

Numeracy Education for Adult Learners: A Scan of the Field

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Introduction

Adult education that focuses on numeracy—understanding of and facility with numbers—is a complex field for both learners and educators to navigate. Adults interested in developing their numeracy must locate courses that fit with their daily work and home lives. Across the country, these courses often have different structures and make different levels and kinds of competing demands on learners. Instructors must navigate varied policy contexts, content, and course structures as they seek to meet the individual needs of the adult learners in their classes. And the research base available to inform adult numeracy education providers and participants appears to be remarkably thin. As part of an effort to help strengthen that research base and to inform the development of a new approach to adult numeracy education, this brief report presents the findings of an initial scan of the field.

The brief is the product of Adult Numeracy in the Digital Era: Adaptive Technology for Quantitative and Digital Literacy (ANDE), a project funded by the U.S. Department of Education. The ANDE project seeks to develop and test an innovative, technology-enabled approach to improving adult numeracy and digital literacy to address barriers to adult numeracy instruction.

The scan of the field of adult numeracy education that is summarized in this brief is intended both to contribute to an understanding of the research, policy, and practice regarding adult numeracy and digital literacy

and to support the development of an ANDE course and related instructor professional development.

The findings presented in this brief are based on reviewing research literature and interviewing experts, numeracy instructors, and adult learners, and observing adult education classes focused on numeracy.

The main theme throughout the findings from the scan is variability—variability concerning learners, instructors, and course implementation. After a section on the process that the research team used in conducting the scan, the report presents the research team’s learning and reflections in four sections that relate to adult learners, adult numeracy instructors, classroom and course structures, and policy structures.

Methodology

The scan process that the research team used for this project was adapted from the process described by the Carnegie Foundation for the Advancement of Teaching (Park & Takahashi, 2013), itself adapted from the Institute for Healthcare Improvement’s rapid innovation 90-Day Cycle Structure.

To conduct the scan, five researchers coordinated a read, review, and development process in three 3-week “sprint periods” over 2 months. A team of two researchers began by reading and reviewing research literature and interviewing knowledgeable experts and numeracy instructors. Then, they presented interim findings to three additional

researchers who were charged with using the results of the scan to inform the future design of an ANDE course. Together, the five researchers discussed what they had learned, refined the next steps, and identified additional resources or literature to review. As part of the scan, the team also interviewed eight researchers or field experts and four instructors or adult education practitioners, and the team conducted site visits, observed adult education classes engaged in numeracy instruction, and interviewed instructors and adult learners as new sources of information.

Once a full draft of scan findings had been completed, additional team members reviewed the findings and identified key themes. Team members considered ways to reorganize the findings to clearly convey what was being learned. For this summary, researchers chose to highlight first what was learned about adult learners, centering individual adult learners to convey how their learning is influenced by instructors, the instructional context, and the policy structures that frame where their learning happens.

The research team's focus in the scan was on finding literature about and implications for adult *numeracy* instruction, yet the team found that it needed to draw on *mathematics* research more generally. The U.S. Department of Education defines numeracy as “the ability to access, use, interpret, and communicate mathematical information and ideas to engage in and manage the mathematical demands of a range of situations in adult life” (National Center for Education Statistics, 2020). However, the literature on adult numeracy is limited; The American Institutes for Research (2006) emphasizes there is “a dearth of attention ... related directly to numeracy learning” (p. 36) and suggests this dearth is because numeracy is sometimes intertwined with literacy in the delivery of adult education classes. Moreover, what counts as numeracy has changed over time and is still evolving. This report frequently uses the word “mathematics” with the assumption that readers will understand that the report is focusing on the *use* of mathematics in adult numeracy education (and the underlying need for conceptual understanding that drives effective use) and that the findings in this report can add to the field of adult numeracy.

Adult Learners

The team found a far smaller formal research base regarding adult learners than exists about learners in K–12 and higher education. There is information available about the variety of reasons and motivations for why adult learners choose to enroll in adult numeracy courses and about their life situations outside of classrooms. However, there was less information available about the ways that courses and course materials are designed to incorporate learners' backgrounds, languages, and experiences in the service of building new mathematical knowledge.

Courses need to account for adult learners' wealth of life experiences.

Adult learners have significant practical numeracy knowledge drawn from life experiences available for them to use to make sense of school mathematics (B. Istas, personal communication, October 11, 2021; B. Toso, personal communication, October 4, 2021; The American Institutes for Research, 2006; Kolb, 2015; Moll et al., 1992). However, they may not recognize how what Istas described as their “street knowledge” may be the same as “school” mathematics knowledge, and they may perceive their own deficits more clearly than their strengths (B. Istas, personal communication, October 11, 2021; B. Toso, personal communication, October 4, 2021).

It is common for adult learners to have been away from formal schooling for several years, and researchers have highlighted that the learners often become less self-efficacious about their mathematical knowledge as time passes from the last mathematics class taken (Jameson & Fusco, 2014). Research and interviews identified that adult learners have mathematical resources and understandings that were built in and out of formal schooling that can be leveraged; however, some adult mathematics learners may not have been successful in prior educational endeavors (Gal et al., 2020, Hannula et al., 2019). Some adult mathematics learners also may have had negative mathematics experiences (Gal et al., 2020) or been diagnosed with learning disabilities (Patterson, 2022) and may have gaps in their knowledge or conceptual mathematics

understanding (B. Toso, personal communication October 4, 2021; L. Ginsburg, personal communication, October 22, 2021; Gal et al., 2020) and may have anxiety related to testing (The American Institutes for Research, 2006).

National Reporting System data shows that people enrolled in adult basic education courses are predominantly women, and a large portion of adult learners are Latino/Hispanic (National Reporting System for Adult Education, n.d.-a). Given that girls and women, in general, tend to have low levels of mathematics self-efficacy and high levels of mathematics anxiety (Gal et al., 2020; Hannula et al., 2019; Jameson & Fusco, 2014), there may be important considerations to account for with this population of adult learners. Also, adult learners' self-efficacy may differ given the mathematics content being studied, and one study suggests learners are more self-efficacious in mathematical domains perceived as utilitarian (e.g., fractions, decimals) compared to domains perceived as academic (e.g., geometry, trigonometry) (The American Institutes for Research, 2006; Jameson & Fusco, 2014).

Adult mathematics learners also have other literacy, digital literacy, or English language skills that may affect their mathematics learning (B. Toso, personal communication, October 4, 2021; L. Ginsburg, personal communication, October 22, 2021; Gal et al., 2020). Adult learners with diverse language backgrounds and skills bring a wealth of experiences—such as running businesses and obtaining prior degrees—to their adult education, yet may still be impacted in their numeracy learning by their English proficiency. The literature illustrated a difference in numeracy skills between adults with low levels of English proficiency and those with moderate levels, yet revealed only limited information about how adult numeracy courses are designed to simultaneously support mathematics or complex content and English language development (The American Institutes for Research, 2006; Batalova & Fix, 2015; Durgunoglu et al., 2021). The scan also highlighted instructors' concerns about accurately assessing adult learners' mathematical knowledge because of language differences and the nature

of English language assessments (The American Institutes for Research, 2006; Pivovarov & Powers, 2021). Instructors' existing assessment practices may not enable them to accurately assess multilingual learners' mathematical understandings in ways that are less dependent on English language proficiency (Patterson & Research Allies for Lifelong Learning, 2020).

Adult learners have an array of motivations for engaging in adult education courses and must balance multiple responsibilities.

Adult learners have complex “out of school” lives and are motivated to participate in adult education by both personal and societal or economic forces to attain high school equivalency or pursue career advancement. These motivations are also affected by the learners' dispositions toward schooling, dispositions toward mathematics, and perceptions of barriers (or opportunities) in learning situations (Evans et al., 2021; Gal et al., 2020). Adult learners' self-efficacy, motivations, and disciplinary perceptions are important considerations for future research as these constructs may affect learners' engagement, persistence, and achievement in the classroom—as well as their numeracy practices out of the classroom.

Adult learners' lives tend to be full of employment and family responsibilities, and these responsibilities may relate to how or whether individuals are able (or not) to regularly attend and participate in class activities (Evans et al., 2021; Gal et al., 2020; Patterson, 2018), regardless of their motivation level. Interviewees consistently commented on adult learners' need to balance jobs, families, and/or other obligations with the “costs” of education, such as childcare and access to transportation. For these reasons, interviewees reported that adult learners may withdraw from formal instruction or attend class irregularly. This cost-benefit analysis that adult learners engage in makes the adult learning environment dramatically different from K–16 learning environments (Comings, 2007).

Adult learners find that strong and positive learner–instructor relationships support their mathematics learning.

In interviews that researchers conducted, adult learners emphasized that positive rapport with instructors created an environment in which they could feel safe to ask questions; research validates the importance of positive and caring relationships between adult mathematics instructors and the adult learners in their classes (Belzer et al., 2020; Prechotko, 2020). Researchers, instructors, and adult learners each emphasized the importance of meaningful and humanizing learner–instructor relationships as a precursor to mathematics learning (Evans et al., 2021). In addition to emphasizing humanizing interactions, one research study (Belzer et al., 2020) validated the observations of instructors who highlighted two effective instructional supports that encouraged class attendance: providing direct feedback to individual learners and beginning each real-time lesson with check-ins on how learners are feeling. Instructors also shared other strategies they used to build community among adult learners, such as asking teachers and learners to share their mathematics autobiographies.

Adult learners report that adult numeracy courses support their success, but evidence of impact on a larger scale is more mixed.

The adult learners who spoke with the research team as part of the scan reported a great deal of satisfaction with their adult learning experience. On average, the learners mentioned that they received individualized attention and encouragement from their instructors, were enthusiastic about what they were learning and felt as though they were progressing toward achieving their personal and professional goals. Instructors, too, generally felt as though the learners in their classes were finding success, although at least one instructor reported that learners motivated by career advancement often found success more quickly than those seeking to obtain their high school equivalency degree or GED®.

Unfortunately, the positive outcomes reported by adult learners and instructors who were interviewed

for this scan do not align with more broadly available data about the impact of adult education on learner success. Aggregate National Reporting System data for the 2020/21 cohort of adult learners across all regions indicated that only slightly more than a third (37.4 percent) of adult learners demonstrated measurable skill gains (National Reporting System for Adult Education, n.d.-b). Additionally, because numeracy instruction is not separated from instruction in other course topics, the research team can only conservatively infer a similar finding about the specific impact of numeracy instruction. Unpublished preliminary data from one state on the impact of participation in adult education courses on learner outcomes tells a similar, yet also incomplete, story about the impact of numeracy instruction. The unpublished report identifies two indicators of success—course completion (12 hours of coursework and taking a pretest and posttest) and educational functioning level (EFL) gain—and examines the percentage of enrolled learners who were identified as having met completion requirements in comparison with those who were labeled as inactive or who left their adult education courses. Of enrolled learners, 60 percent completed their adult education courses while 40 percent were inactive or left their program. This figure is consistent with reports that the research team heard from agency staff during site visits, which indicated that only about 50 percent of adult learners were able to finish their adult learning programs. For Adult Basic Education (ABE) and Adult Secondary Education (ASE) courses, length of participation was positively associated with the learners' achieving gains.

Adult Numeracy Instructors

According to the research done for this scan, instructors of adult numeracy courses have a variety of experiences that they bring to their course content and classes. They may not, however, have had the opportunity for rich mathematics learning experiences or professional development to prepare them for being adult numeracy instructors. Instructors must also balance program requirements and standards with learners' interests

and goals. The program requirements, high-stakes exams, learning standards, and learners' needs and goals create a web of tensions that instructors navigate as they plan for instruction. Professional development should aid instructors in deepening their own mathematical knowledge and understanding the rationale and strategies for using less procedural instruction and more conceptual pedagogies to effectively support learners' numeracy development (The American Institutes for Research, 2006; Saliga et al., 2015).

Adult numeracy instructors have followed a variety of paths to their current instructor jobs.

The backgrounds and experiences of adult numeracy instructors are as varied as the backgrounds and experiences of the learners they teach. In the most recent data provided by the National Reporting System for Adult Education (NRS), more than 35,000 instructors worked part-time and fewer than 10,000 worked full-time. A significant number of instructors had 3 or fewer years of teaching experience in adult education (43 percent of part-time instructors and 23 percent of full-time instructors) (Smith & Hofer, 2003) and may teach at multiple organizations simultaneously (Sun, 2010). No certification is required to teach adult basic education courses, although some instructors have K–12 teaching certificates (National Reporting System for Adult Education, n.d.-b). Interviews and research have revealed that many instructors teach more than one subject (The American Institutes for Research, 2006); not surprisingly, research on adult education instructors tends to focus on instructors in general rather than focusing on mathematics teachers specifically (Belzer, 2007; Smith et al., 2003). Overall, there is a high turnover rate among adult education instructors (Smith & Hofer, 2003).

Adult numeracy instructors also vary widely in terms of their mathematical backgrounds. Interviews and the research literature have highlighted that many instructors struggle with delivering mathematics content because the instructors themselves have had limited mathematics learning experiences, may have had their own negative prior perceptions about or experiences with mathematics, and have narrow

understandings of mathematics (The American Institutes for Research, 2006, Ginsburg 2017; Saliga et al., 2015); as a result, many instructors are more likely to focus on rote memorization, procedural techniques, and decontextualized situations (Constantakis, 2017; Ginsburg, 2016). There is little known about best practices for adult numeracy instructional pedagogies, further hindering instructors' ability to teach in reform-oriented or ambitious ways (Belzer, 2007; Smith et al., 2003). The lack of research evidence leaves adult education teachers "with a very small repertoire of proven pedagogical techniques to use and inspire changes in the adult numeracy classroom" (The American Institutes for Research, 2006, p. 53). Novice adult education instructors may be especially likely to heavily emphasize "calculation skills" in their instruction rather than conceptual understanding (Ginsburg, 2016); and, in a field where turnover is high, many instructors may be novices.

Adult numeracy instructors want and need more research-based professional development.

The American Institutes for Research (2006) described the limited opportunities for professional development for adult numeracy instructors. The research done for the current scan found that professional development opportunities have slightly improved since the earlier research published in 2006. States can now have their instructors participate in a few training opportunities offered through the U.S. Department of Education's Office of Career, Technical, and Adult Education (OCTAE). For example, OCTAE's Standards in Action training program focuses on professional development methods and materials that support the implementation of content standards in adult education programs. The Adult Numeracy Instruction (ANI) program was also recently updated as ANI 2.0, has been field-tested, and is currently undergoing improvement and will soon be available to states as a professional development offering.

While these professional development programs are available, opportunities are still limited. Many instructors who were interviewed for this scan expressed interest in professional learning

opportunities generally and indicated that they wanted coaching to learn more about the use of collaborative tasks and formative assessment. In addition to incorporating new online tools into their instruction (e.g., Google sheets, Jamboards), some of the interviewed instructors also were familiar with trending ideas from mathematics education, such as a growth mindset and the use of contextualized problems. Due to the scant research related to professional development for adult numeracy instructors, as well as the varied mathematical backgrounds of the instructors (Ginsburg, 2016), there is a need to develop a research base to further inform the design of professional development for adult numeracy instructors.

Instructors must balance competing factors when choosing mathematics content.

The interviews and research for this scan found that instructors' mathematics content is driven by multiple and competing factors that they must learn how to effectively balance to support the learning of those in their courses. Since 2013, adult numeracy courses have been guided by College and Career Readiness (CCR) Standards for Adult Education (Pimentel, 2013). The CCR Standards for Adult Education are largely built from the Common Core Standards for Mathematics and include both content specifications (i.e., knowledge, skills, and understandings) and the Standards for Mathematical Practice (i.e., processes and habits of mind). The CCR content standards have been parsed into EFL descriptors (or "grade-level groupings") that provide instructors some guidance about how to sequence adult learners' opportunities.

A debate within the field of adult numeracy education about how standards should be organized introduces another complication that instructors must consider. Currently, the CCR standards are organized by content domains. Others argue that adult learners might be better served if the content were organized by functional domains (e.g., financial literacy, health numeracy, civic numeracy) that align with how mathematics is applied (e.g., Ginsburg, personal communication, October 22, 2021; Grotlüschen et al., 2019). This organization might support instructors who seek to be

familiar with local industry and the mathematics used within those contexts to make the mathematics content relevant and meaningful to adult learners (Ginsburg, 2017).

Regardless of how content standards are organized, the findings of the scan suggest that high-stakes exams influence the content of instruction more strongly than the CCR standards (The American Institutes for Research, 2006; Ginsburg, 2017). Although the instructors that the research team spoke with used the CCR standards, instructors tailored instruction to align with the content of exams, such as the GED, to meet learners' goals. Deciding what content to focus on is one dilemma faced by instructors who must try to balance expectations for high-stakes assessments, such as high school equivalency tests, with learners' needs and goals and with mandated standards (Ginsburg, 2017). Even though the CCR contains both content and practice standards, the current exams used within the adult education landscape are more likely to focus on procedural mathematics and less likely to capture aspects related to the practice standards, critical thinking, problem-solving skills, and many other aspects of numeracy. Although recent updates to the exams seek to align with the CCR standards and address some of these prior weaknesses, teachers need additional support to better organize their instruction around developing and formatively assessing these other aspects of numeracy.

Classroom and Course Structures

The interviews and research for this scan also found that—similar to the variety of learner and instructor experiences—there are a variety of adult numeracy course structures and schedules. Courses vary in length, frequency of class meetings, and class duration. Courses are offered in synchronous and asynchronous online formats as well as face-to-face, seeking to meet learners' needs. Technology-enhanced courses may also provide learners with new learning opportunities through online tools and provide instructors with opportunities to administer

formative assessments easily. Learners' access to course content, however, was found to be limited by their access to technology and the variety of platforms and tools. Given the critical importance of digital literacy skills to college and career readiness, many state programs are discussing the integration of digital literacy content into adult numeracy courses; however, at this time, there is only limited evidence of actual program integration with numeracy instruction specifically.

Adult numeracy courses are implemented in a variety of ways.

Interviews and the research literature revealed a wide variety of instructional practices and in how adult numeracy courses are facilitated. Each program is unique, as captured by the quip, "If you've seen one adult numeracy course, you've seen *one* adult numeracy course." The variation in adult numeracy courses occurs among several dimensions: course length, from a few weeks to the traditional 15-week semester; frequency of class meetings, from multiple class meetings per week to every other week or asynchronous classes; class duration, from slightly shorter than 1 hour to 3 hours long; focus, on mathematics alone or taught alongside other subjects; and format, with learners working on individual problem sheets to groups of learners or the whole class working together on the same material.

Technology may enhance instructors' responsiveness to adult learners but may also limit their access.

Some state agencies have implemented online adult numeracy courses, using synchronous or asynchronous formats (Constantakis, 2017; Vanek et al., 2020). The availability of online courses appears to have been induced by the COVID-19 pandemic; the research team did not encounter many staff or personnel discussing pre-pandemic online courses. The online versus in-person dimension adds to the variability in course implementation (Murray & Negoescu, 2019). Many instructors were concerned about adult learners' lack of access to the technology required to adequately engage with classmates and the course

materials online; research literature notes similar concerns (Belzer et al., 2020; Constantakis, 2017; Rosen & Stewart, 2015). Adult learners' preferences were mixed; some cited difficulty focusing during online classes, while others appreciated the convenience.

Instructors and researchers did highlight potential benefits of technology-enhanced courses and noted some commonly used digital tools. Some research has also highlighted that technology-enhanced courses could leverage some aspects of mathematics learning to provide procedural practice problems for learners and provide immediate feedback (Constantakis, 2017). In response, class meeting time could be used to develop adult learners' conceptual understanding and problem-solving skills through collaborative and complex tasks. Interviewed instructors noted that technology-enhanced courses may also provide instructors with the opportunity to receive reports of students' learning and to use this feedback to inform their instruction. As it currently stands, the most commonly used assessments, such as Tests of Adult Basic Education (TABE) and the Comprehensive Adult Student Assessment System (CASAS), primarily act as summative assessments and do not provide easily usable formative assessment information to instructors (The American Institutes for Research, 2006).

Adult numeracy courses are an opportunity to integrate digital literacy content.

The Workforce Innovation and Opportunity Act (WIOA) (2014) highlights that adult education opportunities need to develop digital literacy and adult numeracy. Digital literacy can help adult learners in workplace preparation or advancement and/or help them to more fully engage in society (Ginsburg, 2017). WIOA draws on the Museum and Library Services Act of 2010 to define digital literacy as "the skills associated with using technology to enable users to find, evaluate, organize, create, and communicate information" (U.S. Department of Education, 2015). In conducting the scan, researchers found that state adult education agencies are interested in understanding adult learners' digital literacy skills and supporting their further development so the learners can better access and engage in

digitally based curricula (Gal et al., 2020; Geiger et al., 2015; Grotlüschen et al., 2019). The NorthStar digital literacy assessment is one program the research team found that assesses whether learners have the existing prerequisite skills to participate in digitally based courses.

Rather than developing adult learners' digital literacy in stand-alone courses, state agencies are attempting to encourage this development by integrating digital literacy into existing content domains (such as English language courses for workers who are English learners). Some states have provided guidance through frameworks that provide digital literacy competency areas (e.g., apply communication conventions and norms in online communities) that aid instructors to think about the types of digital activities they may incorporate into their content courses. At least two state frameworks and one national initiative have elucidated digital literacy skills in different ways. Although the field appears to be suggesting that digital literacy ought to be integrated into content courses, the instructors that the research team spoke with saw this as an additional challenge in teaching. Research suggests that instructors encounter their own barriers to digital access and difficulties in improving digital literacy, both of which impact their capacity to support digital literacy for their learners (Belzer et al., 2022). Researchers did not find any descriptions of adult numeracy or mathematics classes in the literature that had been integrated with digital literacy components; however, instructors described and demonstrated elements of such integration during classroom observations.

Policy Structures

Adult education programs are held accountable by federal reporting requirements. The research team for this scan found that these requirements are not immediately useful to inform instruction and do not necessarily align with metrics that capture the needs and goals of adult learners.

Accountability context influences programming and limits responsiveness to local conditions.

Adult education programs receive a large amount of their funding through the WIOA Title II (Adult Education and Family Literacy Act), administered by OCTAE at the U.S. Department of Education. As such, programs are held accountable for outcomes specified by the federal agency (U.S. Department of Education, 2017). The adult education program staff that the research team spoke with during this scan emphasized that the federal reporting requirements influence local policies, programs, and practices. Moreover, the adult education program staff and instructors emphasized that collecting the data required for federal accountability is not an easy task because the accountability metrics are not responsive to learners' goals and participation patterns. The accountability landscape shapes the practices of practitioners in the adult education space (i.e., getting adult learners to take a test they are not concerned about) but does not consistently align with many of adult learners' goals (Cherewka & Prins, 2022; McHugh & Doxsee, 2018; Pickard, 2021).

Conclusion

There is significant variation in terms of who participates in adult numeracy instruction, what mathematics and digital literacy content is addressed, and how content is delivered. In the best of circumstances and at the smallest individual learner scale, adult numeracy instruction can center around a learner who can find a local program that fits their needs and schedule and a course that includes a research-based curriculum and innovative practices. Their instructor also has the capacity to build relationships with adult learners, design and deliver high-quality instruction, and provide formative feedback to improve learning experiences and the learners' goal attainment.

This best-of-circumstances situation can result in the virtuous cycle of improvement in the field of adult numeracy that is desired by all involved; individual learners and instructors find their own

success while innovative ideas are tested and validated in stable teaching and learning environments, which in turn can promote success for more learners and instructors.

To work toward these ideal circumstances, the research for this scan suggests considering several questions: What measures of adult learner success should be captured? What course design elements or contexts support learners with diverse backgrounds, experiences, and motivations? What mathematics instructional practices or routines improve learners' understanding? What preparations do instructors need to teach all learners? What can best help instructors navigate the federal and state policy contexts and accountability mechanisms?

In the current project that developed this scan, the research team seeks to add to the research base for addressing these and related questions with the overarching goals of improving adult learner instruction, understanding the feasibility and impact of innovations, and ultimately facilitating adult learners' achievement of their personal and professional goals.

More research is needed to improve adult learner instruction and training for instructors and to increase understanding of the feasibility and impact of innovations in these areas.

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