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Advancing Digital Equity in Public Libraries:
Assessing Library Patrons' Problem Solving in
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Executive Summary

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Advancing Digital Equity in Public Libraries: Assessing Library Patrons' Problem Solving in Technology Rich Environments

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Executive Summary

The Advancing Digital Equity in Public Libraries: Assessing Library Patrons' Problem Solving in Technology Rich Environments research project was supported by a National Leadership Grant (LG-06-14-0076-14A) from the Institute of Museum and Library Services (IMLS). It was conducted over the course of three years as a collaboration between researchers from the University of Arizona and Portland State University, and librarians from the Multnomah County Library in Portland, Oregon. The researcher-public library partnership recognizes that public libraries are community anchors that form the cornerstone of sustainable collaboration efforts focused on adult's digital learning. Through such innovative partnerships we believe the full range of factors that promote digital inclusion and greater digital equity can be achieved.

Purpose of the Research

In our digital world, ensuring that all individuals are proficient digital problem solvers is vitally important. This knowledge makes it possible for adults to navigate digitally and address their educational, employment, and health, and to seek out learning opportunities in the library and community. The purpose of the research was to examine and understand the digital problem solving processes of vulnerable adults. Vulnerable adults were defined as those individuals who are economically insecure, who may not have stable housing, and who may not have regular access to computers and the internet beyond that provided by the library or a mobile device. The research was intended to discover what digital problem solving skills individuals had, how they used those skills, and how libraries could determine how best to support these individuals as they engage in digital problem solving. To that end, the project team designed tasks, observation protocols, documentation, and adaptable tools that librarians can use to support digital problem solving.

Scope of the Research

The project's five main activities were: 1) defining digital problem solving, 2) administering, analyzing and interpreting data from PIAAC's Problem Solving in Technology Rich Environments (PSTRE) assessment and a library use survey, 3) designing tasks for observing digital problem solving in the library and analyzing data from these tasks, 4) creating a checklist to be used in conjunction with the observation tasks, 5) disseminating findings from this work within related communities including libraries, adult education, PIAAC researchers, and those focused on digital inclusion.

Data Collection

The research used a mixed methods design. This design enabled the research team to identify the relationship between PSTRE scores and responses to a library use survey as well as provide deeper insights into the nature of

the digital problem solving of vulnerable adults. Data collection included: (a) a survey that collected data on basic demographics, library use, and participants' self assessment of difficulty for tasks commonly completed using a library's website; (b) PIAAC's Problem Solving in Technology Rich Environments (PSTRE) assessment, and (c) an observation and interview protocol used with participants as they completed the PSTRE and a set of online library tasks the research team designed.

Participants. Data were collected from approximately 450 library users who completed the library use background survey. Of those participants, 211 completed PIAAC's Problem Solving in Technology Rich Environments (PSTRE) assessment. An additional 18 individuals participated in the observation and interview protocol. Those individuals who participated indicated that they were able to read English*, had some experience using computers and the Internet, and indicated interest in completing the PSTRE were invited to take the assessment.

**Upon the advice of one of the Spanish speaking members of the research team, the decision was made not to offer the PSTRE in Spanish because the Spanish version is written in a register different than what is familiar to most Spanish speakers who used the Multnomah County Library.*

Participants were recruited and data were collected across two phases. Phase one involved recruiting in library branches, online using the library's website, and through a link that went out in the library's newsletter. After initial analysis revealed this group skewed toward female and more educated, a second phase of data collection was implemented that focused on the library's outreach community. This effort resulted in a participant pool made up of individuals who were subsidized housing residents, urban campers, job seekers, veterans, and others. This second phase of data collection also included a subset of individuals who responded to a request to participate in a longer an observational protocol in which data were collected to examine their digital problem solving and online navigation processes.

Instruments. The study used three instruments for data collection: (a) the background survey of library use taken by all participants, (b) the PSTRE assessment taken by a subset of participants, and (c) the observation protocol, which involved a limited number of participants.

Background survey. The research team designed a 21-item background survey to collect basic demographics, information on library use, and the participants' perspectives on the difficulty level of various common online library tasks. The demographic portion of the survey was aligned with the background survey used by PIAAC so that results could be compared to the national PSTRE scores. The background survey also included a question designed to determine whether the participants could digitally highlight and drag text, and copy and paste text. These abilities were required to complete the PSTRE.

PSTRE. Our research team administered the Problem Solving in Technology Rich Environments (PSTRE) assessment connected to the Program for the International Assessment of Adult Competencies (PIAAC) and accessed through [Education and Skills Online](#) (OECD, 2016). The PSTRE is a valid and reliable scenario-based assessment made up of 9 multi-stem constructed response items. The items evaluate digital communication, use of networks to acquire and evaluate information and perform practical tasks in personal, work-related, and community contexts. Completing these tasks requires basic digital literacies but also requires digital problem

solving abilities needed to sort information, interpret search results, navigate databases, and complete functions within and across novel digital interfaces. PSTRE yields scores ranging from 200 to 400 reported in four levels. In our study, participants who took the PSTRE received a customized [PSTRE score report](#) to help them interpret the meaning of their scores.

Observation protocol. The research team developed [five tasks](#) and an observational protocol that would allow for the examination digital problem solving more precisely within a library context. The five tasks were aligned to the PSTRE framework and required navigating the library's website and linked data bases.

The 18 participants who participated in the qualitative part of the study were observed as they completed the PSTRE and the [5 library tasks](#). Their online activity was recorded using screen capture software. Scaffolding, defined as support given at the point of need, was provided to these individuals as they completed the tasks in order to provide a positive learning experience rather than frustration. Thus the PSTRE scores were not included in the quantitative analysis. These individuals were also interviewed about their digital problem solving practices and their responses were used to enrich the qualitative data.

Data Analysis

Quantitative and qualitative data were analyzed separately. The findings from each were then examined to explore how findings from one set of data informed the other. Links to documents with more detail about findings are provided in the sections that follow.

Quantitative analysis. For the quantitative portion of this mixed methods study, we conducted three phases of analysis: 1) basic demographics; 2) comparisons between Group 1, recruited in library branches, online on the library's website, and through a link that went out in the library's newsletter, and Group 2 made up of individuals who were part of the library's outreach community: veterans, subsidized housing residents, urban campers, job seekers, and others; and 3) a latent class analysis that examined the relationship between two groups of participants. The latent class analysis allowed us to examine the relationship between library activities, library website use, and PSTRE scores.

Qualitative analysis. Qualitative analysis was conducted using a coding scheme developed by the research team. Initially, selected screen capture recordings were analyzed during whole team meetings. Once a level of inter-rater reliability was established, the team divided into subgroups to analyze the remaining screen capture recordings. These analyses were then shared with the whole team during weekly meetings. The researchers on the team then read through all the coded data and developed categories and themes, which were shared with and elaborated on by members of the whole team.

Definitions

A number of constructs were operationally defined during the course of this work.

- **Digital problem solving** involves the **nimble use of skills, strategies, and mindsets** required to **navigate online in everyday contexts**, including the library, and use novel resources, tools, and interfaces **in efficient and flexible ways** to accomplish personal and professional goals. See the [Defining](#)

[Digital Problem Solving](#) document for a more complete discussion of the definition of digital problem solving.

- **Digital contexts** are operationally defined as being the variety of activities the participants indicated they used the library and library website for on the background survey.
- The digital problem solving **process** involves individuals *learning how to problem solve* as they move through a task and encounter new interfaces, resources, and changing contexts.
- Digital problem solving **approaches** involves *the ways individuals use strategies while problem solving*.
- Digital problem solving **strategies** involves the actions individuals take while problem solving.

Summary of Findings

The findings demonstrated the vital role of examining digital problem skills through a diversity of contexts.

- Participants recruited through the library branches, online on the library's website, and through a link that went out in the library's newsletter navigated across a wide number of digital contexts. These participants scored higher on the PSTRE assessment than the outreach group.
- Participants recruited through library outreach navigated across a limited number of digital contexts. These participants scored lower on the PSTRE assessment than those who were recruited in the library and through the library's newsletter group.
- Across both groups, library website use was a strong predictor of PSTRE scores.
- Different problem solving contexts require the use of different cognitive skills and strategies.
 - The number, frequency, and complexity of contexts play an important role in how individuals engage in digital problem solving and the challenges and successes they experience.
 - Digital problem solving needs to be seen as a set of contexts and events that are dynamic across different situations.
 - Learners must be nimble to apply a range of strategies to maximize their use.
- Observational data show how **highly integrated and interdependent the problem solving processes are**.
 - The processes are recursive, which has a profound effect on instructional implications. For example, instruction needs to help learners see the interdependence and the necessity to move back and forth, and to circle back around between processes as navigation, exploration, and decision making is modeled, discussed and enacted.
- Digital problem solvers use different **strategies** to apply what they know to new situations.
 - Some strategies may be more effective than others and over-reliance on prior knowledge or prior experience online may in fact hinder problem solving.
 - Digital problem solvers need to be flexible and aware of when they should persist, and when they should try another approach to meet their goal.
- Problem solvers may use **all of the approaches and strategies** we documented **regardless of their experience** with digital problem solving
- **How individuals shift their approaches and use the strategies differs** depends on their experience with the task and the contextual aspects of the problem being solved.

Materials for Library Use

- A design protocol with tasks for observing digital problem solving in the library.

The task protocols offer other libraries a useful tool for understanding patron's online problem solving strategies and introduce metacognitive scaffolding prompts that suggest what libraries can do to support digital problem solving development. A full presentation of design principals, tasks, and metacognitive prompts designs are available on the [Blueprint for Designing Digital Problem Solving Tasks](#) document.

These tasks and metacognitive scaffolding prompts and protocol were developed and refined with the Multnomah County Library's website resources in mind. The research team encourages other libraries to adapt the tasks and observational protocol, or to build on the observational protocol inspired by the design principles offered.

- This research gave rise to a flexible, observational checklist which can be used during a meeting with a librarian or other library staff to observe problem solving tasks.

The [Observing Digital Problem Solving Checklist](#) tool has a direct relationship to trends emerging from data analysis. It is meant to be used by a librarian/staff/volunteer in an in-person setting to better understand how to shape interactions with a patron when they come in for assistance. The tool can be used in conjunction with a reference interview, requests for assistance, 1-to-1 appointments with a librarian, or in the context of a class. It can be used to identify who needs more support, and what type of support to offer. The tool is designed to support individual interactions, and/or used with a small group.

Conclusions and Implications

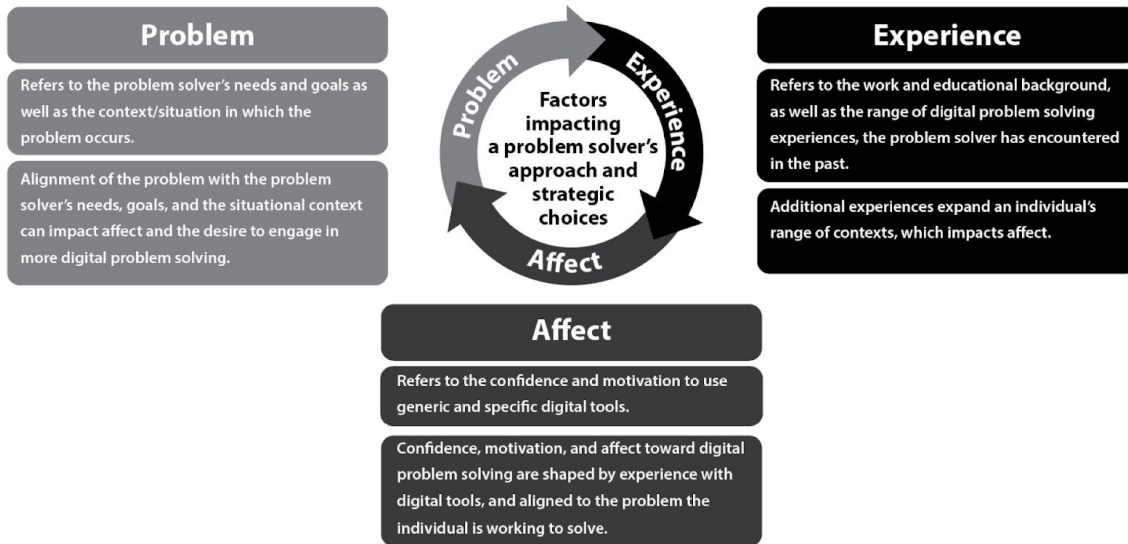
How problem solving occurs. Problem solvers may use all of the approaches and strategies we documented regardless of their experience with digital problem solving, but *how* they shift their approaches and use the strategies differs depending on their experience with the task and the contextual aspects of the problem being solved.

What impacts problem solving. A problem solver's approach and strategic choices are impacted by 1) the problem to be solved, 2) the problem solvers' unique repertoire of experiences 3) affective factors. To be a, nimble problem solver, one must incorporate strategies flexibly, not just once but on a regular basis across contents and events.

All factors are also impacted by the characteristics and socioeconomic and cultural background of the problem solver. The following questions provide helpful insights into the background and experience of the digital problem solver.

Does s/he have access to both digital hardware and high speed internet? If so, is it at home or does s/he have to go to another location such as a library or school? Also, does the problem solver have access to learning opportunities and support around his/her digital problem solving?

Limited access to hardware and high speed internet interferes not only with a problem solver’s opportunities to engage in this cycle above, but limited access to educational opportunities around using digital tools does as well.



How experience affects problem solving. Flexible/intuitive/efficient problem solvers who have experience across a range of contexts are more likely to transfer what they learn as they move through a task to new situations within the task or different tasks. *Less experienced problem solvers may need coaching and support in order to make this transfer.* More experienced problems may be able to make this transfer of learning without support or with simple reminders.

Library/University collaborations offer rich opportunities for work in digital inclusion. This research invites libraries into national and international conversations taking place among policymakers, educators, and community organizations around digital problem solving and digital inclusion. It positions libraries to design better and grounded data-driven life-long learning opportunities for all adults. There continues to be a thriving connection between libraries and digital inclusion efforts at the national level. These data position libraries and researchers to take concerted action to improve basic skills required in a digital age and to tackle inequities, to adapt to diversity, and to support action with evidence.

Libraries as leaders in digital inclusion. These findings show that libraries are ideally positioned to take a leadership role in work around digital inclusion.

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