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Citation Details

Jacobs, G. & Castek, J. (2018). Digital problem solving: The literacies of navigating life in the digital age. *Journal of Adolescent and Adult Literacy*, 61 (6).

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Digital Problem Solving: The Literacies of Navigating Life in the Digital Age

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For publication as

Jacobs, G. & Castek, J. (2018). Digital problem solving: The literacies of navigating life in the digital age. *Journal of Adolescent and Adult Literacy*, 61 (6).

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Digital Problem Solving: The Literacies of Navigating Life in the Digital Age

Digital problem solving reflects an individual's ability to navigate and use multiple digital resources in order to accomplish goals across domains including work, personal interests, educational pursuits, social or professional networking, civic participation, and for future uses not yet conceptualized. To accomplish these goals, individuals need to enact everyday literacies (Knobel, 1999) that include: "asking questions, constructing meaning from [information and] data, generating [and sharing] creative solutions, and reflecting on how to improve these solutions for different contexts" (Manderino & Castek, 2016, p. 79). As individuals move through daily lives, they are constantly traversing disciplines as they collect information and make decisions. Most activities individuals required to maintain a productive and healthy lifestyle depend on access to, and the ability to, navigate digital resources. Thus, digital problem solving has become an integral part of daily life. By engaging in problem solving in a continually wider range of contexts, problem solvers can both expand their experience and increase confidence for engaging in digital problem solving.

The Everyday Literacies of Digital Problem Solving

A 3-year study, launched by us in conjunction with Multnomah Public Library, in Portland, Oregon, was funded by the Institute for Museum and Library Services (IMLS) to address digital equity in libraries and communities. Portland was selected as the study site partly because of the community's commitment to digital inclusion and equity. Led by Multnomah County Library, a coalition of 48 partners helped create an actionable, community-wide plan centered around shared priorities for digital inclusion: ensuring access to affordable high-speed Internet and devices; providing training and support to ensure that everyone has the skills to use digital technology; empowering community partners to bridge the digital divide through funding,

coordination, training and staff resources; creating opportunities for jobs in the digital economy for underserved populations; and building a policy framework that supports digital equity and meaningful Internet adoption (see City of Portland, 2016). Homing in on these priorities, researchers and practitioners can help confront underserved adults' issues of exclusion and marginalization that are increasingly being amplified by the digital mediation of modern social life.

The study was designed to help vulnerable adults bridge the digital divide and advance their lifelong learning opportunities. Learning about these individuals was consistent with the project's goal of creating a bridge to digital equity and inclusion for underserved populations. Specifically, data demonstrate that digital problem solving requires a set of practices that extend beyond digital skills alone (Frank & Castek, 2017) to include ways of knowing how to approach learning and inquiry within everyday contexts. Basic digital literacy skills are insufficient when individuals must navigate online interfaces, discern accurate and reliable information from fake news, or understand how to protect personal privacy (Castek, Gibbon, & Jacobs, 2017). A digital problem solver needs an extended set of digital literacies but also knowledge of the genres of digital tools and available resources to problem solve efficiently across digital spaces. This knowledge is constantly evolving as individuals navigate ideas online and cross a variety of digital spaces.

A Study of Digital Problem Solving

Approximately 450 individuals completed a survey about their library use. Half of these participants were recruited through the library website and newsletter and the other half from the library's outreach communities, including those residing in subsidized housing, urban campers, veterans, and adults seeking jobs. Key demographic variables such as employment, internet

access at home, and internet use in the library were central to understanding patterns across groups.

To measure the skills adults used to navigate online resources and interfaces, our research team administered the *Problem Solving in Technology Rich Environments* (PSTRE) assessment connected to the Programme for the International Assessment of Adult Competencies (PIAAC) (OECD, 2016). The PSTRE is a valid and reliable scenario-based assessment that evaluates digital communication, use of networks to acquire and evaluate information and perform practical tasks in personal, work-related, and community contexts. A subset of the 450 participants completed the PSTRE (n=211). Another group including volunteers from the library's community outreach group and members of the library's advisory board (n = 18) participated in think-alouds designed to examine a range of digital problem solving strategies.

Completing these tasks required practical knowledge to conduct searches, navigate databases, and interpret search results, and use those result in practical ways that are deeply connected to practical use in real life. As such, digital problem solving was defined as extending beyond the consumption of information to include participating in social networks, digital writing, and other personal and educational pursuits. This expanded understanding of digital problem solving is linked to the everyday literacies, civic participation, digital access, literacy support, and lifelong, life-wide learning that libraries as community anchors provide for the public.

Digital Problem Solving and Life-long Learning

Engagement in digital problem solving is part of lifelong learning that begins in childhood, develops during adolescence, and continues throughout adulthood regardless of an individual's formal level of educational attainment. However, it is important to recognize the

unique challenges of being an adult learner, especially with respect to learning the digital practices that are so essential to engagement in modern life. More specifically, the results of the Longitudinal Study of Adult Learning (Reder, 2012) demonstrated that adults who engage in learning opportunities continue literacy development after leaving formal education but do so at a different pace than adolescents because of the demands of adult life. Furthermore, previous research into the digital literacy acquisition of adults (Castek et al., 2015) showed that learning digital literacies in ways that were connected to their life goals allowed adults who otherwise had been excluded from the digital world to see and participate in it in transformative ways. Through digital participation, these adults stayed connected to the workforce, built connections to family, explored new interests, and reduced isolation by connecting across geographic distances. Developing these important connections are first steps toward becoming digital problem solvers.

The ability to learn digital problem solving is especially important because the massive amounts of information available online require finding information, assessing reliability, reasoning about sources, organizing and transforming information, and using online tools to create and communicate ideas (OECD, 2012). However, this higher level thinking is difficult to learn from digital participation alone and requires additional support or instruction no matter a person's background or level of education. Adults recognize they need to navigate the digital world, as evidenced by research conducted by Horrigan and Gramlich (2017). They reported that 76% of Americans are open to receiving additional support in making sense of the material available to them online, with 61% of the individuals surveyed indicating interest in learning how to use online resources. Libraries are well positioned to provide such support.

Moreover, Smith (2015) found that a number of Americans find it difficult to engage in digital job seeking even if they have access to the Internet and computers. Similarly, Horrigan

(2016) found that 52% of adult Internet users who are newer to computers are less likely to use digital tools for learning. Although Horrigan's research investigated willingness to engage in online learning, the results may be indicative of a lack of overall readiness to use digital tools for in-depth problem solving. Thus, learning how to be a digital problem solver needs to be part of lifelong learning for all if digital equity and inclusion are to be realized.

Research by the Pew Internet and American Life group (Smith, 2014) and the results of the U.S. Programme for the International Assessment of Adult Competencies study (Goodman, Sands, & Coley, 2015) indicate that American youth and young adults may have knowledge of the digital world, but are not inherently facile digital problem solvers across contexts, especially those required for college and career readiness. It is important to let go of assumptions that youth and young adults are automatically proficient digital problem solvers because they grew up in a world where digital devices are ubiquitous. It is unrealistic to expect individuals who do not have opportunities to engage in authentic digital problem solving practices to be able to pick up those practices as adults without guidance.

Therefore, understanding digital problem solving has implications for education at all levels, especially as it relates to issues of digital equity and inclusion. Better understanding the range of strategies and digital problem solving mindsets among youth and adults, coupled with the resources libraries have to help individuals, may make it possible for all individuals to better engage personally, educationally, civically, and economically in the world.

Identifying Where Digital Problem Solving Can Be Learned

Understanding digital problem solving leads to the question of how and where individuals can learn how to become flexible digital problem solvers. Some of these practices might be learned in formal educational settings such as high schools, community colleges, four-

year institutions, and vocational or technical institutions. Yet those individuals who have not experienced success with formal education, who live and work within communities where digital problem solving may not be an everyday practice, or may not have the resources to pay for formal education need alternative places to learn these skills. Educators need to look to informal learning environments as places where digital problem solving practices take place. Libraries, as community anchor organizations, are especially well positioned to meet the needs of youths and adults who are not part of the formal educational system and who may not be part of other learning systems such as adult basic education or workforce development.

The Library as a Place to Participate in Digital Problem Solving

The remainder of this column uses data from the research to provide illustrative examples of the opportunities for learning digital problem solving in libraries. The Multnomah County Library system provides services far beyond supplying things to read, listen to, or watch; lectures, or children's storytime. The library also offers résumé writing classes, opportunities to learn a second language, access to consumer and academic databases, health information, genealogy research, and social services. Individuals who may not have regular access to computers and the internet frequent the library in order to find answers to questions and problems in their life. As such, the library has become a place for the authentic practice of digital problem solving by connecting adults with a supportive community of librarians, staff, volunteers, and peers.

Documenting Digital Problem Solving Processes

We observed and screen-captured audio and video as 18 adults, who represented a range of digital competency profiles, completed digital problem solving tasks. Although a number of participants had advanced education, they tended to be unemployed and dependent on the library

for internet access. A number of these individuals were living on the street, or in transitional or subsidized housing. Our analysis led to understanding of the range of digital problem solving strategies that participants used and the types of supports individuals needed to experience success. Table 1 summarizes characteristics of three participants who represented a continuum of digital competency in digital problem solving and online navigation patterns.

Insert Table 1 about here

Although the three men described in Table 1 share similar characteristics, an analysis of their digital problem solving processes revealed a range of strategies, background experiences, and tendencies, which suggest different types of support were needed to boost their digital problem solving. Ron needed the most support, and Greg was the most independent of the three and was able to figure out solutions even when working within novel environments and experiencing unexpected setbacks. Dan was able to figure out solutions when he felt he understood the task and the interface, but needed support on those tasks where he lacked familiarity or context. Ron appeared to struggle because he had little experience or knowledge of many of the types of problems and interfaces provided. He needed cues to help him focus his attention on the correct area of the webpage as well as guidance in making sense of the information provided. Dan struggled when presented with a problem that he thought he had an adequate strategy for, but was stymied with his strategy was insufficient to achieve the needed results. Greg rarely struggled, but was less attuned to the nuances of the problem statement because he clicked around with fluency and was too quickly satisfied with the results he found. He submitted responses before carefully checking whether he had addressed the task.

Considerations of the participants' characteristics led the research team to consider how an individual's range of experiences across a variety of contexts can be used to determine the

level and type of support needed to help individuals gain experience and confidence in digital problem solving. Our analysis showed that three factors impact a problem solver's approach and strategic choices: problem, experience, and affect (see Figure 1). These factors consider context together with learner characteristics including background and experience in the digital world.

Insert Figure 1 About Here

Examining the relationship between these three factors suggests that the range of contexts an individual experiences digitally can both expand their capabilities and increase their confidence. An approach to building digital problem solving skills that has demonstrated promise is expanding adults repertoire of familiar digital contexts to include those that require a range of kinds of navigation. By traversing a range of contexts, all aspects of digital problem solving become contextualized in meaningful ways that help learners not simply build the skills required for today, but instead develop the mindsets and flexibility for future digital pursuits across environments and contexts that will constantly change, now and in the future.

Increasing Support for Digital Problem Solving

Findings from this study indicate that digital problem solving is best taught in the context of meaningful use and in connection with the community in which the individual lives (see also Frank & Castek, 2017). The authors advocate that the field should move beyond skills-based assessments of a learner's competencies, which inherently signifies deficit thinking, and instead move toward a deeper understanding of connections to a learner's goals, and what that individual knows and needs to learn to do to navigate life in a digital age. As such, the research team developed materials that can be used to help librarians and others who work with adults better serve their learners with targeted support. (For more information, visit the Digital Literacy

Acquisition and Equity Research Hub <https://dlaerhub.wordpress.com>.) The resources entail

contextualized, responsive, and scaffolded support that build connections to public libraries and their community partners. Such instruction can have transformative effects on the lives of individuals and help them build the confidence necessary to traverse digital landscapes with confidence and scale new challenges across their life span.

Acknowledgements

This project was made possible in part by the Institute of Museum and Library Services (IMLS) National Leadership Grant # LG-06-14-076-14A.

The authors acknowledge contributions by Cindy Gibbon, Amy Honisett, Judy Anderson, Vailey Oehlke, and Patricia Moran at Multnomah County Library and Matt Timberlake at Multnomah County IT. We thank members of the grant's advisory board as well as research collaborators Tyler Frank, Mei-kuang Chen, Stephen Reder, Andrew Pizzolato, and Laura Hill for their many contributions.

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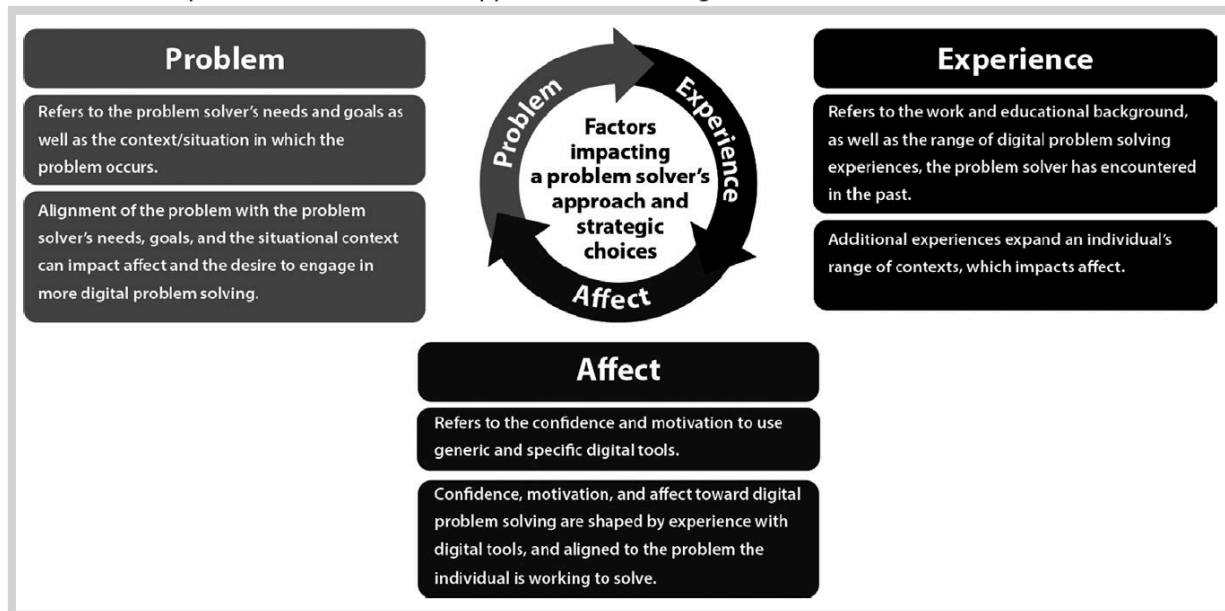
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Table 1
Summary of Characteristics, Strategies, and Levels of Support Needed by Adults

Name	Age group	Life circumstances	Library internet use	Digital problem-solving strategies	Level of support
Ron	45–55	High school graduate, living on the streets	Once a week	Read and reread materials	High
Dan	55–65	Some postsecondary education, recently lost his photography studio	Three times a week	Applied prior knowledge, overrelied on patterns in familiar contexts to navigate new ones	Moderate
Greg	18–24	Some postsecondary education, living on the streets	Sporadically	Demonstrated work-arounds when facing difficulties	Low

Figure 1
Factors That Impact a Problem Solver's Approach and Strategic Choices



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