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Technology literacy assessments and adult literacy programs: pathways to technology competence for adult educators and learners

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Abstract

This case study was conducted to consider digital literacy programs for lower literate adults in Minnesota. Two programs were considered, the Northstar Digital Literacy Program, and the Learner Web system. Both are being used at regional sites in Minnesota to target digital competency and literacy education for adults. Interviews were conducted with a current educator at one site, with a coordinator for these two programs who has been involved since the programs began, and, experiences of the authors acting in the capacity as tutors for these programs were included for considering practical experiences in the learning environments. This paper's effort is a brief environmental scan of challenges and possibilities for this emerging area of adult education, and should not be generalized. Emphasis is placed on digital literacy teaching and learning; considering assumptions educators might make about their students access to, and knowledge of, technology use; how technology could be further integrated into literacy education; and, on assessments and higher level technology competence (being able to type or send an email are important skills, but in today's society more skills are needed to succeed in college or work).

Introduction

Adult Basic Education (ABE) has been increasingly impacted by technology in recent years as educational institutions, workplaces, and government programs in the United States have shifted more of their information and services into digital spaces. These services, which used to require filling out a paper form or a telephone call have shifted into online spaces and now require technology tools to access and use. Citizens require technology access then in

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addition to knowledge and the skills necessary for working in digital spaces in order to be self-sufficient and participate fully in today's society. This case study addresses some of the emerging concerns and possibilities with ABE and technology literacy efforts for adults in Minnesota. While ongoing technology infrastructure improvements over the past few years is making it increasingly possible for many to have limited free access to computers and the use of the Internet, these opportunities address only part of digital divide concerns. Broadly, digital divide refers to one's access to and use of technology. Disparities for our citizens who lack the literacy and digital competencies necessary to make effective use of digital options remains an ongoing challenge of the digital divide.

Two areas of digital competencies are of specific interest for this paper: basic technology competence - such as being able to fill out a form online or navigate a web page or website, and cognitive technology competence - such as the ability to apply critical thinking and one's reading comprehension skills to strategically use technology for seeking out and understanding information. Filling out an online form and having the reading comprehension skills necessary to understand information may be beyond the reach of adults who do not meet the U.S. Congress definition of literacy from 1991, "an individual's ability to read, write, and speak in English, and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and develop one's knowledge and potential" (National Literacy Act of 1991, Sec. 3). Literature indicates that many lower-literate adults lack even the most basic of technology skills, let alone have the literacy proficiency necessary to realize the Internet's full potential. We will highlight several of these studies later.

In 2012, a digital assessment project and, in 2007, a web-based software system were developed to address several recognized education gaps. Both are in use at regional sites in

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Minnesota to target digital competency and literacy education for adults. These are the Northstar Digital Literacy Program and the Learner Web system. The Northstar Digital Literacy Program at their own pace. The Northstar assignments require learners to demonstrate computer and online tasks hands- on and in real-time as opposed to only abstractly learning these skills (Vanek, 2013). For instance, in the assignment about email, learners need to compose an email to be able to pass the module. An additional program, Learner Web, is also available at no-cost for the learner. These learners are provided free computer access, self-guided online learning modules, and, instructor or tutor support for developing their literacy and digital learning (Castek, Reder, Withers, Pizzolato & Pendell, 2013; Vanek, 2013). Learner Web is currently in use across five states and in four cities in Minnesota. Combined, these two projects complement each other and are showing promise in furthering digital competence and literacy goals. Since the Northstar and Learner Web programs were developed by ABE educators, researchers, and others who work closely with ABE populations, these are suited for addressing literacy needs of this learning audience.

Digital literacy program opportunities can play a crucial role as a first step for understanding technology literacy needs and for leveraging this information to better target a starting point for developing a learner's technology literacy. As this is an emerging area of teaching and learning in ABE, it is not fully evident which digital literacy program options are useful for the diverse populations ABE serves. For this local program scan, emphasis will be placed on exploring the potential of two digital literacy programs currently in use at three sites in Minnesota for developing technology literacy: the Northstar Digital Literacy Project and Learner Web. Co-authors for this paper have served as tutors for these digital literacy pilots in

Minnesota and used research efforts from an *Advanced Assessment in Adult Literacy* course to further investigate digital competency assessment and possibilities in adult literacy overall.

Literature Review and Background

Recent research indicates a positive correlation between adult education and technology education for: developing multiple literacies, program recruitment, and encouraging learner retention in adult literacy programs. Several indicated that technology can be an educational aid for literacy development (Davies, 2011; Judson, 2010; Kotrlik & Redmann, 2005; Munteanu et al., 2013; Park & Woldeab, 2012; Reder, 2012; Reder, 2013; Strawn, 2008). Cullen and Cobb (2011) also found that adults interested in ABE are more likely to attend literacy programs when they include a technology education component. In addition to this, Weber's (2004) research indicated a possible problem for ABE programming that does not include technology education, since learners were found to be more likely to drop out of literacy programs when their needs for technology were not being met. Moreover, there is research indicating that many adults, who have yet to obtain their General Educational Development (GED) exam and are not enrolled in GED classes at an ABE site, are still using online resources to self-study for the GED tests (National Institute for Literacy, 2008). The GED is the standard high school equivalency test in the United States. The National Institute for Literacy (2008) conducted a study on the interaction between adults' literacy skills and their ability to study online independently. The Institute found that even learners at the lowest levels of literacy could engage and learn with online educational resources, and were eager to do so to continue their academic goals. All of these studies suggest that including a digital literacy component can support ABE goals in a variety of ways.

A possible challenge for using technology in ABE programs concerns anxiety. Specifically, technology anxiety; in which many initially resist the object and subject in question

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due to fear and uncertainty. This phenomenon can be contrasted with approaching objects and subjects with a sense of curiosity and further desire to explore. Technology anxiety can occur for both the adult learners in a program and for the adult educators, tutors, and facilitators in a program who lack the training to understand and support technology-enhanced teaching and learning in their classrooms (Kotrlik & Redmann, 2005; Park & Woldeab, 2012). Some adult educators have made progress with including lower risk technology options in their adult education programming through basic keyboarding or Internet offerings available in their organizations. Research shows a possible gap with integrating technology into core instructional ABE areas, such as reading and math however (Kotrlik & Redmann, 2005). When thoughtfully incorporated into instruction, including technology as part of instruction can help develop subject areas, as well as lessen technology anxiety for both educators and learners. It can be argued that ABE reading and math can be taught successfully without a technology enhancement. There are several data-driven reasons for integrating technology into all instructional areas though. For ABE for instance, it is important to note that the GED moved to an online-only format beginning in 2014. Approximately 674,000 started the GED tests, and approximately 400,000 passed the GED tests in 2012 (Snyder & Dillow, 2013). The shift from paper only tests to the new online-only test will create challenges and anxiety for anyone needing to access the GED site and take the online tests who lack the proficiencies necessary to use a computer, navigate computer programs, or fill out online forms. On the plus side, there have been recent successes with the use of Learner Web's self-paced system for addressing these types of literacy gaps with adult learners at all sites.

Knowing about technology and its use, as well as understanding how to support ABE learners feeling comfortable using technology to accomplish specific learning objectives,

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especially for inquiry and problem-based assignments, is still finding its way into ABE's vision. Existing options that are appropriate for adults with lower literacy levels are limited due to this being a relatively new area for ABE. So, taking a step back to consider parameters of technology literacy helps identify where programming might better support technology literacy. A review of the literature provides several areas for programs to examine.

Davies (2011) considered technology literacy in terms of the learners recognizing what technology is capable of, their being able to use it, and their ability to make appropriate decisions about which technology application to use. Ideally, to achieve minimal technology-literacy levels, it is useful for ABE programs to consider assessments that capture the evaluation of quality of use, wisdom of use, and the ability to make technology decisions in practical and authentic situations (Davies, 2011). This can include programs finding level-appropriate assessment options which can measure how much technology competence their learners already have, while being able to track progress the learners are making along with other literacy-level assessment information that is currently mandated for federal funding. Van Deursen and van Dijk (2010) were able to capture what some of these levels look like.

In 2010, van Deursen and van Dijk conducted a study on Internet skills and the digital divide in the Netherlands. 93% of households had access to the Internet at the time of the study. This is a very high percentage of the population compared to other developed countries. For instance, the United States showed approximately 72.5% of households had Internet access in 2010. Having Internet access does not mean computer access nor an understanding of technology use however, but it does provide evidence of efforts to address part of the access concerns with a possible digital divide. The van Deursen and van Dijk (2010) study involved testing participants on four sets of skills related to digital literacy. The first was operational skills, such as being able

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to save a file, bookmark a website or fill out a form online. The second was formal Internet skills, which center on the ability to navigate and orient oneself on the Internet, search and browse through results and surf between webpages. The third set was information skills, or the ability to find needed information using the Internet. Finally, the fourth set tested was strategic skills, or the person's ability to use the Internet to complete goals. Strategic skills were assessed by asking participants to book a trip as cheaply as possible or to compare one political party's positions to another party. Operation and formal skills are discussed as medium-related skills and information and strategic skills are considered content-related skills. The 109 participants in the van Deursen and van Dijk (2010) study received two assignments for each skill set mentioned above, with eight assignments total. While 93% of Dutch households had access to the Internet, only 11% of the study participants could complete all eight assignments. The two main predictors for higher level Internet competence in the van Deursen and van Dijk (2010) study were age and education-level. The participants' amount of Internet experience was only a small predictor of performing better on the operational skills assignments. The self-reported weekly time spent on the Internet revealed a negative correlation in relation to how quickly participants could complete an assignment. The results can perhaps be explained due to people learning to use the Internet by trial and error versus formal instruction and therefore not knowing more efficient ways of accomplishing a task (van Deursen & van Dijk, 2010). A common example of a time efficiency issue would be a learner typing a web address into the search engine box, instead of the address bar, which eventually leads to a site, but through increased steps and time. For learners unfamiliar with computers and computer programs who may have had the knowledge needed to pass a paper and pencil exam on a particular topic, an additional barrier exists when the learner does not know how to efficiently navigate computer tools and spends too much time

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on processes. Failure to pass a formal exam in a digital space could be misconstrued as a knowledge-based issue when it is a process issue. Likewise assuming that youth in ABE programs will be efficient in digital spaces due to their growing up with technology can also be an error. We will consider this next.

Li and Ranieri (2010) conducted a study in China with teenage participants which indicated mixed results when compared with the van Deursen and van Dijk (2010) study. These participants could be considered "digital natives," a term used to describe people who are of the generation that grew up with technology. This can be contrasted with so-called "digital immigrants," which can refer to someone who is older and learned technology later in life or who was raised in a country without the technology exposure of more developed countries (Prensky, 2001). Of the participants in this study, 87% had a computer at home and 78% had Broadband Internet access. Their average length of computer ownership was five years. Li and Ranieri (2010) tested the study participants using the Instant Digital Competence Assessment (iDCA) tool. Due to the students being young, having high literacy rates and their having Internet access at home, it would be assumed that they would perform well on the iDCA assessment. However, the overall performance of these digital natives was at the "pass" level, versus good or excellent levels. These findings suggest that the students' performance for the assessment was not significantly influenced by length of computer ownership, Internet access at home, or frequency of Internet use. Instead, like van Deursen and van Dijk (2010), they found the highest predictor of achievement to be the participant's education. The highest variance of assessment scores for these Chinese students was the school they attended. This could imply that certain schools are teaching more content-related skills through technology enhanced venues that also focus on reading comprehension and critical-thinking skills.

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There are also studies which indicate that gains in technology literacy lead to gains in other academic-competency areas. Judson's (2010) study with fifth- and eighth-graders in Arizona considered gains in technology literacy along with gains in other content areas (reading and math, for example). Prensky (2006) suggested that youth today are digital natives "fluent in the digital language of computers, video games, and the Internet'' (p. 9). It could be assumed that these younger learners would be confident with using technology due to their interactions with video games, computers and the Internet. Becker's (2000) research, however, found that schools use computers for word processing more than anything else, leading to questions about students using technology as consumers versus students using technology as creators. In other words, it could be that they can play videogames, send text messages and scan webpages for information to add to a report, but they may not be able to use technology for higher-level skills such as problem solving, analyzing the information or for making a decision. Judson's (2010) findings were that broad-based gains in technology literacy were linked to gains in language arts. He further suggested that language arts may have an advantage over mathematics or reading. Even if schools are mostly using computers for word processing, technology use is already integrated into language arts instruction and learning, unlike in reading and math classes. If this is the case, what other possible technology tools might be leveraged to lead to gains in other content areas? Returning to lower-literate adults often lacking foundational skills needed for digital literacy and the basic literacy skills like reading comprehension, which also impacts digital literacy potential, research suggests that opportunity to improve depends on one's location. Norris and Conceição (2004) considered technology access aspects in low-income, inner-city communities. They suggested that while access to technology is growing overall, there is no place where the access gap is wider than in inner-city, low-income communities. For instance, in 2004, only 22.8% of

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urban, female-headed households had Internet access, versus 42.3% of the urban area in general. European Americans were also more likely to own computers than African Americans. Moreover, different ethnicities accessed the Internet for different purposes. For example, 61% of European Americans reported using the Internet for news, versus only 15% of African American adults. African Americans were more likely to report using the Internet for entertainment purposes versus information-seeking purposes. While the landscape of the Internet and the population's access to technology has changed greatly since 2004, minority and low-income populations still seem to be lagging behind in digital literacy (McCain, 2009, Strawn, 2008). Norris and Conceição (2004) identify possible obstacles such as approximately 87% of Internet content is written in English at a standard literacy level. A standard literacy level can be too high for lower-level literate adults. Their study also identified cultural concerns that may be affecting Internet usage such as the Internet being a product of dominant, white-male culture. The Internet may not be an obvious source when seeking information for marginalized populations then who may prefer making a phone call or seeking information through other sources, such as asking their community members. The Connected Nations 2012 Residential Survey reports that 70% of U.S. homes now have broadband access. However, only 43% of low-income populations have broadband access. 82% of the U.S. population owns a computer at home, compared to 59% of low-income homes. 71% of African Americans own a computer, and 58% have broadband access. Since 2004, the rates of broadband access have shot up across populations, but low-income and minority homes still lag behind the average.

Zarcadoolas, Blanco, Boyer, and Pleasant's (2002) study on the ability of low-literate adults to find and understand Internet content indicated that low-literate adults were generally not using the internet because they did not know how. When participants were asked what they

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would like to use the Web for if they knew how, they identified (in descending order): health information, school and/or homework, parenting information, job search, news, information about their home country/other countries, entertainment and email. The prevailing reason they were not currently using the Internet for each of these purposes was due to a lack of knowledge about how. In contrast to the Norris and Conceição (2004) study, this implies that lower-literate adults may not be choosing to use the Internet mainly for entertainment, instead, they may primarily use their home computer for entertainment because it is the only thing they know how to use their computer for. Entertainment websites may be easier to access and navigate than more information and content-heavy websites. As part of Zarcadoolas et al. (2002) study, the participants were asked to complete tasks such as finding information about a specific health condition at www.healthfinder.gov or about weather conditions in a specific region using www.weather.com. They were then assessed on their ability to: decipher large amounts of information, stay on task to accomplish their goal, and to navigate around and between websites. Common difficulties included not being able to locate information on a webpage that required scrolling down, troubles using navigation buttons like the back button, entering web addresses in the correct bar, and spelling errors that prevented them from accessing the information needed. None of the participants routinely scrolled down or could use graphic links without a text label. Many also made the assumption that a website did not have information they needed when they had misspelled a search term and were unable to recognize their spelling mistakes. The Zarcadoolas et al. (2002) findings indicated that literacy education is important for digital competence. While the tasks for the research study had an operational basis, participants found these tasks difficult due to lower basic literacy skills like spelling, and, due to lower critical

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thinking skills needed to prompt one to scroll down for more information or to use the back button to return to a previously viewed page for needed information.

Cullen and Cobb's (2011) study of a needs assessment in a library technology literacy program indicated similar findings to previous studies included here. Lower-literate adults lag behind in operational computer skills which can put them at a disadvantage for reaching higher level cognitive technology literacy. The adults in the Cullen and Cobb (2011) study were challenged by similar tasks as those used in the Zarcadoolas et al. (2002) study. Participants also struggled with identifying links, zooming (such as on a map feature), using the back button, entering web addresses and scrolling down past the screen view. About 50% of the participants in Cullen and Cobb's (2011) study had Internet at home, but 85% said they rely on someone in their home to help them when they need to use their computer. Therefore, while access may in fact be available, how to use the computer for their needs was a challenge.

Finally, an exploratory study of a mobile application designed for low-literacy adults in literacy programs in Canada indicates that there are additional reasons for incorporating technology into ABE programming (Munteau et al., 2013). Several students in the study mentioned that they preferred using a mobile application, Alex©, to look up words online over using a traditional paper dictionary since it provided faster and easier access in the classroom and at home, and, saved them significant time completing homework over using traditional paper dictionaries for searching for words, spelling, or definitions. One goal of this project was to increase independence and encourage their learners to use the literacy resources, including a provided mobile device, beyond their schoolwork. An indicator of success for their efforts was one student, who liked reading the newspaper but was embarrassed by his lack of literacy who began reading the newspaper and doing his ABE homework on his provided mobile device at a

coffee shop where he "felt socially accepted, since the shop is typically frequented by college students who use laptops and mobile devices while studying there" (Munteau et al., 2013, section 4.3.4). In addition, their teaching ABE learners through integrating and providing mobile devices led to a student mentioning doubting his ability to study for these tests using the device in class and finding confidence in his study abilities. Empowering these literacy learners with technology tools and programs that they could more easily use seemed to develop confidence and provide independence. Comments from their participants suggest that traditional support materials, like a paper dictionary call attention to their lower-literacy, and also hindered their ability to easily and efficiently seek unknown words, spelling, and definitions (similar to challenges when lower-literate learners misspelled words in a website and could not locate needed information from the Zarcadoolas et al study). The ability to look up information on their mobile device rather than needing a paper dictionary was a plus since learners could more discretely do their literacy homework using the mobile device at work, home, and in public.

While barriers to computer and Internet access and knowing how to use computers and programs in meaningful ways continue to be a challenge across populations, lower literacy can add additional layers of challenge for some, as the literature mentioned here has indicated. Understanding these challenges and barriers can provide data-driven ideas for supporting adult literacy goals, including possible assessments and programs. We will consider the programs next.

III. Learner Web and the Northstar Digital Literacy Projects, and digital literacy concerns mentioned in the literature

Learner Web was originally designed to address learning gaps for high school dropouts. Longitudinal research data showed these dropouts were interested in continuing their academic

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goals of high school completion and had been trying unsuccessfully to continue their education efforts being stymied by a lack of options. These participants needed options that could both assess and then help them target specific learning gaps for completing high school or passing the GED. Developed as a self-paced learning support system, the Learner Web pilot programs provided computer access and instructor support toward developing literacy and digital competence to address possible opportunity gaps for adult learners. This digital literacy project was implemented at a public housing computer lab site, and a workforce center site that Digby volunteered for during 2011 as a community technology tutor as part of the Minnesota Literacy Council program opportunities. Used to match learning content to the learners' goals, the Learner Web program provided the structured support needed by the learners. As part of our local program scan of these projects for this paper, we also interviewed a digital literacy educator using these two programs at a local library, and a coordinator and content developer involved with Learner Web and Northstar projects since their beginnings. The intent is not to comprehensively cover these programs here, rather to learn more about the background of these programs and better consider how they address or do not address current issues and possibilities in ABE. The Learner Web content has recently been rewritten to match the Northstar Digital Literacy assessment modules. Combined, the Northstar and Learner Web are furthering simultaneous digital competence and literacy goals.

The Northstar Digital Literacy project provides a no-cost to the learner, online assessment which evaluates the basic skills needed for certain computer and online tasks. Currently being implemented at almost 50 literacy partner program sites, the Northstar Digital Literacy assessment is in use at public libraries, workforce centers, adult education sites and non-profits in the Twin Cities and surrounding area approved to issue Northstar Digital Literacy

certificates. Originally sponsored by Saint Paul Public Libraries and the Minnesota Literacy Council, the Northstar assesses medium-related digital literacy skills at partner sites. The Northstar audience is anyone who needs to improve basic digital literacy skills, with at least a mid-level English language literacy (although a Spanish version is also available). It can be a useful tool for individuals to identify areas for improvement, and educators may also use the assessments as pre- and post-tests in conjunction with Learner Web learning plans. The Northstar program initially assesses a learner's ability to: recognize web addresses, sign in to email, fill out online forms, identify and use the address bar, use the Internet navigation buttons, type in a search engine field, use a scrollbar, recognize and react appropriately to pop-ups, as well as their understanding of basic Internet security and internet scams. When a learner is taking the assessment from a sponsored site, upon completion of all modules, the learners can be awarded with the Northstar Digital Literacy Certificate (Northstar Website; Vanek, 2013). This can provide a credential for employment.

The Northstar Digital Literacy Assessment can be compared with the assessment Li and Ranieri (2010) used in the European Union, the Instant Digital Competence Assessment, to provide clarity in terms of the technical and the cognitive assessment dimensions mentioned in the literature review. The technical dimension of the iDCA involves operational and formal Internet skills (van Deursen & van Dijk, 2010) such as identifying tools for a task, knowing how to address pop-ups and recognizing symbols such as icons. The cognitive dimension of the iDCA correlates to information and strategic Internet skills (van Deursen & van Dijk, 2010), such as summarizing and analyzing information, organizing and managing data, identifying relevant information and evaluating information reliability. This cognitive dimension relies heavily on the participant having reading comprehension and critical thinking skills (Li & Ranieri, 2010). The

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iDCA may be more appropriate for higher literacy populations as an assessment than the Northstar in that it has certain prerequisites to take the test, such as basic knowledge of computer terminology. The iDCA website states that the assessment is not meant to test skills in the traditional sense, rather it is designed to help the students reflect on their own digital competence and give the teacher direction for future work. This is true of the programs currently being used at the Minnesota sites too. The possible varying levels of digital literacy assessments can assist programs in deciding which option might be more appropriate for the level of their adult learners. Without basic literacy skills in reading comprehension, an adult learner cannot perform well on an assessment if their lower-level language needs are not also being addressed.

A digital literacy educator who teaches classes at an urban public library was interviewed about the use of the Northstar assessment that was piloted at their site. The population served at this library is primarily non-white, including African Americans, and English language learners from East Africa and Southeast Asia. Many of the learners have had exposure to computers and the Internet, including using the Internet for entertainment purposes such as Facebook and Youtube, but not for information-seeking purposes, such as using Google. The literacy educator's observations concur with several studies in our literature review which reference that adults and children frequently use the Internet for entertainment, but that does not necessarily translate to digital competence (Judson, 2010; Becker, 2011; Norris & Conceição, 2004). As Li and Ranieri posit in their 2010 study, frequency of Internet use was not in itself a predictor of performing well on an assessment. These findings are consistent with comments from the site's educator who identified that many of the participants in the library's digital literacy program had Facebook accounts and were familiar with how to view videos in Youtube, yet did not know how to access or use Google. He mentioned that most of the people accessing his computer classes

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are members of minority cultures, and they clearly see the advantage and necessity of using the Internet.

The Northstar assessment is not used for intake purposes at this library site, only for evaluating progress. The library's curriculum has been designed, however, to align with the Northstar tests available. So, at the end of each class, learners can test out if they are ready. An advantage of designing their curriculum this way is that there are clear benchmarks for success for the students, as well as reportable and measurable outcomes for their literacy program efforts. As Park and Woldeab's (2012) study suggested, technology anxiety can initially be crippling, but as these adult learners develop some comfort and ease with technology and have a few successes to point to, their interest in, enthusiasm for and curiosity about technology increases. It is valuable that the Northstar program offers clear moments of success for adult learners. One aspect to keep in mind with the Northstar assessment is that it does not explicitly test the ability to complete practical tasks, a key component of digital literacy (Davies, 2011; van Deursen & van Dijk, 2010; Li & Ranieri, 2010). However, this aspect is addressed through instructional efforts since instructors and tutors at this site are taught to integrate the skills that are tested by the Northstar into curriculum. Learners can learn Northstar modules through practical efforts like sending an email or looking up a bus schedule.

An interesting viewpoint expressed about this project at this library site was the suggestion that a traditional classroom environment may not be the best way to teach digital literacy. This educator found that one-on-one interactions seem more effective since it allows curriculum and instruction to be tailored to the individual's needs. This informal learning environment may seem more comfortable and in-line with Cullen and Cobb's (2011) findings that low-literate adults prefer to ask family or friends for assistance when they need to use the

Internet for something. This informal teaching and learning model was used as part of Bey's experience as an AmeriCorps member coordinating the electronic classroom at a public library, and Digby's experience as a community technology tutor at a public housing site and a workforce center. All sites regularly had adults showing anxiety about using computers during the intake process. The anxiety for some increased due to poor spelling and slow typing, as well as perceptions that websites are inaccessible as Zarcadoolas et al. (2002) found. Unlike patrons mentioned at the library site Bey and her interviewee worked at, there were some at Digby's workforce site who stated a lack of interest in learning or trying to use computers to look for needed information on a website if they perceived that trying to use technology would slow them down and be more of a frustration than making a phone call. In several of these cases, the potential learners cited that they were only there because access to unemployment benefits had moved into the online environment and phoning no longer worked to gain access to their benefits (or they perceived this to be the case). Several potential learners mentioned that they had been asking others to help them access their benefit information to initiate a payment through the online system, but their friends and family who had helped could not always be relied on. Therefore they felt pressure to learn how to use computers even though they did not want to. The role of assessment in all situations was important since it helped the tutors and learnes consider where to start in the learning process. Educators or tutors can be relied on for informal assessment efforts beyond more formal intake-type assessment opportunities.

A next step beyond Northstar and Learner Web as learners advance could possibly be the iDCA for conducting a needs-assessment and guiding decisions toward continuing content-related skills and addressing more advanced curriculum needs. As technology anxiety decreases for learners, and medium-related skills are mastered, learners may be interested in moving into a

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more formal classroom environment to gain more advanced technology skills, perhaps as further support for increasing other literacy skills. An educator could be articulating through real-world experience the findings of more formal research, especially research surrounding the facilitation of Learner Web in classrooms. For lower-literate learners, the Northstar, Learner Web and iDCA programs may be too difficult considering that these were not developed specifically for these populations. The Learner Web digital literacy content was developed for learners who are roughly at TABE 3/CASAS 221, and the Northstar program is more appropriate for learners who are roughly at TABE 4/CASAS 221 (Vanek, 2013). Lower-literate learners can and should be referred to other literacy and technology-enhanced programs when Learner Web or the Northstar options seem too advanced.

It is encouraging to note that several studies found that the lowest-level learners can benefit from computer use to improve their literacy levels (Aro & Olkinuora, 2007; Munteau, et al., 2013; National Institute for Literacy, 2008; Park & Woldeab, 2012). Without these kinds of integrated learning opportunities, these learners risk becoming marginalized as educational institutions, workplaces and government programs in the United State increasingly move services online. Learner Web provides a self-paced, but guided, online learning experience that many lower-literate adults can be independently successful in. Portland State University's latest study (2013) on the use of Learner Web in tutor-facilitated classrooms considered what worked in classrooms to teach lower-literate adults digital literacy. Their findings suggest that face-to-face interaction and personalized supports are still vital for new technology users. So, use of a one-size-fits-all option for online learning where everyone is on the same timeline for the same topics or skills may not be as beneficial for these learners since they start in different places and have different priorities and motivations to develop their technology usage. As, Reder, Vanek

and Wrigley (2012) highlight for Learner Web's features, modules are task-based, and the activities leverage existing Internet sites, such as using the Internet to find specific locations. Learners control their pace, and make decisions for themselves about which Learner Web activities to explore and complete. The lessons can be completed as often as wanted. Tutors are available at the sites mentioned above to guide the intake process and to provide additional direction and encouragement as needed or if learners show frustration or anxiety about a module activity. They can also quickly address technical concerns if a website or the technology is not performing as expected. Reder, Vanek and Wrigley (2012) refer to this as "just-in-time" or "on-demand" assistance for supporting the learning environment.

With regard to assessing learners coming in to the Northstar or Learner Web projects, co-authors' experiences as tutors supporting the Learner Web and Northstar projects showed that first exposures to digital literacy learning can be challenging or promising depending on the learners. The Learner Web program had an intake process that allowed potential participants the opportunity to learn about the program, complete or work with an instructor or tutor, and, if appropriate, begin setting up an email account and then start using the Learner Web's self-paced program for the learning plan(s) the person was interested in pursuing. These first exposures with the instructors or tutors, to the computers and to the program that we used as part of our tutoring efforts were noticeably a critical time which sometimes resulted in early frustrations and some learners not returning to continue their literacy efforts with the program. Part of the engagement frustrations observed early on seemed to stem from technology anxiety issues or lower-level literacy impeding understanding of the program materials (sometimes related to English language literacy and sometimes to lower-level reading comprehension) as mentioned previously. For others, however, the intake and first exposures to Learner Web and the

instructors or tutors led to early successes and learners then enrolling in the program to continue their Learner Web learning plans. The role of assessment in all cases can help ensure that the adults are tracked correctly into appropriate projects and education options.

Limitations and Implications for Practice

Findings from this study should not be generalized to other populations due to the small sample involved in our local program scan, although issues and possibilities encountered at all sites align with findings from several other studies.

Park and Woldeab's (2012) findings contribute to the theory that low-literate, urban adults want to use technology for information purposes, but might lack the know-how to do so. Park and Woldeab's study is unique in that it is a case study of African immigrants who took a literacy class that involved using technology. Not only were participants in the Park and Woldeab study immigrants to the United States, they were also digital immigrants with limited experience using technology in their native countries. This area, whether all digital immigrants (American-born or not) experience some sort of technology culture shock in beginning computer classes, is an important area for future research. Park and Woldeab's article points to an initial learning hump where technology was scary and intimidating. However, once the women began to learn the basic skills needed (the medium-related skills described by van Deursen and van Dijk, 2010), their learning began to progress rapidly. The initial experience with the Internet caused "shock" but with one-on-one assistance and the community to help each other learn, they were able to use the basic skills needed to operate the computer and Internet and start to make progress in their digital competence. These findings agree with the Munteau, et al. (2013) study which showed that their lower-level literate and immigrant students who struggled with English were "intensive users" (section 4.5) of the mobile application, Alex©. Indeed, where their

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students struggled with using traditional support materials like paper dictionaries to complete their homework, in a short amount of time their students highlighted that the technology support materials were easier and saved them significant amounts of time doing their literacy homework. These are promising findings in favor of technology use for literacy education for our low-literate and low English language literate populations.

84% of the participants in the Cullen and Cobb (2011) study said they would be more likely to attend literacy training if computers were involved, but also expressed fear that they might make too many mistakes or fall behind if literacy classes involved technology. Cullen and Cobb encouraged educators to create curriculum that is perceived to be relevant (such as for job search purposes), have adequate of one-on-one tutoring available, encourage collaboration between students since most low-literate adults are used to working with others to use technology and including training on basic trouble-shooting (such as what to do if your computer locks up, or how to recognize the results of spelling errors). Digital literacy has the capacity to improve all types of literacy and increase engagement with literacy programs, but if not implemented with low-literate adults' needs in mind, it can lead to higher rates of drop-out, due to frustration with technology's demands. Accurate assessment practices are part of the key to addressing this challenge.

By the year 2016, it is estimated that 70% of jobs in the United States will require information and communication technology (ICT) skills (McCain, 2009). ICT skills are the type of higher-level skills described by van Deursen and van Dijk (2010) as content-related skills and by Li and Ranieri (2010) as the cognitive dimension. As technology becomes less expensive and more readily available, adult educators will need to truly confront how to teach true ICT literacy; the ability to access, organize, interpret, evaluate, create and communicate digital information.

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Adult educators have a unique position to increase the population they serve with ICT literacy because, no matter how much technology is made available, people cannot access technology information thoroughly and effectively unless they have the necessary reading, writing, problem-solving and critical thinking skills (Strawn, 2008; Moore, 2011). As Li and Ranieri, and van Deursen and van Dijk, found in their 2010 studies, merely having access to technology does not translate directly to being able to use technology, instead the main predictor of competence is education-related. Adult education programs already excel at helping adult learners improve their literacy skills; the next step is integrating these lessons with technology. iDCA is a possible direction for furthering technology competence once medium-related skills are mastered.

Extending the idea of technology becoming less expensive and possibly being readily available for all in the future, Smythe's (2013) findings indicate an additional concern beyond what has been identified so far. In one of her case study vignettes, one instructor cautioned introducing digital technologies uncritically into literacy programs: "If we introduce the latest 'must-have' digital tools, tools our students will never be able to afford, not only are we being "played" by corporations that make these products, we may also be sending the message that our learners will be never be included in a digital culture. Once they acquire one tool, the next will have arrived and they will be once again on the outside" (Smythe, 2013, p. 567). The Munteau, et al. (2013) study included providing their participants with a mobile device. An interesting benefit of this was having a participant who refused to purchase or be seen with a dictionary, actively engaging in reading and doing homework in a coffee shop and feeling socially acceptable due to having similar technology to discretely study there. While the Learner Web and the Northstar programs focus on technology competence, emphasis is placed on using these programs as sites that provide free computer access, and access to tutors, not on competencies

for particular devices. The socially acceptable factor mentioned in the Munteau et al. (2013) study for low-literate adults might be worth looking into further for future studies if technology access and the knowledge and skills necessary to work in digital spaces might encourage students broadening their learning environment or their motivation to study and develop their literacy knowledge and skills. These suggestions make a case for developing and using level appropriate programs that can be accessed on mobile devices to supplement adult literacy development.

Furthermore, to address the shift of the GED testing process in 2014 to computer-based testing, some adult education programs have already begun to help interested students prepare, since their technology competence will be as much a prerequisite for passing the tests as reading comprehension or mathematics. Recently, the Minnesota Dept of Education (MNDoE) has determined that Northstar standards are now state's ABE technology standards. MNDoE is supporting ABE teacher training efforts for how to best integrate the literacy standards into their programming. Learner Web and Northstar can contribute toward addressing some of the opportunity gaps for this learning population, but the extent to which these programs can help these learners prepare for the new GED is an area for future research. Whether these programs can adequately assist this population in accessing and using the online environments of educational institutions (for continued formal education, for instance), workplaces and for government programs is an additional area for future research. It is increasingly important for citizens to have technology literacy in order to more fully participate in society.

Finally, it is important for our adult educators to learn and know how to teach technology with the state technology literacy standards in mind as well. Initial experiences for our learners and educators with technology can cause a lack of interest in use due to frustration and

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intimidation. A suggestion for supporting ABE educators interested in this area is for them to go through the training for Learner Web educators/tutors. The training teaches computer skills and know-how on troubleshooting for the program and technology while clarifying the learning plan options that programs may be interested in pursuing for their classes and learners. Further training on using assessments to appropriately tailor technology curriculum to learners, identifying clear benchmarks of success (such as the Northstar certification or completion of the different module areas from Learner Web's assignments), emphasizing group work and collaboration, and, being available for one-on-one tutoring, are key for ABE technology educator and learner success. Traditional classroom approaches may not be the best approach for technology education as mentioned, but adult educators have long been pursuing creative education strategies. The motivation for adult educators is clear: increasing technology literacy efforts appears to draw and retain adults to literacy programs for technology-related practical and personal reasons and these types of programming options also provide a simultaneous way to teach literacy skills.

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