiency Self-

assessment scale (Ropp, 1999), or focusing on a specific technology, for instance, using the Facebook Use Scale (Ellison, Steinfield, & Lampe, 2007) as a measure social media usage.

### ***eHealth Literacy Actions***

The definition specifies key actions when evaluating an individual's eHealth literacy. These include (1) searching, (2) acquiring, (3) comprehending, (4) appraising, (5) communicating and (6) applying health information. The words are arranged chronologically starting from searching to application of health information found using digital technologies. From this process, scholars can develop an operational definition of eHealth literacy. For instance, the degree of eHealth literacy can be measured by creating operational measures of the abovementioned process. A composite scale of each step of the process may provide a perceived eHealth literacy score (via self-report measures) or a true eHealth literacy score (via the experimenter's observation of participant actions). This suggests that higher scores translate to a higher degree of eHealth literacy. Therefore, future research may be conducted to create a psychometrically validated eHealth literacy scale developed from the proposed definition. This scale can then be compared with eHEALS (2006a) to determine which scale provides greater reliability and validity.

### ***Healthcare Contexts***

The definition informs scholars that eHealth literacy is relevant in all healthcare contexts. Specifically, eHealth literacy is evident in the context of health promotion, disease prevention, curative services and rehabilitation. Although the definition advocates the use of eHealth information in all healthcare contexts, it does not suggest that people use such information without medical advice. For instance, although a person found a better medication for a

particular disease via the internet, he/she should not immediately use it without consulting a medical doctor.

### ***Quality Of Life***

Similar to health literacy, eHealth literacy should be thought of as a step towards the formation of an acceptable quality of life (Nutbeam, 2000; Sørensen et al., 2012; WHO, 2013). Based on the new definition, quality of life is not a one time achievement. It entails constant improvement to the point of maintaining it when it has reached its highest peak. Consequently, there is a critical need for more research to identify the link between eHealth literacy and its impact on quality of life. Future studies should also strive to understand the mechanisms that underlie between these links. It is only when we can fully understand the relationship between eHealth literacy and quality of life that we can determine the former's true impact.

### ***Lifespan***

Research on eHealth literacy can be conducted throughout the lifespan. Understanding the differences between each age group in terms of eHealth literacy will not only inform research but will inform practitioners to tailor-fit the development of eHealth applications. For instance, examining eHealth literacy among the elderly will greatly inform developers on how to further improve the usability of their applications.

### **Conclusion**

eHealth literacy has gained substantial interest among different scholars as it extends the endeavors of health literacy in the digital age. As a growing field of research, it is necessary to come up with an inclusive conceptual definition that can guide future research. This study conducted a concept explication that reviewed a total of 14 eHealth, health, and digital literacy



definitions to come up with a well-informed conceptual definition of eHealth literacy. To restate, eHealth literacy involves the interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of healthcare with the goal of maintaining or improving the quality of life throughout the lifespan. With a new conceptual definition at hand, future research should focus on developing an operational definition that will serve as a framework for a more reliable and valid eHealth literacy scale.

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## **Rural High School Students' Digital Literacy**

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## **Abstract**

The influence of technology and digital resources on students' literacy continues to grow along with the increased prevalence of technology in the world today. Although elementary and middle year students' literacy has been examined, a gap exists in the literature regarding high school students' literacy, especially their digital literacy. This research examined the literacy habits and activities of Grade 10 and 12 students from 16 composite and high schools within a Rural Canadian School division. 424 students ( $M_{age}=16$  years) completed a survey regarding the frequency of their literacy activities with a focus on their digital literacy habits. Results of the research show potential for increased use of digital technologies and literacy texts in and out of classrooms. Recommendations include supporting digital literacy for rural high school students by increasing opportunities to use new technologies in the classroom and encouraging teachers to use a variety of print and digital literary texts.

*Keywords: digital literacy, literacy, technology, rural, education, teacher education*

Learning what students are doing with technology is important for many reasons. It helps us create curriculum, resources, and learning environments where all learners can find success. Developing these three areas is important at all ages and grade levels. Research activity into students' literacy in elementary and middle years as it is at these stages of school where learners are in their earliest development. Far less literacy research on high school students has been conducted and even less research has examined rural students' high school literacy. The limited amount of research in high school settings may be based on the belief that students know all they have to about reading and interacting with information when they are in their upper years. Such a research imbalance negatively impacts a comprehensive approach to literacy and technology in the rural pre-kindergarten to Grade 12 learning environment. At the high school level there is still a need to have thorough knowledge and understanding of students' literacy for administrators, teachers, and students to discover what these groups are reading and learning. Radical changes in technology have created a significant new area in high school literacy. To investigate high school digital literacy, a survey was designed and conducted in a rural Saskatchewan school division. The findings generated from the survey are designed to share a snapshot of current rural high school students' literacy and technology preference and practices. It is hoped that teachers, administrators, and parents will find the results useful in charting an effective future course for students in rural high school settings. Specifically, the purpose of this research was to: (a) examine the digital literacy choices of rural adolescents; (b) uncover how technology is a part of their lives both in and out of school and, (c) provide teachers and administrators with information to improve the learning experience for high school students. Studying the results will support a better understanding of high school students' habits and daily activities related to literacy and the use of technology. Knowing more about high school

students' literacy and technology activities is a key part of long term planning for Rural School Divisions in regards to best serving the needs of their students.

### **Theoretical Foundation**

This research is driven by an understanding that learning options for students are changing at a rate faster than ever before. Students are studying in more flexible environments with a variety of different literary texts and communication tools (e.g., smart phone, tablets, social media). Students are learning in a way that is mobile and they are working and learning outside of traditional educational contexts. They are growing up in a world that is constantly connected through many different systems and strategies. To keep pace with this change, now and in the future, senior students need to further develop what people are calling “21st Century Skills” (Binkley et al., 2012). Not only do learners need to develop reading and writing skills but they also need to learn to manage technology, cooperate, and prepare for more flexibility in their learning (Glaus, 2014).

A new generation of Canadians is engaging with literacy and learning on an individual and societal level. Reading technologies, other than traditional printed material, such as smart phones, iPads, and tablets are becoming part of radical changes to how young Canadians interact with information inside and outside of schools. Along with the change in students, “advances in technology are having a profound impact on Canada’s educational system” (Industry Canada, 2014, para. 1), impacting traditional structures and opening up new channels for learning. Despite a view that this generation is Canada’s best hope for a successful future, some believe that a skills divide is emerging in young people’s new digital reading processes where standards of comprehension and critical thinking are being lost (Eaton, 2011; Employment and Social Development Canada, 2014; HRSDC, 2003). It is vital, then, to understand the impact of digital

technologies on young Canadians' reading literacy and the current study aims to provide a foundation of understanding of rural students' literacy.

This new generation of Canadian students is entering a world in which more and more people are connected through various digital technologies (Palfrey & Gasser, 2008). Canada is one of the most wired country in the world, embracing digital technologies in all of their most recent manifestations (Chambers, 2003; Peterson & McClay, 2007). Digital media and associated devices are part of this new generation's daily fabric of learning, play, and socialization (Ito et al., 2008). Characterized as the "born digital" generation (Palfrey & Gasser, 2008), "Today's graduating students face technological competencies that emphasize the capacity for innovation, leadership, multi-disciplinary collaboration, collective problem identification, resolution in a dynamic, digital environment" (Greenhow, Robelia, & Hughes, 2009, p.248). Bolter (2001) writes that our wireless networked culture, with its varied forms of digital text, gives readers the opportunity to "redefine cultural ideals inherited from printed genres and forms" (p. 208). As a result, young Canadians have more choices about how and where they spend their learning time; constructing meaning "in ways that are increasingly multi-modal – in which written-linguistic modes of meaning are part and parcel of visual, audio, and spatial patterns of meaning" (Cope & Kalantzis, 2000, p. 5). Students have increased opportunities to employ new technologies that are deemed important for future economic productivity, while teachers are increasingly pressed to evaluate how and when to use new technologies within the curriculum and learning activities of the classroom. Indeed, the past decade has witnessed tremendous changes to communication technologies that have brought about important shifts in understanding what it means to be literate (Cope & Kalantzis 2000, 2009; Lankshear & Knobel, 2006), as well as young people's

reading and learning practices (Chandler-Olcott & Mahar, 2003; Moje, Overby, Tysvaer & Morris, 2008).

Traditionally, *literacy* has been viewed as a set of discrete skills, such as decoding print on a page, that can be key to realizing one's full economic and social potential. *Literacy*, then, may be broadly defined as:

“The ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society” (UNESCO, 2004, p. 13).

*Reading literacy*, as defined by the OECD (2010), includes a wide range of cognitive competencies, from basic decoding, to knowledge of words, grammar and larger linguistic and textual structures and features, to knowledge about the world. It also includes meta-cognitive competencies; the awareness of and ability to use a variety of appropriate strategies when processing texts. Supplementing these definitions of what it means to be literate, the *multiliteracies* framework (Cope & Kalantzis, 2000; New London Group, 1996) that this study employs, acknowledges an emerging cultural, institutional and global order that engages through a range of technologies, increased mobility, and global interconnectedness. It forwards that meaning is constructed socially through increasingly multimodal texts and emphasizes the affordances of critical stances for transformative purposes (Cope & Kalantzis, 2000; New London Group, 1996). Within this theoretical framework, the participating researchers acknowledge not only the cognitive, affective, and psychomotor competencies, but also the

social-constructive, multi-modal, and critical nature of young people's emergent *reading literacy*.

Schools are being challenged to keep up with these many changes in youth's literacy practices (Dobson, 2007; Peterson & McClay, 2007). The issue is especially important in rural settings where access to information can be difficult and resources are more limited than urban centers. Peterson (2011) points out a need for more research to find ways to support rural writing development in middle years and high school (Barter, 2013). Providing reading choice for students will also encourage and support literacy development (Morgan & Wagner, 2013). Taking the opportunity to connect what adolescent students are doing outside of regular classroom time may also help strengthen classroom practice (Skerrett & Bomer, 2011). The current research samples students' literacy activities both in and outside of school to elucidate those activities that might be implemented or utilized in the classroom to support student learning.

An understanding of young peoples' reading literacy is particularly vital in a digital economy organized and managed primarily by digital immigrants. *Digital immigrants* are those individuals who were born before 1990 and who have had to adapt to, rather than be born into, a digital-based society (Prensky, 2001). Literacy and educational researchers, such as Merchant (2008), recognize that it is therefore difficult for contemporary institutions to decide "... which dispositions, values, and practices will remain important and which new ones may be required... a struggle between the valorization of traditional routines and the lure of radically different futures" (p. 751). By examining the emerging literacy of Canadian youth, researchers and practitioners will be better informed regarding the literacy practices that youth deem important,

and will be better able to make decisions regarding the use of technology and digital texts both in and outside of the classroom.

Some worry that new technologies are part of a generational rift, and a dangerous turn away from accepted standards for knowledge, literacy, and civic engagement (Ito et al., 2008). This is troubling for those of an older generation of educators and employers who have invested much of their understandings of the word and the world through the page. As Striphas (2009) suggests in *The Late Age of Print* "... digital texts appear to some as harbingers of loss—of knowledge, authority, history, artistry, and meaning" (p. 22).

Revised language and literacy curricula across Canada have also included expanded notions of text and *multiliteracies* (Cope & Kalantzis, 2000) within their considerations for delivery and prescribed learning outcomes throughout the past decade. The term *multiliteracies* refers to the multiple means of communication available both personally (e.g., text messaging) and through media (e.g., social networking), as well as the increased prominence of cultural and linguistic diversity that also affects literacy. A number of studies have examined new literacy and multiliterate practices within elementary and middle years classrooms. Such studies include: Peterson and McClay's (2007) pan-Canadian inquiry into middle years students' and teachers' classroom writing practices; Siemens, Warwick, Cunningham, Dobson, Galey, Ruecker, and the INKE Team's (2009) international and interdisciplinary collaborative research project that examined user/reader experiences with a wide range of digital and non-digital textual artefacts; and Rowsell and Burke's (2009) case-studies which examined the situated digital reading practices of three selected middle school literacy learners. Yet, the impact of digital technologies on young Canadians' reading literacy - what changes are occurring to students' cognitive, affective, psychomotor and social reading competencies - have yet to be investigated at the

secondary level. There is a pressing need for empirically-based insights into the impact of digital reading technologies on literacy and learning as the next generation of young Canadians enters into post-secondary studies.

This research approaches the many possibilities of literacy learning for adolescents. This topic has not attracted much research attention until now, in contrast to the reading processes and instruction of younger students (Graham, McKeown, Kiuahara & Harris, 2012; Marinak, 2013; Pressley & Allington, 2014; Roe, Smith & Burns, 2011). It is an important topic because reading and literacy development do not stop at the age of 12, and the changes that adolescent and young adult students go through have important implications for the approaches taken in education. This research examines one aspect of the digital communications revolution with the ultimate aim to have the knowledge gained from this study result in recommendations for educational policy, teacher education, and developments in the publishing industry.

### **Method**

A total of 430 surveys were returned for analysis. Six participants' data were excluded from entry due to failure to follow instructions.

### **Participants**

All grade 10 and 12 students ( $n = 850$ ) from the 16 high- and composite schools within Sun West School Division (Saskatchewan, Canada) were invited to participate in the survey. Of the 424 ( $M_{age} = 16.13$  years,  $SD = 1.09$ ) participants in the sample, 173 (40.8%) were males. The majority (90.6%,  $n = 384$ ) reported *English* as their first language with 6% ( $n = 28$ ) of participants indicating that they speak a second language at home ( $n = 9$  speak French).



## Design

This research examined Grade 10 and 12 rural Saskatchewan students' perception of the importance of various digital technologies as well as their use of those technologies. Students' print and digital literacy practices were also examined along with general demographic variables. The survey consisted of a total of 119 questions encompassing the following areas of literacy: (a) *literacy self-perception* (e.g., self-assessed reading ability and enjoyment), (b) *exposure to technology* (e.g., access to digital technologies), (c) *technology use* (e.g., use and length of time spent using various digital technologies), (d) *literacy activity in school and outside of school* (e.g., digital and print reading choices in and outside of school), (e) *literacy control or influence* (e.g., who selects school reading, how much influence students should have in selections), and (f) *demographics* (e.g., age, grade, school).

## Materials and Procedure

Following a pilot test of the measure ( $n = 10$  Grade 10;  $n = 10$  Grade 12 students), the survey was revised for clarity and understanding. In 2013, information for parents of prospective participants was provided that outlined the purpose and time commitment involved with their child's participation in the study. Older students consented to their participation independently while parents of younger children were free to decline their child's involvement; five parents opted their child out of participation. The revised survey was then provided to all of the high- and composite schools within the Sun West School Division in Saskatchewan, SK, Canada. Participants completed the survey independently during the school day and all anonymous responses were returned to the researcher. Each section of the survey is described in detail next.

**(a) Literacy self-perceptions.** The first section of the survey examined students' perceptions of their own reading and what mediums they use to complete their reading. Using a

series of 7-point Likert scales, participants provided self-report ratings of *reading ability* (1 = I do not read; 7 = I am an exceptional reader) and *enjoyment in reading for school* and *outside of school* (1 = I never enjoy reading for school/outside of school, 7 = I always enjoy reading for school/outside of school). Participants also indicated if they completed most of their reading using a computer, mobile device (e.g., cellular phone, iPod, tablets), or printed materials (e.g., books, magazines) and were then asked to rank order up to 10 of 20 different sources of material that they read the most (e.g., emails, text messages, magazines, poetry, etc.).

**(b) Exposure to and use of technology.** The second section of the survey examined students' exposure and accessibility to technology and the value that they placed on the use of technology. Participants were first asked how important the Internet was to them as a means of accessing information (1 = Not important at all, 7 = Extremely important) and then indicated which digital devices they (or their family) owned and/or had access to (e.g., desktop and laptop computers, cell phones, e-readers, tablets, iPods) and whether the devices were connected to the internet or not. Estimates of the daily time spent using each device was also provided by the students. Participants were asked to indicate whether these different devices were *brought to school*, if devices were *allowed in school*, and whether or not they *desired to bring* those devices to school. Participants also indicated what their top five activities to complete on their computers. This section of the survey ended by asking participants to self-rate their ability to use a list of digital devices (1 = No ability, 7 = Expert ability).

**(d) Literacy activity inside and outside of school and outside of school.** The next two sections inquired about students' literacy activity both in and out of school. Participants were to select from a list of items what they read and then to rank order their most important sources of information and reading material. Participants were asked to indicate if their most important

choice was more important than traditional books and to provided an open-ended response as to why they were or were not more important. Participants provided a self-report rating from 1 (Not important at all) to 7 (extremely important) regarding the importance of traditional books and digital resources.

The section involving literacy activities in school also asked participants to rate how important each of ten items in a list of digital devices was in supporting their understanding or learning of school content. Participants also provided an open-ended statement regarding how their selected digital devices support their learning, whether students were allowed to look up additional information on digital devices during lectures and whether or not such activities help or hurt understanding.

**(e) Literacy control and influence.** This section of the survey sought to evaluate a number of areas of participants' choice and control over their literacy practices both in and out of school. Participants were asked to indicate which sources of information they used, as well as to rank order the items according to frequency of use, both in and out of school. Participants' opinions regarding why the items they deemed as most important to them were also sought through open-ended responses by asking "Why are [items] more important?"

The next section of this part of the survey required participants to indicate how important various technological devices were as a tool for supporting their learning/understanding of school content (1 = Not at all important, 7 = Extremely important) and how those devices supported their learning in an open-ended response question. Participants also indicated whether or not they used technological devices to look up information during classroom lectures, whether or not, and how this helped or hurt their understanding of classroom content.

A set of four questions then aimed to evaluate who (self, teacher, self & teacher together) selects classroom reading material, how much influence students should have in such selections (1 = None at all, 7 = Most possible), how important various individuals (classmates, friends, family, teachers, others) are in helping participants understand classroom concepts (1 = Not important at all, 7 = Most important)

**(f) Demographics.** The survey concluded with a number of demographic questions to help describe the participants in the study.

### Results

Data were screened for completeness, outliers (scores  $> \pm 2$  SD around the mean) those with  $> 20\%$  missing data on any given section of the survey were excluded from analysis for that section. Outliers were excluded from descriptive analyses as they related to each section and six participants' data was removed from all analyses due to failure to follow the survey instructions.

#### **(a) Literacy Self-Perceptions**

On the 7-point scale, participants rated themselves as being relatively good readers overall,  $M = 5.14$ ,  $SD = 1.31$ . The majority of participants indicated that they were *good* (5) to *exceptional* (7) readers ( $n = 306$ , 72.2%) while very few ( $n = 8$ , 1.9%) consider themselves to be *non-readers*.

The majority of participants ( $n = 283$ , 66.8%) reported that they sometimes, rarely, or never enjoy reading for school ( $n = 170$ , 40.1%,  $n = 77$ , 18.2%, and  $n = 36$ , 8.5%, respectively), while few ( $n = 140$ , 32.7%) reported enjoying school reading most of the time ( $n = 118$ , 27.8%) or always ( $n = 22$ , 5.2%). With regards to reading enjoyment outside of school, most students ( $n = 261$ , 61.6%) reported that they sometimes, rarely, or never enjoying such reading ( $n = 108$ , 25.5%,  $n = 100$ , 23.6%, and  $n = 53$ , 12.5%, respectively). Just over a third of the sample ( $n =$

162, 38.2%) reported that they enjoyed reading outside of school either always ( $n = 79$ , 18.6%) or most of the ( $n = 83$ , 19.6%).

Table 1 summarizes the data regarding participants' top five reading material preferences as well as where those choices fit within participants' top three choices. Of the 15 choices listed, the formats with the fewest endorsements were e-zines (>1%), electronic newspaper articles (1%), graphic novels/comics (1%), e-graphic novels/comics (1%), and blogs (1%).

*Table 1.* Top five self-selected reading material outside of school. The total percentage of participants selecting each type of material as their "Top" (#1) choice, and among their top 3 choices are provided.

<b>Content</b>	<b>As top choice (%)</b>	<b>In the top 3 (%)</b>
Text messages	60	83
Books, printed material	18	44
Social networking sites	15	62
Online video	9	35
Instant Messaging	8	31

The number one literary activity for participants outside of school was clearly text messaging. Reading books and printed material was a distant second and social networking, although more commonly reported in the students' top three choices, was ranked third.

### **Technology Use, Exposure, and Access**

On the 7 point scale, 88.3% ( $n = 374$ ) of the sample reported that they found the internet to be an *important* (5) to *extremely important* (7) means of accessing information,  $M = 5.80$ ,  $SD = 1.16$ . The devices that participants reported having access to and bringing with them to school are summarized in Table 2 along with the average reported daily use (hh:mm) and average self-rated proficiency of each device.

*Table 2.* Percentage of endorsements for each technological device that participants reported having access to (own it, have access to it), the connectivity of the devices, if the devices were allowed to be brought to school, whether participants brought allowable devices to school with them, participants average daily use, and participants' average reported proficiency using each device. Standard deviations are in parentheses.

<b>Device</b>	<b>Own it (%)</b>	<b>No Access to it (%)</b>	<b>Connected to the Internet (%)</b>	<b>Bring it to School (%)</b>	<b>Not Allowed In School (%)</b>	<b>Average Daily Use (hh:mm)</b>	<b>Average Proficiency</b>
Cell Phone	87.3	5.9	57.1	83.0	7.3	7:17 (6.21)	6.40 (1.07)
iPod	78.3	9.2	47.2	67.2	2.1	3:45 (5:06)	6.42 (1.23)
Windows Laptop	69.1	13.9	54.2	10.8	4.0	1:44 (1:43)	5.65 (1.55)
Windows computer	67.0	13.7	56.4	-	-	1:41 (2:30)	5.67 (1.46)
Tablet	35.6	35.4	29.2	7.8	2.4	1:40 (2:43)	6.31 (1.91)
E-reader	22.4	45.5	13.0	6.6	0.9	1:05 (0:54)	6.23 (2.37)
Mac Laptop	11.1	48.3	12.5	2.8	2.1	1:22 (1:22)	6.50 (2.15)
Mac Computer	9.2	50.2	8.3	-	-	0:48 (0:58)	6.50 (2.18)

The data showed definite trends related to student use of technologies and digital devices.

There are a variety of different technologies that large numbers of respondents owned or had access to. Most reported access to cell phones; windows based computers and laptops; iPads and iPods but little or no use of Mac desktops or laptops. Students overwhelmingly identified cell phones and iPods as the devices they most own and use.

Cell phone use was the most intensive with 30% of respondents saying they used their phone 8 hours or more a day with 6% reporting that they always had their phone on and with them. Forty-two percent said they used their iPod for two or more hours per day followed by Windows Laptop at 23% for two hours or more.

Participants' favourite activities to do on technological devices are provided in Table 3. Social networking (e.g., Facebook, Twitter) and watching various video media (e.g., YouTube, Netflix) were within the top three places for over 70% of the sample.

Table 3. Participants' favourite activities to do on technological devices.

Activity	Top 3 Total (%)
Social Networking, Facebook, Twitter	75
YouTube, Netflix, Watching videos	72
Finding information	22
Downloading/Listening to music	39
Gaming	21
Shopping	14
Communicating	13
Creative tasks	10
Reading	2

There were three activities which were clearly more popular than others: social networking, online video and music. Three quarters of students were engaged in activities related to Facebook, twitter, and YouTube. The other selections were made as participants' top choice but the responses were very low compared to the first five activities listed above.

Specific technologies were rated for how important they are for supporting student understanding of learning school content. Table 4 provides a summary of responses to the importance of different literacy material to students' learning in school.

Table 4. How important materials are for supporting student learning and understanding.

Material	Mean	Standard Deviation
Traditional Books	4.64	1.60
Desktop Computer (no internet access)	2.41	1.71
Desktop Computer (with internet access)	5.96	1.38
Laptop Computer (no internet access)	2.42	1.70
Laptop Computer (with internet access)	5.66	1.69
Cell Phone (no data package)	2.97	1.91
Cell Phone (with data package)	5.60	1.75
E-reader (no internet access)	2.51	1.87

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Tablet Computer (no internet access)	2.94	2.08
Tablet Computer (with internet access)	4.49	2.19
iPod	4.26	2.15

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*range: 1 – 7 for all responses.*

Participants were also asked if there was anything else to add about devices and how useful they were to them. Here is a selection of the thoughts they shared:

*Without the Internet the devices are really useless.*

*Cell phones allow us to be contacted, look up info and find people.*

*If I did not have Internet access, I would not be able to do many of the required projects.*

When asked how the device they rated as most important supports their learning they shared the following thoughts:

*... my cell phone is always with me so if I need to know something outside of school I can look it up where ever I am.*

*With classes I'm taking online they are extremely important because if I don't have them I can't learn anything.*

*I use them for majority of the homework and research I do.*

### **Literacy Activity**

To examine trends and opportunities of literacy activity, students in the next section were asked two similar sets of questions. One set had them focus on what they did with reading and technology outside of school time while the second had them focus on what they did during their time in school. Table 5 provides a summary of the percentage of participants that endorsed using each material both in and outside of school.



Table 5. Literacy Activity Outside and Inside School.

<b>Literacy Activity</b>	<b>Outside of School (%)</b>	<b>In School (%)</b>
TV	86	9
Movies	85	34
Magazines	62	40
Online Movies (e.g., Netflix)	58	7
Books	58	81
Other Internet Content	39	39
Online TV Shows (e.g., CTV.ca)	30	11
Newspaper Articles	25	36
Blogs	15	16
Comics	14	7
E-Books (Electronic Books)	11	8
Online Newspaper Articles	9	34
Graphic Novels	9	13
Online/Electronic Comics	6	3
Online/Electronic Graphic Novels	3	2
E-Zines (Electronic Magazines)	2	3

When they were asked to rate the importance of a variety of sources of information outside of school the more traditional literary and multimedia texts were rated the highest. Television and movies were rated as the most popular literacy activities outside of school time by a considerable margin. Out of school students also spent time with magazines and books. When it came to activity outside of school there was little variety. Many of the traditional or most obvious choices were present. In school students are still using traditional texts including books. There was no one form of text that was a clear second choice.

*Other Internet content* represented a wide variety of websites and specific sources. Gaming was the only response that occurred more than once and made up an insignificant percentage. When asked if the most important choice they made in the previous list was more important than traditional books 42% reported that their choice was ‘more important’ whereas

35% said it was ‘equally important’ as traditional books. The following text is a sample of the reasons they gave to support their answers to the previous question:

*I learn and remember things better when I observe rather than reading.*

*[More important] Because I have no access to printed informative materials outside of school.*

*It has easier access, more information, and is easier to understand than traditional printed materials.*

*I like the feel of books and magazines, but the Internet can get you more info faster.*

When asked if they use their devices to look up information or images while the teacher is lecturing, most participants reported both benefits and drawbacks to such practices. Refer to Table 6 for a summary of the data and supporting open-ended responses.

Table 6. Use of Technology in School.

<b>Use of technology during lectures</b>	<b>%</b>	<b>Examples of Participants’ Responses</b>
I am not allowed to but would like to	25.2	<i>I think that phones are somewhat of a distraction, but all in all it comes down to a person knowing when it's appropriate to use it or when to pay attention to the teacher.</i>
Not allowed to and don't want to	25.2	<i>Because if you are looking stuff up on a phone you are not listening to the lecture.</i>
Rarely	21.2	<i>It does not help because you could just start texting instead of learning. It does help because you can look up information if you need it.</i>
Sometimes	14.6	<i>It helps if I am getting the topic and then I am able to take it to the next level. But if I am confused it will only lose my concentration and make me more confused.</i>
Allowed to but don't	7.5	<i>It helps sometimes but it's easier to ask your teacher.</i>
Always	2.6	<i>If I see something like a picture it helps me remember what was taught at the time for better understanding.</i>

When participants were asked if this helped, hurt or sometimes helped and sometimes hurt their understanding of classroom content, 32.1% reported that it helps their understanding, 10.4% reported that it hurts their understanding, while 50.5% indicated that it sometimes helps and sometimes hurts their understanding.

**Importance of digital resources.** Participants deemed digital resources as relatively important to their learning both outside ( $M = 5.19$ ,  $SD = 1.36$ ) and inside of school ( $M = 5.25$ ,  $SD = 1.36$ ),  $t(411) < 1$ ,  $p = .554$ . Traditional books however were deemed significantly less important to their learning outside of school ( $M = 3.84$ ,  $SD = 1.65$ ) than inside of school ( $M = 4.65$ ,  $SD = 1.60$ ),  $t(405) = 1-.72$ ,  $p < .001$ . The range of responses was wide however, for both questions (*range*: 1 = not at all important to 7 = Extremely important).

To help qualify these results, participants' responses regarding why they felt that digital resources were or were not important both in and out of school were separated and entered into separate word clouds. Figures 1 and 2 provide summary of responses regarding the importance of digital materials in school and out of school, respectively. Figures 3 and 4 summarize responses that indicated that digital materials were not important both in and out of school, respectively.

Figure 1: Importance of digital resources in school.



Figure 2: Importance of digital resources outside of school



Figure 3: Why digital resources are not important in school

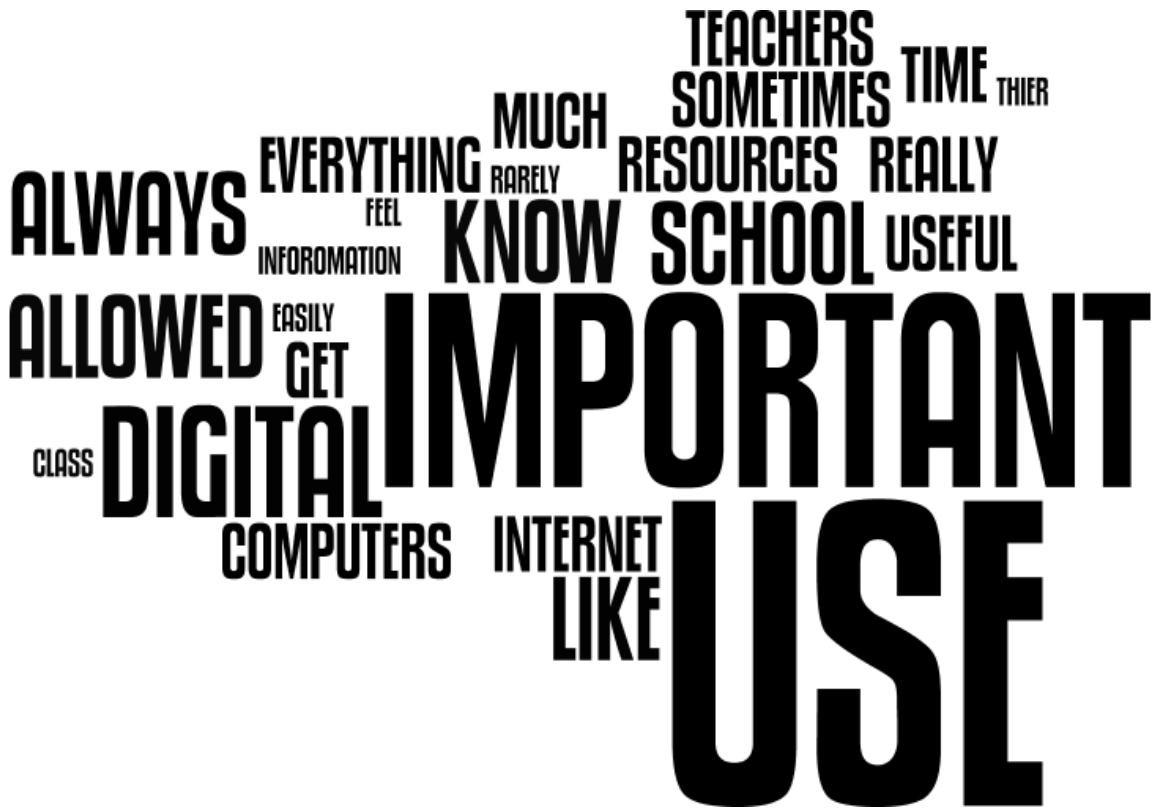


Figure 4: Why digital resources are not important outside of school.



**Importance of traditional books.** When asked how important traditional books were outside of school the results were more evenly distributed. Sixty-one percent reported books being ‘important to extremely’ important. 24% placed themselves in the middle of the scale while 22% were in the bottom two categories on the scale. When asked how important traditional books were inside school the results were more evenly distributed with 66% reporting very to extremely important. Ninety percent of participants felt traditional books were important for learning in school. The following word clouds provide a sample of the reasons students gave to support their answers regarding why traditional books are important both in (Figure 5) and outside of school (Figure 6). Figures 7 and 8 provide a summary of responses regarding the lack of importance of traditional books both in and out of school, respectively.

Figure 5: Why books are important in school.

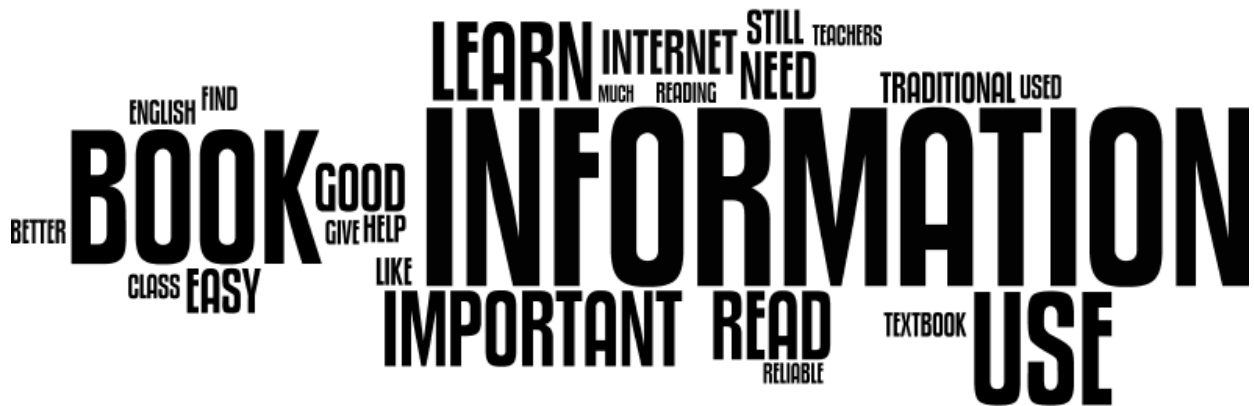


Figure 6: Why books are important out of school.

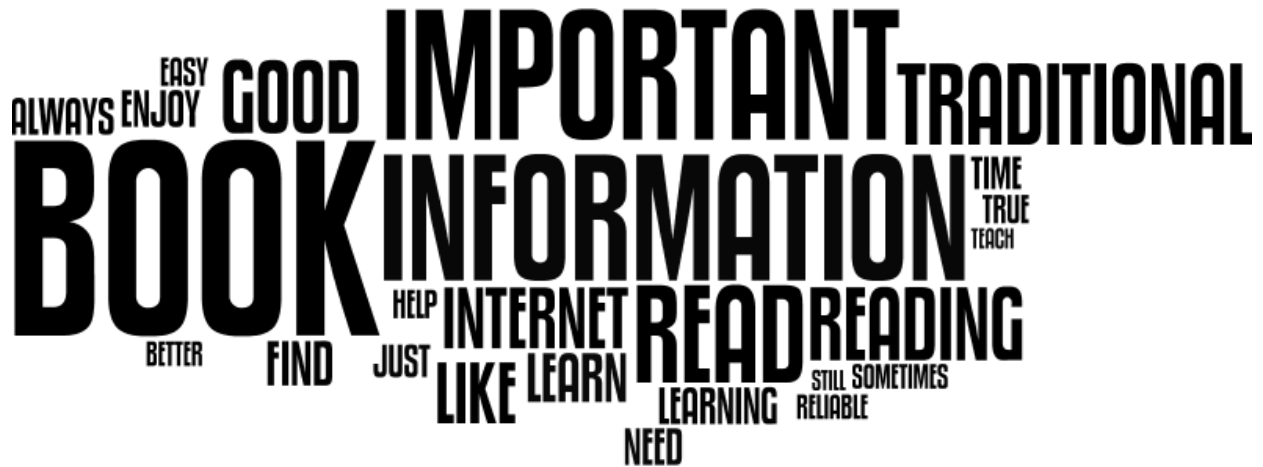


Figure 7: Why books are not important in school

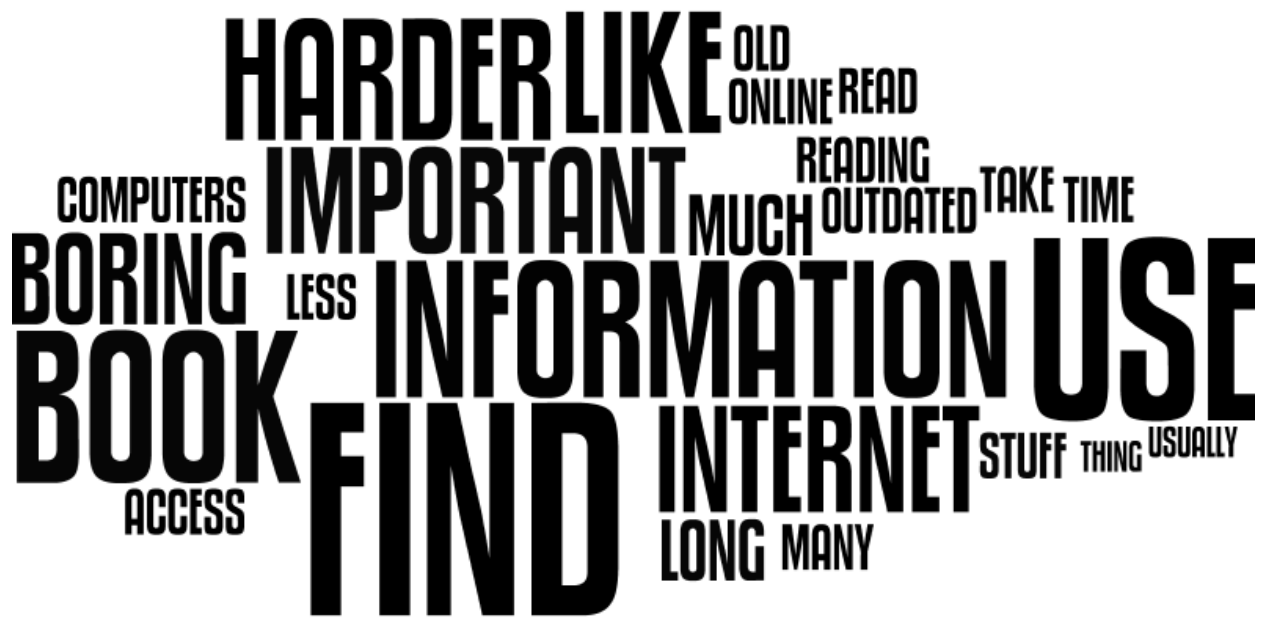
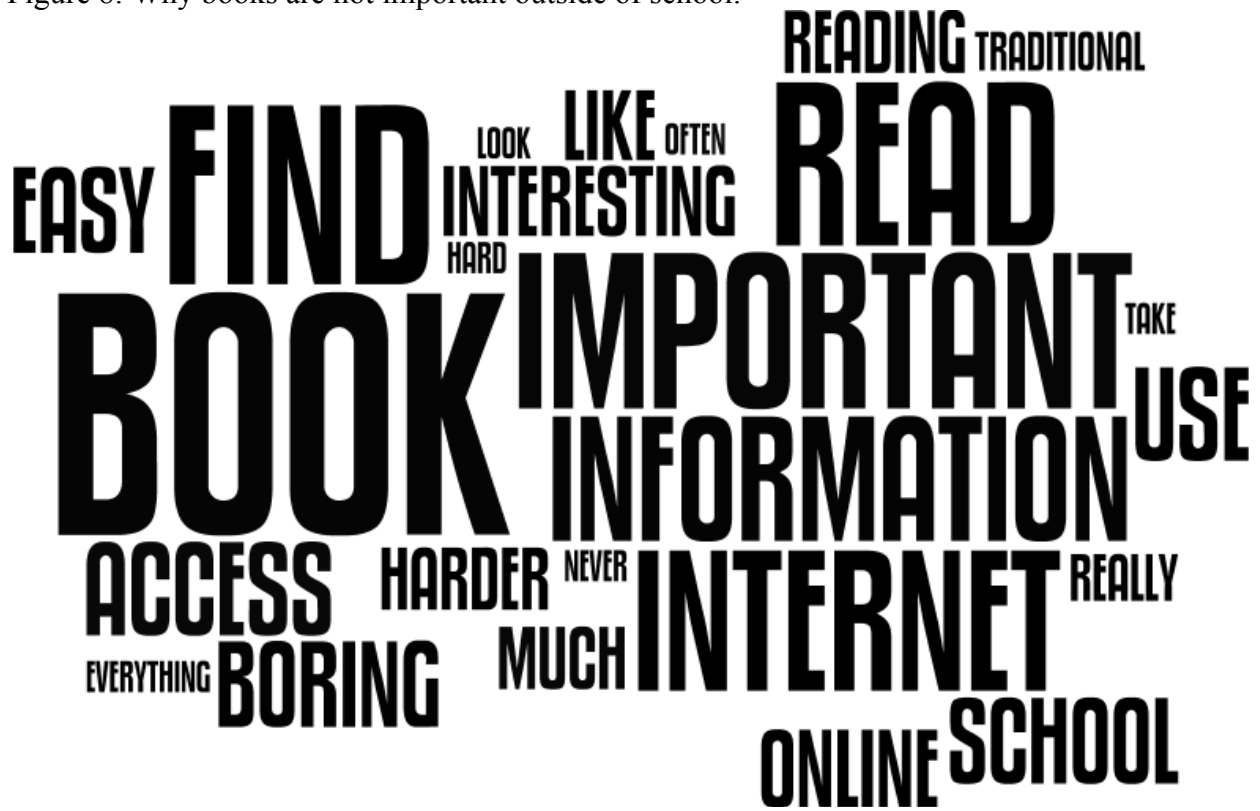


Figure 8: Why books are not important outside of school.





When asked if the most important choice was more important than traditional books, 32% reported that their choice was more important. 38% said it was equally important as traditional books. 11% said printed materials were the most important choice. The following is a sample of the reasons they gave for their answer to the previous question:

*Using Internet it's easier to find and access updated info on a wide range of topics.*

*Because it is faster, easier to work with and all the information is there you don't have to get another book.*

*As long as I am getting the correct info it doesn't matter.*

*The teacher should always be the primary source of information.*

*They may not personally be important to me, but they are the resources we're expected to use (books).*

### **Literacy Control and Influence**

With regards to who selects material to read for school, the majority of selections were done by the teacher (68%), followed by participants themselves (16.9%) and then the student and teacher together (14.9%). On a scale from 1 (none at all) to 7 (most possible), students indicated that they should have relatively equal input as the teacher in choosing what should be read for school,  $M = 4.79$ ,  $SD = 1.51$ . To follow up these questions the participants were then asked how much input students should have in what is read in school. Thirty percent of respondents said 'very or most' possible. If you include 'occasionally and possible' the response goes up to 85%.

When asked who had the greatest impact on understanding classroom concepts participants ranked teachers as 'important to extremely important' 84% of the time. Friends ranked next at 65% followed by classmates (57%), family (54%), followed by others at (35%).

When asked who they share, comment or discuss course content with online friends was reported as the highest at 72%, classmates 51%, family 50%, teachers 33%, and students from other grades 32%. In this question online experts were ranked lowest at 4%.

### **Discussion**

Research into the multiliteracies of the youth of today is a necessary step towards integrating and advancing technology in educational contexts. To help elucidate the literacy practices of high school students, the current study surveyed a large sample of rural Saskatchewan Grade 10 and Grade 12 students. Specifically, the research aims were (a) to examine the digital literacy choices of adolescents, (b) uncover how technology is a part of their lives both in and out of school, and (c) use the findings to provide teachers and administrators with information and options to improve the learning experiences for students.

### **Summary and Recommendations**

The results of the research point to many clear themes connected to the original research questions. The overall response rate within each survey item was high. Students who completed the survey answered almost every question. When asked to provide qualitative feedback they shared thoughtful and personally relevant answers. The data shows us definite trends and choices made by the high school students. We see a group that is reading both at home and in school and who rate themselves as good to excellent readers. Despite the positive self-perceptions of technology ability they report that they are not using them intensively for traditional reading. At home they are connected to reading and literacy primarily through books and mobile devices. At home four of the top five reported literacy behaviours involved electronic or digital content. Reading text messages was the number one reported reading activity outside of school. The participants firmly supported the importance of being connected to the Internet.

Even with access to these technologies and belief that the Internet is important, reported home connectivity was not high as expected. When students accessed the Internet at school it was mostly through cell phones and iPods. When asked to report on their ability to use specific devices cell phones and iPods were the devices that they claimed to have the highest skill levels at using. Although they reported the ability to bring devices to school there is a sense from their responses that they are not embracing the full extent of 'bring your own device' (BYOD). They identified desktop computers, laptops and cell phones connected as the most important devices for supporting student understanding of content but only if the technologies were connected to the Internet. During classroom lectures they reported advantages to using technology to support their understanding but only if it did not act as a distraction.

Students reported an even distribution when asked how much time each day they spent on various devices. Cel phones topped the list with iPods also being popular. Some students were spending a minimum of eight hours a day with their phones on and at the ready. iPods were also a constant companion both in school and at home. They rated their technology skills quite high with the devices that they had access to and used regularly.

Facebook was the number one choice for close to half of the respondents when students were asked to rank their favourite online activity. Watching online video primarily through YouTube ranked as their second choice and finding information was third. Collectively, social networking was a top three choice for a large majority of the students. Watching online video and movies were also highly rated. The students' reported activities did not include high number of students using technology to read or complete creative tasks inside or outside of school

When asked about the types of content they used out of school, TV, movies, magazines, books, and online movies were all rated highly. These choices were also highly ranked for their

importance in contributing to student learning. When asked about what contributed to their learning in school, the traditional printed book was the choice with the strongest support. Other literary texts received below average scores. Overall students regarded digital resources and books as important for supporting instruction and learning both at school and at home.

Teachers still have an important role in the daily literacy of students. Participants reported that teachers determine what is being read in school most of the time but they also thought students should have more say. Teachers are also rated as the most important when it comes to assisting students in school. Online, friends become the most important form of support with teachers falling out of favour.

## **Recommendations**

The findings from this research yield a variety of potential recommendations for administrators and teachers to enhance student learning. First, we recommend the development of policy related to devices in school use and expectations. If students are welcome to bring technology into the school how is it used? When is it used? What are the expectations around privacy? Participating students reported a welcome environment to bring in resources but are there any guidelines related to use of these devices?

Second, teachers need to incorporate ways to use technology to support communication and course content delivery. There is plenty of potential to embrace new opportunities through the creation of mobile content and reformatting existing content to work on mobile devices. Part of this strategy should include the creation text-messaging plans for emergencies and for school to home communication to improve overall school efficiency. Along with the promotion of technology use there needs to be development of programming that promotes healthy uses of technology. Raising student awareness related to healthy uses of technology contributes to the

overall positive lifestyle for students. Information and training around digital citizenship is important. Students need to be aware of the strengths and weaknesses of traditional and evolving technologies. School divisions must develop and offer professional development opportunities for teachers to explore the variety of literacy texts available both in traditional print and electronic format. Instead of the regular 'book fair,' this event may include an online publisher fair or connection with commercial organizations to display and promote their material. This work cannot take place unless schools provide teachers with appropriate technologies and other resources so they may find ways to innovatively integrate them into their classrooms. Schools should also ensure that libraries and learning commons have a variety of printed and electronic texts available both inside and outside the school. Keeping up with information means having a well-resourced library. Resources specifically designed for mobile devices can be used by students in classrooms and at home to support their learning. Connecting to educational online databases also provide a wealth of readily available information for students.

Promoting a variety of literacies to students through the activities of classroom teachers, librarians, and technology leaders would also be a good course of action. To accomplish this, a mix of traditional and non-traditional literacy texts should be used. This includes promotion of reading in general, regardless of the type of reading material, to help students find joy in all types of literature. A final recommendation in light of the current results would be to expose students to both Mac and PC platforms in order to broaden their skill set and enhance multimedia and visual arts creativity. For reasons of cost or lack of exposure, students have shown a low connection to and ability with Apple computers. Providing them with more exposure to the Apple platform, as well as supporting their skills on PCs, will allow them to take control of developing content instead of only consuming it on their phones and iPods.

## **Conclusions**

The analysis of the data demonstrates many encouraging signs related to students' literacy and technology for teachers and administrators. Most students report a positive attitude towards technology and connecting with information through the technology. A significant majority of students have access to a form of technology both at home and in school. A lack of consistency exists in their sense of self in that they rate their skills and abilities as strong in some technologies but low in others.

Based on the reported solid foundation opportunities exist for teachers to make increased use of the technology students are bringing to the school. This opportunity may take the form of supplementing resources found in the library or connecting to the online services offered by school divisions and other providers. Before efforts related to technology and literacy are expanded it will be important to create policy so that technologies students are using can be integrated into their schoolwork. The data shows that schools are welcoming students to bring technology to school. What they are bringing to school may not be part of an organized bring your own device (BYOD) program but there is evidence that there are opportunities to create a BYOD program as students are informally taking advantage of the opportunities technology provides in the classroom. The feedback from students shows that there exists little opposition to bringing their own technology devices to school sends a positive message. There is still no evidence that teachers are making an effort to use smartphones and other mobile devices as part of instruction.

There is an opportunity to expose learners to a wider variety of sources of information to assist them both in and out of school. In particular more time could be spent exploring blogs, electronic newspaper and electronic novels, graphic novels and other online literature. An

awareness of these forms of literacy will help connect them to new concepts of reading, literacy, and textural forms.

Students are primarily reading text messages outside of school. This may be an important change to the communication that takes place between the school and students. It may also be an opportunity to create community between students. This finding also presents an opportunity to look at communication in general and how text messaging is and is not effective. By extension it may be safe to say that they are also reading text messages in school. Texting may be an innovative method to bridge learners into creative ways of sharing their work.

The survey of the technologies the students use or have access to also shows very definite outcomes. There is a definite divide between types of computer operating systems. Those who have access to desktop and laptop computers are mostly PC-based. There is very little Mac ownership or use. This changes when it comes to iPods and iPads where access and use are much higher. Use of iOS devices is high and almost all of the students reported possessing skills in using these mobile devices. This skillset shows there may be opportunities to incorporate more mobile technologies into the classroom for innovation and instruction. Providing equipment for in-school use would build on the skills the students are developing outside of existing formal technology programming. It also shows that it may be an opportunity to take advantage of content management systems such as iTunesU or YouTube to distribute content to students.

Students have access to hardware but reported access to the Internet at home appears to be lower than expected in rural areas. This may be a reason to modify requiring students to work online at home or flipping the classroom. A yearly survey of student home Internet access would be an important consideration for the division to help with communication and planning around digital homework or access to information outside of the schools. Information from local Internet

providers may help people to recognize the benefits of home Internet access for their students and families.

A majority of students report 'okay to excellent' technology skills but there is still a small but significant section that reported not being competent with using technology. As more and more information is available online and computers are found in most work environments it would be a goal to move that number closer to 100% when it comes to computer skills. There may be a need to develop more technology confidence and provide skill opportunities for these students.

Students reported spending many hours actively using their mobile devices and having these devices with them most of the time. Inside school the connection between what they value and what they are doing was not as strong. This outcome indicates that they need freedom to pursue the tasks that interest them when they are in school. The pervasiveness of the technology in students' daily lives also illustrates an need to develop information on healthy uses of technology and digital citizenship.

This survey does not look at the skills and habits of the teachers or specifically what they are doing in their classroom. A survey of teachers' technology initiatives may be a logical next step. With teachers having such a major influence on what students read in class and providing a valuable role in assisting learners, teachers also need to be exposed to a broader scope of resources such as electronic texts. There are plenty of opportunities to expose students to working with others online based on their top activity being social networking. Also there is the potential to create lectures and other video resources to share as online video and build these technology options in teaching and learning. Participants in this study report being very much in tune with a variety of social networking sites and online video outside of the classroom.



However, they reported few instances where they used video in school. With the changes in Canadian copyright legislation there are more opportunities to legally use video in the classroom to support learning. These patterns are further evidence of the opportunities that exist to integrate familiar literary experiences into instruction.

One of the startling findings was that student report not much communication, reading or involvement in creative tasks at school or at home. Activities that were strictly communication such as email and instant messaging were selected less than 2%. Creative activities such editing images and video, and word processing were also low at just over 1%. Reading was chosen as the top activity by only 1%. The low response rates as first choice increased somewhat as a third choice. They may not identify the work they are doing online as communication or reading. Creating a mash-up or editing pictures for Instagram or Pinterest are creative tasks and students need to see that these can be important ways to share schoolwork as well as their personal stories. Making them aware of the expanded definition of what reading is and what literacy can be has the potential to add value to what they may see as simply socializing. Promotion of creativity and creation through technology will also be important. Learners need to go beyond being merely consumers of content to become creators to share their thoughts ideas and learning in various ways.

From the responses and the written comments it is very clear that students see advantages to having access to technology during course lectures but were equally concerned about becoming distracted by the technology. It is not clear if they have developed this line of thinking on their own or have had the directive from their teachers. They are also not aware of the importance of working online with their teachers or accessing the support of experts from an online environment.

This research shows that there is potential to support a new form of literacy but currently that potential is not being realized. Clearly a shift in high school literacy habits is taking place. High school students have a definite opinion but this research points to a disconnect between what the students are doing as part of their daily lives and what schools expect of them. To engage learners and assist their literacy development schools must take advantage of a new wave of texts and ways to access them. Motivating students and keeping them motivated can happen with a shift to what students are already doing with technology. Creating within this group a heightened awareness that they can use technology to read, create, and learn will make them more successful now and in the future.

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# **The Pen or the Paper?: Written Expression Supports for Secondary Students with Emotional Behavioral Disabilities**

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## **Abstract**

Written expression is a critical skill for students with disabilities; yet, little is known about how to best support secondary students with emotional behavioral disorders (EBD). This repeated acquisition study served as a follow-up study that demonstrated the effectiveness of a novel technology (the FLYPen™) for written expression. Three secondary students with EBD alternated between the FLYPen™ and the associated graphic organizers alone to write eight essays to explore which support was most effective. Prior to this study, all students struggled in written expression, and typically included one paragraph without topic sentences or supporting sentences. Students were equally supported in with each method. Students indicated the FLYPen™ “hooked” their interests in writing, but the paper-based graphic organizers provided the actual structure and support for improved writing.



The ability to write is a fundamental skill in today's society of constant communication through writing (Harris, Graham, & Friedlander, 2013; National Commission on Writing, 2003; National Writing Project, 2009). Unfortunately, recent assessment data suggests that students struggle to effectively produce written products. The National Writing Report suggested that the majority of eighth and twelfth graders were writing at or below a basic level (i.e., demonstrating slightly below to significantly below grade-level written expression). In other words, students with and without disabilities were not mastering essential written expression skills needed to effectively communicate their ideas at their respective grade levels (Graham, Harris, Hebert, & Morphy, 2014; IES, 2010, 2011; National Commission on Writing). All students may know what written expression elements (i.e., on-topic information, thesis statement) are needed to successfully complete a written expression task, but may not be able to accurately complete or consistently demonstrate in these without support. Challenges in written expression begin with ineffective planning and organization or "prewriting" (Graham & Harris, 2009; National Commission on Writing). A lack of or insufficient prewriting leads to inadequate written expression with the inclusion of irrelevant details, increased usage of repetitive ideas and phrases, poor structure, and little to no revision (Englert, Zhao, Dunsmore, Collings, & Wolbers, 2007; Graham & Harris, 2005, 2009; Harris & Graham, 2009).

While all students may struggle with written expression, students with high incidence disabilities struggle to a greater degree (Author, 2014, 2015; Graham & Harris, 2009; Taft & Mason, 2010; Troia, 2006). Compared to their peers without disabilities, students with high incidence disabilities write shorter, less organized, lower quality, and only partially completed passages (Graham & Harris; Taft & Mason; Troia). Students are less likely to be successful in courses with an emphasis on written expression, ranging from lab reports in science to the

traditional research papers in English. Additionally, students may not make the needed academic progress due to poorer grades or increased class failure (Ehren, Lenz, & Deshler, 2004; National Writing Project, 2009). A lower quality of written expression impacts postschool outcomes, including a lack of promotion in employment and not being as successful as possible in higher education (Taft & Mason).

Much of the existing literature on written expression and students with high incidence disabilities focuses primarily on learning disabilities (Graham & Perin, 2007), often excluding students with emotional behavioral disorder (EBD) (Hudson, Hinkson-Lee, & Collins, 2013; Taft & Mason, 2010; Wehby, Lane, & Falk, 2003). Some scholars suggest that academic challenges, including written expression, experienced by students with EBD may mimic their peers with learning disabilities. Thus, students with EBD may benefit from the same planning, organization, content generation, and revision strategies, such as the use of graphic organizers (Isaacson, 2007; Mason & Shriner, 2007; Taft & Mason; Wehby et al.). Graphic organizers allow all students to brainstorm and organize their ideas prior to composing paragraphs—or, prewriting (Graham & Harris, 2009; Flower & Hayes, 1980; Troia, 2006). When using graphic organizers for prewriting, written expression improves with a decrease in repetitiveness, and an increase of on-topic information and supportive detail sentences for each main idea (Flower & Hayes; Taft & Mason).

Supports for written expression for students with and without high incidence disabilities typically fall into two broad categories: paper-based and technology-based. While paper-based strategies support written expression, little attention has been paid to technology-based supports (MacArthur, 2009; Strum & Rankin-Erickson, 2002). Researchers have found some advantages to students using computer-based concept mapping software (e.g., spelling and grammar check)

as compared to paper-based concept mapping for prewriting. While both methods produce improved written expression, there is no difference in the overall quality or length of the written expression passage when using technology (Authors, 2014; MacArthur; Strum & Rankin-Erickson, 2002). Englert and colleagues (2007) utilized an Internet-based procedural facilitator to provide textual prompts to students as they wrote. Compared to students who received traditional instruction, students with the Internet-based supports and prompts demonstrated a higher quality of written expression.

To continue to explore the value of technology on written expression, the Authors (2010) investigated the use of a pentop computer (the FLYPen™) with the written expression software and two paper-based graphic organizers. The FLYPen™ provided auditory prompts based on where the students tapped on specific parts of the graphic organizers. For example, when the students tapped on “Topic Sentence,” the students were prompted to write a topic sentence for each paragraph. Three secondary students with high incidence disabilities increased their overall quality of written expression in both organization and content. The students were excited by the technology when introduced to it, but the excitement diminished as students continued to use it. Students stopped paying attention to the auditory prompts and focused only on the paper-based graphic organizers. This implied that the graphic organizers might actually provide enough support to improve written expression. Thus, the researchers examined if the FLYPen™ with the auditory supports with graphic organizers or if the graphic organizers alone supported written expression with the following research questions: (a) does the use of the FLYPen™ with graphic organizers or the graphic organizers alone best support written expression?, and (b) which method is more preferred by the students?

## Method

### Participants

The participants of this study included three secondary students with emotional behavioral disorders (EBD) and their special education teacher. All students were in a combined eleventh and twelfth grade special education English/Language Arts class and met the state criteria for being classified as being a student with an EBD (see IDEA, 2004, sec. 300.8.c.4.iA-300.8.c.4.iE). All students also exhibited primarily internalizing emotional behavior disorders (e.g., anxiety, withdrawn), rather than externalizing (e.g., aggression, noncompliance). The teacher reported that all students struggled across academic areas, including in written expression. She described all students as being reluctant, poor writers. Prior to the start of this study, none of the students produced a high quality five-paragraph essay. Students wrote in an illogical order with little supporting details. Students previously used graphic organizers in their English/Language Arts class for reading comprehension (e.g., KWL charts) but did not use graphic organizers specific for written expression. The teacher used outlines as a prewriting strategy, but did so infrequently and not at the time of this study.

*Brittany.* Brittany was an 18-year-old twelfth-grade student classified as having an EBD with a full-scale IQ of 95 (Wechsler Abbreviated Scale of Intelligence, 1999). At the time of the study, Brittany had not passed the state's graduation qualifying exam in mathematics or English/Language Arts after three attempts. This exam included a written expression component. She received study hall, English/Language Arts instruction, and mathematics instruction in a special education classroom. Before using the FLYPen<sup>TM</sup> and graphic organizers, Brittany wrote without organization, simply listed facts when writing five-paragraph essays, and frequently changed topics.

*Matt.* Matt was a 17-year-old, twelfth-grade student, with an EBD and a full-scale IQ of 92 (Wechsler Intellectual Scale for Children-III, 1991). Max experienced difficulties starting and completing assignments; worked at a slow pace; and, used avoidance behaviors to evade classes, assignments, or things he did not enjoy doing. During his participation in this study and in classes outside of it, Matt needed constant prompts and cues to stay on-task. At the time of the study, Matt had not passed the graduation-qualifying exam in English/Language Arts and mathematics three times. Matt received special education instruction for mathematics and English/Language Arts, and a supported study hall. He was also in a supported science class, where a special education teacher provided additional assistance during the general education class. Prior to this study, Matt struggled in written expression. He typically included two to four sentences in total for a five-paragraph essay, and did not include any topic sentences or additional information to support his ideas.

*Peter.* Peter was a 16-year-old, eleventh-grade student. In order to complete his graduation requirements, Peter enrolled in the class used for this study to receive credit for sophomore English. Peter was diagnosed with an EBD and a mild intellectual disability with an IQ measuring 69 (Woodcock Johnson-III, Test of Cognitive Abilities, 2001). He received a supported study hall, and special education mathematics and English/Language Arts classes. At the beginning of this study, Peter had not passed the state's standardized assessment for sophomore-level English/Language Arts. In order to graduate with a standard diploma, Peter was required to pass. He re-took this exam near the completion of this study and passed. Prior to start of this study, Peter's essays were repetitive and short, without paragraphs. He did not include topic sentences and included irrelevant details.

## **Setting**

This study took place in a Midwestern rural, combined middle and high school serving students in grades 7 to 12. The students participated in this study across one academic semester during their 48-minute special education English/Language Arts class. Over the course of this study, class instructional activities – including the essays written – were centered on the novel *October Sky*. While the students in this study were typically the only ones in the classroom, other students periodically came in to take tests or work on their homework. During the class a paraprofessional was present, but also did not play a role in this study.

## **Materials**

Materials in this study included a pentop computer from LeapFrog Technologies (2005a) – the FLYPen™ – and its written expression software, which included paper-based graphic organizers for students to use with the software. The FLYPen™ is a commercially marketed tool capable of providing a variety of academic supports through content-specific software (LeapFrog, 2007-2009). The FLYPen™ is a large, ballpoint pen with a USB hub at the end. A software cartridge inserts into this hub, much like how a flash drive would plug into a computer's USB port. To use the features of the FLYPen™ (i.e., auditory prompts), the user must write on dot-matrix paper designed specifically for the FLYPen™ (LeapFrog, 2005b).

The FLYPen™ software used was for written expression and targeted to secondary students. This software led students through completing two prewriting graphic organizers on the dot-matrix paper for writing five-paragraph essays. The FLYPen™ provided auditory prompts for each section of the prewriting pages, after a user double tapped the FLYPen™ on specific sections of the planning pages (i.e., the command to go onto the next section). On the first page, the Idea Map, students indicated their choice of essay. Students then wrote their topic, a thesis

statement, and then were guided in completing a concept map-like structure. Students were instructed to draw a line down the center of the page, put three circles on each side, and connect each pair of circles with a line. Students wrote a supporting reason in each circle on one side of the structure with the contrasting arguments on the opposite circles. The second page, the Planning Page, prompted students to fill out an outline-like graphic organizer. The graphic organizer provided specific spaces to write the topic sentence and details for each paragraph.

To complete the prewriting pages, the FLYPen<sup>TM</sup> offered two modes for the user to select from: Editor and Quick Path. In the Editor mode, the FLYPen<sup>TM</sup> provided step-by-step directions to complete each graphic organizer with additional prompts for directions on how to access hints, hear examples, or repeat a direction. For example, when drawing the Idea Map, the FLYPen<sup>TM</sup> gave an auditory prompt to draw three circles down the right side of the page, and double tap to indicate when finished. Then, it prompted the students to write one idea in each circle. The Quick Path mode provided students with only the main prompts (i.e., instructed the student to draw and complete the concept map, instead of going through each step given in the Editor mode). In each mode, students completed the same Idea Map and Planning Page.

### **Experimental Design**

The research study utilized a repeated acquisition, single subject design. This design occurs when the research is (a) using “multiple equivalent learning tasks” and, (2) with “at least two different experimental conditions” (Kennedy, 2005, p. 163). With this design, participants alternated between each of the interventions without the use of a baseline, generalization, or maintenance (Kennedy). Researchers use this design when conditions can be randomized and to evaluate an academic skill difficult to reverse (e.g., written expression). For example, the students in this study could not “unlearn” how to plan and write essays between each condition.

This design was explicitly selected as the researchers had already explored the effectiveness of the FLYPen™ and this study served as a follow-up (see Authors, 2010).

Students alternated between two methods during each research session of two essays: writing one essay with the FLYPen™ with written expression software and graphic organizers and one with the graphic organizers alone. When using the graphic organizers alone, students did not have access to the FLYPen™. The order of what method was presented first was randomly selected for each session. During sessions one and two, students used the graphic organizers first. Students used the FLYPen™ first during sessions three and four. Research sessions occurred two days a week with essays written on two separate days. Data collection continued until data become stable for each participant (i.e., each student was individually performing similarly across essays).

## **Procedures**

To establish students' written expression abilities prior to the start of this study, the teacher provided two to three essays completed by each student prior to data collection (i.e., when the students were not using the FLYPen™ or graphic organizers). Essay prompts were similar to those used in this study, related to the novel, and completed during in-class activities. The teacher described these samples as being "typical" of each student's written expression ability. These essays were used for comparison and not to establish a baseline.

*Instruction.* To learn to use the FLYPen™ and the written expression software, the students were provided instruction on how to turn it on/off, write, and follow the auditory prompts using games. All games were designed for the FLYPen™ and required students to respond to an auditory prompt. Students completed three activities: a music, basic mathematics,



and geography game. Students only moved on to the next phase of the training when they could complete each independently. No student struggled to complete the activities.

Next, students were taught how to use the written expression software and the graphic organizers. The first author demonstrated how the FLYPen™ provided auditory prompts, where to write on the graphic organizers, and defined the FLYPen™ terminology (e.g., “focus statement” for thesis statement). Because the research required the students to use the paper-based graphic organizers independently, students were instructed on how to complete these without the FLYPen™. As a group, each student partially completed one set of graphic organizers on a generic topic. Students then completed the remainder of the each independently. Students experienced no difficulties in understanding the components of each graphic organizer.

*Intervention.* During each session (N=4), students alternated between writing an essay using the FLYPen™ with the auditory prompts and graphic organizers, and one essay using the graphic organizers alone. A total of eight essays were written – four of each method. Each essay took one instructional period to complete. All essays were persuasive, per the teacher’s request. Sample essay prompts included, “Why should [book author] visit our high school?” and “Why should I live in [setting of the novel]?” Each student worked independently with minimal assistance from the teacher and/or a member of the research team (i.e., troubleshooting the FLYPen™). Two of the three students (i.e., Brittany and Peter) completed both the graphic organizers and essays during the instructional period. Matt worked at varying rates, characteristic of his work outside of this study. He typically finished one or both of the graphic organizers during the class period and then finished essays during a supported study hall. Matt completed the final two essays during class time.

During the initial sessions using the FLYPen™, students were instructed to use the “Editor” mode. For the third and fourth essays with the FLYPen™, students were told that if they understood the sequence of steps they could select between the “Editor” or the “Quick Path” mode. Student also had to successfully use the FLYPen™ on previous essays. Peter and Brittany choose to use “Quick Path” on their last two essays using the FLYPen™; Matt only used this mode on his last essay. During the sessions where students used the graphic organizers alone, students were only given these and did not have access to the FLYPen™ prompts.

### **Data Collection**

The researchers used two rubrics to evaluate each essay, adapted from a previous research study on the FLYPen™ (Authors, 2010). Each rubric included items related to planning, organization, content, style and voice, and grammar (Graham & Harris, 2009; Isaacson, 2007; Troia, 2006). The first portion of the rubric included 17 Likert-scale ratings items (i.e., quality rubric), ranging from zero to three. A score of “zero” represented no evidence, “one” little evidence, “two” some evidence, and “three” mastery of that item. Sample rubric items included the following: includes planning details, planning details related to the topic, logical flow, consistent topic, introduction, topic sentence for body each paragraph, content relates to the topic sentences, conclusion, and grammatical errors. A total score of 51 was possible for each essay (17 items with a maximum score of 3 per item). A separate event recording rubric was used to record the number of times each written expression element was included (e.g., number of topic sentences and body paragraphs instead of rating the quality of each).

### **Data Analysis**

Using the overall quality score, students’ essays were examined first using descriptive data (e.g., mean and range of scores for each method). As the purpose of this study was to

understand if there was a difference between using the FLYPen™ with the graphic organizers or the graphic organizers alone, a nonparametric statistic (e.g., the Mann-Whitney  $U$ ) was used to understand if the two methods were statically different with regards to the quality rubric. A standard significance level was used (e.g., 0.05) for the test statistic, a z-score. For the event recording rubric, the mean was calculated for each of the items to quantitatively describe elements present in essays, such as the number of sentences and paragraphs.

*Interobserver Agreement.* Approximately one-third of each student's essays were randomly selected for interobserver agreement. The first rater, the first author, initially scored the quality portion of all essays and one-third of the event recording rubric for interobserver agreement. A second rater, the third author, was provided instruction and practice on how to use the rubrics to score each of the essays using the event recording rubric. This was done through using practice essays not related to this particular study where both raters scored portions of each essays; agreement was 100%. The first round of interobserver agreement was initially lower than desired due to slight differences in the number of words, sentences, and grammatical or capitalization errors. After additional training and discrepancies were addressed (for example, if how a student wrote a letter was a capitalization error or their handwriting), agreement increased to 100% for both rubrics. Interobserver agreement was derived by dividing the number of agreements by the total number of items, then multiplying by 100 (Kennedy, 2005).

### **Procedural Validity**

To establish procedural validity, the teacher was observed on her instruction (e.g., telling students the prompt and method) during six of the eight essays. A task analysis was used to determine the steps: begin class, handout materials, tell students which method was going to be

used (i.e., FLYPen™ or just the graphic organizers), write the essay topic on the board, read the essay topic, and provide assistance if needed. Procedural validity was 100%.

### **Social Validity**

The students were asked a series of questions at the end of data collection for social validity, including questions addressing overall perceptions of the FLYPen™ and the accompanying graphic organizers. Questions included the following: “Before you used the FLYPen™ and the papers what kinds of things did you do to help you write essays?,” and, “Which do you think helped your more? Why?” The teacher responded to questions prior to and at the conclusion of this study. For the teacher, the questions focused on the instructional value of the intervention, such as “Do you feel that your students benefited from either method? How so?,” and “Which method is more practical during instruction?”

### **Results**

The results of this study suggested the FLYPen™ with the graphic organizers and the graphic organizers alone supported the students equally. Students reported a preference for the graphic organizers alone as they able to easily complete them and were able to predict the directions from the FLYPen™. Yet, the students and their teacher also saw value in how the FLYPen™ was motivational and provided individualized support.

### **Brittany**

Brittany averaged an overall rating score of 46.5 out of a possible 51 for the essays using the graphic organizers alone (range of 45 to 48) and 46.3 when using the FLYPen™ with the graphic organizers (range 44 to 47). A visual analysis of Brittany’s data suggested little differences in her scores across each method (see Figure 1). Additionally, the Mann-Whitney U analysis indicated her scores between each method were not significantly different ( $z = -0.60$ ;  $p =$

0.55). Brittany opted to use the “Quick Path” (i.e., less auditory prompts) mode for essays during sessions three and four; however, these scores are similar to previous FLYPen™ essays.

<Insert Figure 1>

Bethany consistently wrote three separate body paragraphs and an introduction, all based off of her planning on the graphic organizers. Overall, Bethany included 11 planning details, out of a possible of 11, and no off-topic sentences when using both methods. She averaged 4.5 paragraphs with 4.5 topic sentences with the FLYPen™, with 243 words and 14.8 sentences. When using the graphic organizers alone, she included an average of 4.8 paragraphs with 5 topic sentences, 13.5 sentences, and 225 words.

### **Matt**

When using the FLYPen™ with the graphic organizers, Matt’s average overall rating score was 38.5 out of a total possibly of 51, ranging from 38 to 39. With the graphic organizers alone, Matt’s average score was 38.3 (range 37 to 39). No significant differences occurred between Matt’s scores with each method ( $z = -0.32$ ;  $p = 0.71$ ; see Figure 1), a finding also supported through visual analysis. Matt also opted to use the “Quick Path” in his final essay, with no impact on his performance.

Despite continually using the graphic organizers with and without the FLYPen™, Matt continued to typically write one paragraph for all of his essays with the exception of his last essay. However, this one paragraph often included an introductory and concluding statement with a higher quality of sentences and details between compared to his essays before the start of this study. Largely due to his pace of work, Matt was inconsistent in completing the graphic organizers and essays with or without the FLYPen™. As the study progressed, he became more consistent. Despite challenges, Matt stayed on-topic in his essays and presented information in a

logical format. Matt included an average of 9.5 planning details out of 11 possible when using the FLYPen™ and 9.3 when using the graphic organizers alone. Matt averaged 6 sentences when using the FLYPen™ and 75.5 words, and 6.8 sentences and 82.5 words when using the graphic organizers. He typically included, on average, 0.8 similar phrases when using the FLYPen™ and 0.5 when using the graphic organizers.

### **Peter**

Peter averaged an overall written expression rating score of 47.3 (range 47 to 48) with the FLYPen™ and the graphic organizers and 47.5 (range 47 to 48) with the graphic organizers alone. Peter's scores were identical across each condition for the last three sessions of data collection. A visual analysis indicated Peter benefited equally from both methods (see Figure 1), which was supported by the lack of significant differences between the rating scores for each intervention ( $z = -0.68$ ;  $p = 0.5$ ). Peter used the "Quick Path" on the final two FLYPen™ essays. Scores on these essays were consistent with the previous two essays when using the audio prompts from the FLYPen™.

Peter performed equally across each essay. He tended to use similar phrases across his essays such as "these are the reasons..." for his main points, in the introduction and concluding paragraphs. On average, Peter included 0.8 similar phrases when using the FLYPen™ and 1.3 similar phrases with the graphic organizers. Peter consistently included 11 planning details out of a possible of 11 and did not include any off-topic information when using either method. Peter included 5 paragraphs with 4.5 topic sentences when using the FLYPen™ alone and 4.8 paragraphs with 5 topic sentences with the graphic organizers only. He included an average of 18.3 sentences and 185.8 words with the FLYPen™, and 17.3 sentences and 186.3 words with the graphic organizers.

## **Social Validity**

When asked why it was important to know how to write well, the students reported it was important for their goals (e.g., college, graduating from high school) or as a means of explaining oneself in writing. Initially, Brittany expressed frustrated with the FLYPen™ when it would get “off” on a step, usually due to her continuing to tap on the graphic organizers while listening to a direction. As she used the FLYPen™, Brittany enjoyed the technology more because she found it easier to write essays when the FLYPen™ explained the components of an essay. Matt and Peter were more positive about the FLYPen™, indicating it provided them instructions and support such as step-by-step directions and hints. All reported they would rather use the graphic organizer pages alone and acknowledged they stopped listening to the auditory prompts as they used the FLYPen™ after using it several times.

The teacher also emphasized the value of the technology with the individualization the FLYPen™ provided. Instead of having to work one-on-one with students, reteach, or continually adjust the pace of instruction while waiting for students to complete parts of graphic organizers, the FLYPen™ provided individualization and allowed students to work at their own pace. The teacher believed the FLYPen™ provided a starting-point for her students to be motivated to write because it was an interesting technology. However, the teacher felt the graphic organizer pages were what actually helped the students in planning and organizing writing tasks, as the graphic organizer pages accompanying the FLYPen™ broke down an essay into separate sections while allowing students to brainstorm and write topic sentences.

The value of the graphic organizers with and without the FLYPen™ was noted outside of the student products for this study. For example, Matt reported he used the strategies taught (i.e., planning, brainstorming) in his other classes when writing. When Peter re-took his standardized

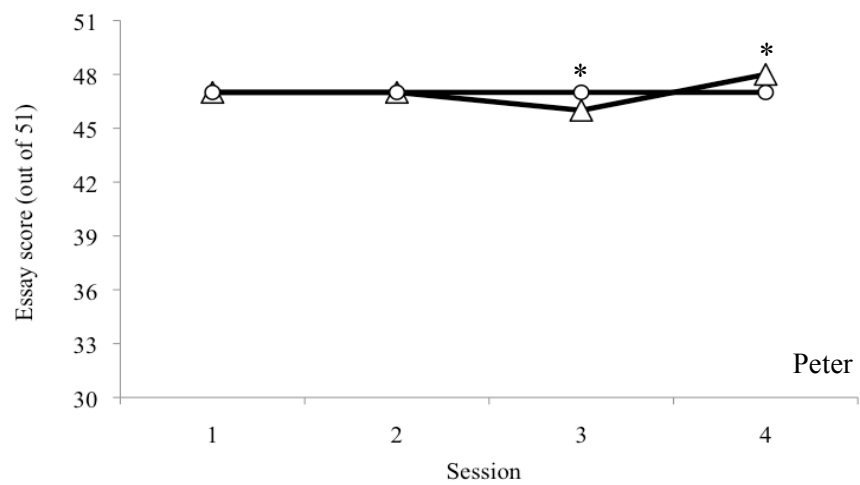
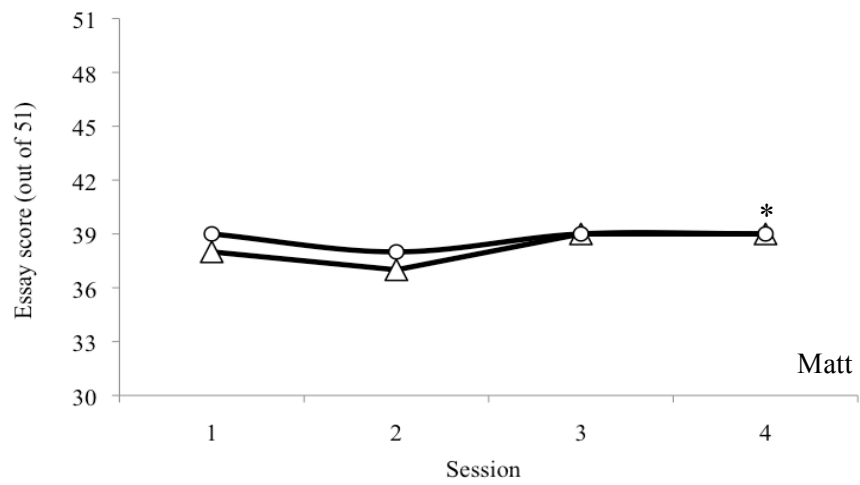
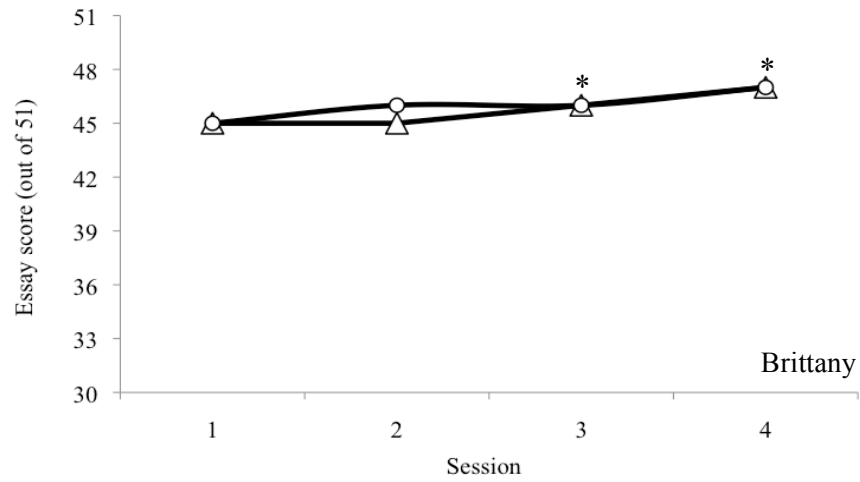
English/Language Arts assessment for the writing component, he passed. He attributed his success on the written expression portion to internalizing the strategies he learned in this study from using the FLYPen™ and graphic organizers.

### **Discussion**

This study sought to understand if a technology-based tool – the FLYPen™ – with its written expression software and graphic organizers or the paper-based graphic organizers alone supported written expression. Both methods supported students equally in terms of the quality of the essays written and overall usability.

Prior to implementation of either intervention, students struggled to brainstorm, write topic sentences, often wrote only one paragraph, and lacked supporting details in their essays. They found written expression to be a difficult task. When introduced to the FLYPen™ and graphic organizers, Brittany and Peter *immediately* included multiple paragraphs, focused topic sentences, supporting details, and a higher overall quality of their essays. While Matt struggled to write multiple paragraphs, the overall quality of his essays also increased with the inclusion of focused, supportive sentences. The teacher and the students acknowledged that the FLYPen™ made writing more exciting and the students more willing to write. The technology provided a hook to interest previously reluctant writers to begin writing. Yet, the students and the teacher found the graphic organizers to be the most beneficial in actually supporting written expression as the prompts provided by the FLYPen™ were pre-programmed and did not change. Thus, in attempting to understand if the “pen” or the “paper” supported the students, the answer is possibly “both.” In other words, the success experienced was the result of an effective written expression package: a combination of a novel, motivating technology (i.e., the FLYPen™ with audio prompting) and the consistent written expression support from graphic organizers.





○ Essays with the FLYPen™ and graphic organizers  
 △ Essays with the graphic organizers alone  
 \* Denotes that student did not use the “Editor Mode” during a FLYPen™ essay

Figure 1. Overall quality score for each student from the rating rubric

## **Value of Technology**

Although the written expression products produced by the students were not better in terms of quality or quantity when using the technology compared to graphic organizers alone, they were also not worse. Hence, the audio prompts neither helped nor hurt as compared to just the paper-based supports. However, the social validity results suggest the technology provided motivation for the students writing and potentially provided a needed review for specific written expression elements such as the thesis statement. Given the challenge the teacher faced getting the students to write, the FLYPen™ provided a need “hook” to interest the students in order for them to actually learn about and make improvements in written expression. The motivation the FLYPen™ provided to write is consistent with previous research, suggesting literacy-based technologies may increase students’ motivation and interest in academic tasks (MacArthur, 2009; Okolo, 2008). Hence, with the added motivational element of the FLYPen™, students were more receptive to prewriting, the paper-based graphic organizers (see MacArthur, 2000, 1996).

In addition to the motivational value of the FLYPen™, it also provided auditory prompting. Arguably, the auditory prompts not only provided directions, but also helped the students stay on-task in completing each step of the graphic organizers. In the “Editor Mode,” if a student attempted to move ahead to the next section of a graphic organizer prior to double tapping (signal to move on) or wrote in the wrong section, the FLYPen™ beeped loudly to indicate an error and would not provide the next direction until a previous one was completed. While research has minimally explored potential benefits of technology-based auditory prompting for written expression for students with EBD, students with EBD were more likely to continue writing or write more when a teacher gives an auditory prompt followed by praise (Lee & Laspe, 2003). Additionally, Hudson and colleagues (2013) also found that students with EBD

were able improve their written expression when given prompts and were able to maintain the targeted written expression skills over six weeks.

Other emerging research on students with autism also suggests the value of auditory prompting for written expression. Pennington and colleagues (2012; 2010) provided verbal simultaneous prompting then physical prompting, as needed, when using a written expression software. Results demonstrated significant improvements in the number of complete sentences and words written. While the prompts provided focused more so on beginning and completing the task, improvements in overall written expression were demonstrated. Research has found that prompting, through technology or a person, is effective in increasing students' focus towards any given task and performing the requested actions (Morse & Schuster, 2004).

### **Value of Graphic Organizers**

As a stand-alone support, paper-based graphic organizers were effective in supporting written expression. Research suggests that graphic organizers positively impacts planning, supports organization, and increases written expression ability across grade levels and for all students (Graham & Harris, 2009; Graham & Perin, 2007). In this study, the combination of the "Idea Map" (i.e., a concept map) and the "Drafting Page" (i.e., an outline of topic sentences and supportive details) provided students with a brainstorming and organization structure. These graphic organizers enabled students to focus their ideas, and have a foundation for each paragraph using the topic sentences and supportive details. The teacher in this study emphasized how important it was for students to have such a structure and to know where to begin each paragraph. This structure allowed students to better translate their ideas (i.e., planning) into an actual organized essay with separate paragraphs and detailed sentences.

For the students in this study, the graphic organizers used with the FLYPen™ were one of the first types of graphic organizers ever used, and one of the first times they had been required to systematically plan and organize before writing. Prior to the start of the study, Matt and Peter indicated how they just “thought about” what they wanted to write and began writing. Both acknowledged their previous method was ineffective in producing quality essays. While Brittany created concept maps in the past, she reported they did not provide her as much support in writing as she needed and were insufficient. After using graphic organizers, all students reported that prewriting was a valuable component of improved written expression.

### **Implications for Practice**

The primary implication for practice of this study was the success of a low-to-no cost support (i.e., paper-based graphic organizers) in improving students’ written expression. Although the technology benefited the students and perhaps resulted in them being more willing to write, teachers may experience the same student success through paper-based supports. Teachers can use find motivating, lower-cost, and accessible technology as a stand-alone support (e.g., typing, word prediction) and with paper-based graphic organizers to encourage secondary students to write. If a teacher does not have access to technology, such as the FLYPen™, other technology-based supports are available to potential motivate students to engage in writing, such as creating an outline with a word processing program. Teachers can also consider using concept mapping via commercially available software (e.g., Inspiration, <http://www.inspiration.com/>) or free ones (e.g., Cmap, <http://cmap.ihmc.us/>).

### **Limitations and Future Directions**

One limitation involved removing a student from this study due to unrelated factors; his results may have provided additional support for the results of this study. Another limitation is

the lack of baseline data. However, this was an intentional decision per the single subject design used (i.e., repeated acquisition). This study serving as a follow-up study to one exploring the effectiveness of the FLYPen™. An unintentional limitation was the lack of formal assessment of motivation, which the social validity interviews revealed to be an unanticipated result. Last, interobserver agreement was initially low. However, this was resolved with additional training and practice.

Future research includes replicating this study by including longer measures with a generalization phase to understand if written expression abilities were sustained when not using the FLYPen™ or graphic organizers across settings and types of writing. Research should compare written expression motivation and abilities with two groups of students – one with and one without a novel technology – to better examine the association between motivation and technology. Additional research is simply needed in the areas of secondary students with EBD, as research is limited in how to best support students' written expression in special or general education settings.

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# **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.

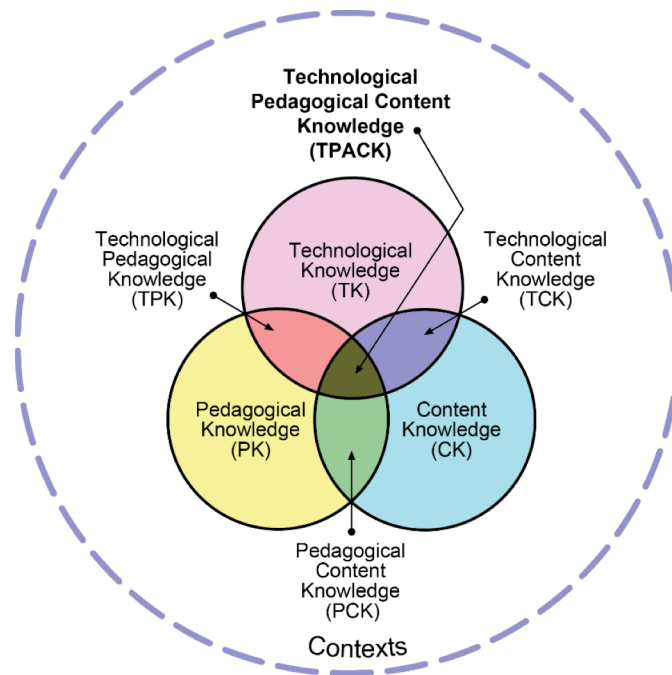
According to Bridget Dalton (2015), "Web literacy is huge. It's everything we do on the Web" (Dalton, 2015, p. 605). Web literacy, for instructional purposes, includes the knowledge and skills student use to locate, evaluate, synthesize, organize, and communicate information found online (November, 2008; 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*

<b>Teacher Example</b>	<b>Content/Grade</b>	<b>Web Literacy Applications</b>	<b>Pedagogical Tools</b>
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 21<sup>st</sup> 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
<b>TK</b> Technology Knowledge	Locate Communicate	<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 &amp; 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>
<b>PK</b> Pedagogy Knowledge	Organize Collaborate Communicate	<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 &amp; 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>
<b>CK</b> Content Knowledge	Evaluate Synthesize Collaborate Communicate	<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 &amp; 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>

Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
<p><b>PCK</b></p> <p>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 &amp; 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>
<p><b>TCK</b></p> <p>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 &amp; 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>



Knowledge	Web Literacy Skills Used	Teacher Knowledge	Student Knowledge
<p><b>TPK</b></p> <p>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 &amp; 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>
<p><b>TPACK</b></p>	<p>Locate Evaluate Synthesize Collaborate Communicate</p>	<p>“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 &amp; Mishra, 2009, p. 66).</p>	<p>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.</p>

Appendix B  
Focus Group Questions

1. We initially asked teachers what they understood about literacy terms such as Web literacy, digital literacy, etc. Can you elaborate on how you've encountered these terms and how well you understand them?
2. What are your thoughts about Web literacy and teaching the skills students need for success with online content?
3. What Web literacy skills do you feel are most difficult for students? (locate, evaluate, synthesize, organize, or communicate)
4. Whatever your subject, what are you responsible for teaching with regard to Web literacy skills?
5. How can you integrate technology into your literacy practices?
6. What do new teachers need to understand about technology integration and Web literacy skills?
7. What Web literacy skills are most important for your students?

## Appendix C

### Instructions for Web Literacy Assignment

#### Instructions:

The task for each teacher, regardless of grade level, is to provide students an opportunity to develop Web literacy skills such as locating, evaluating, synthesizing, organizing, and communicating online information. Select a project that relates to the content you teach. The project should focus on student-centered development of a topic (teacher choice or student choice). The students will engage digital skills and media as they complete the project, and as appropriate, be encouraged to evaluate and synthesize the information they encounter. As we learned in our Web Literacy workshop, students are presented with a LOT of text when searching for information online and must learn to determine which information is credible and relevant. At times, it may be beneficial for students to use online tools such as Diigo to organize online information. Some suggestions for a Web literacy project might include: a report, a final project, or a presentation of the information to their class in a meaningful format (iMovie, PowerPoints, etc.). The product should require students to communicate the information they learned in an effective way. The project may be a small scale project or a large scale project. At the second focus group session, you will be provided time to share your project idea as well as any positive or negative feedback you have regarding the experience.