Liquid Mode Field-Test: Readability Technology in Adult Literacy Education

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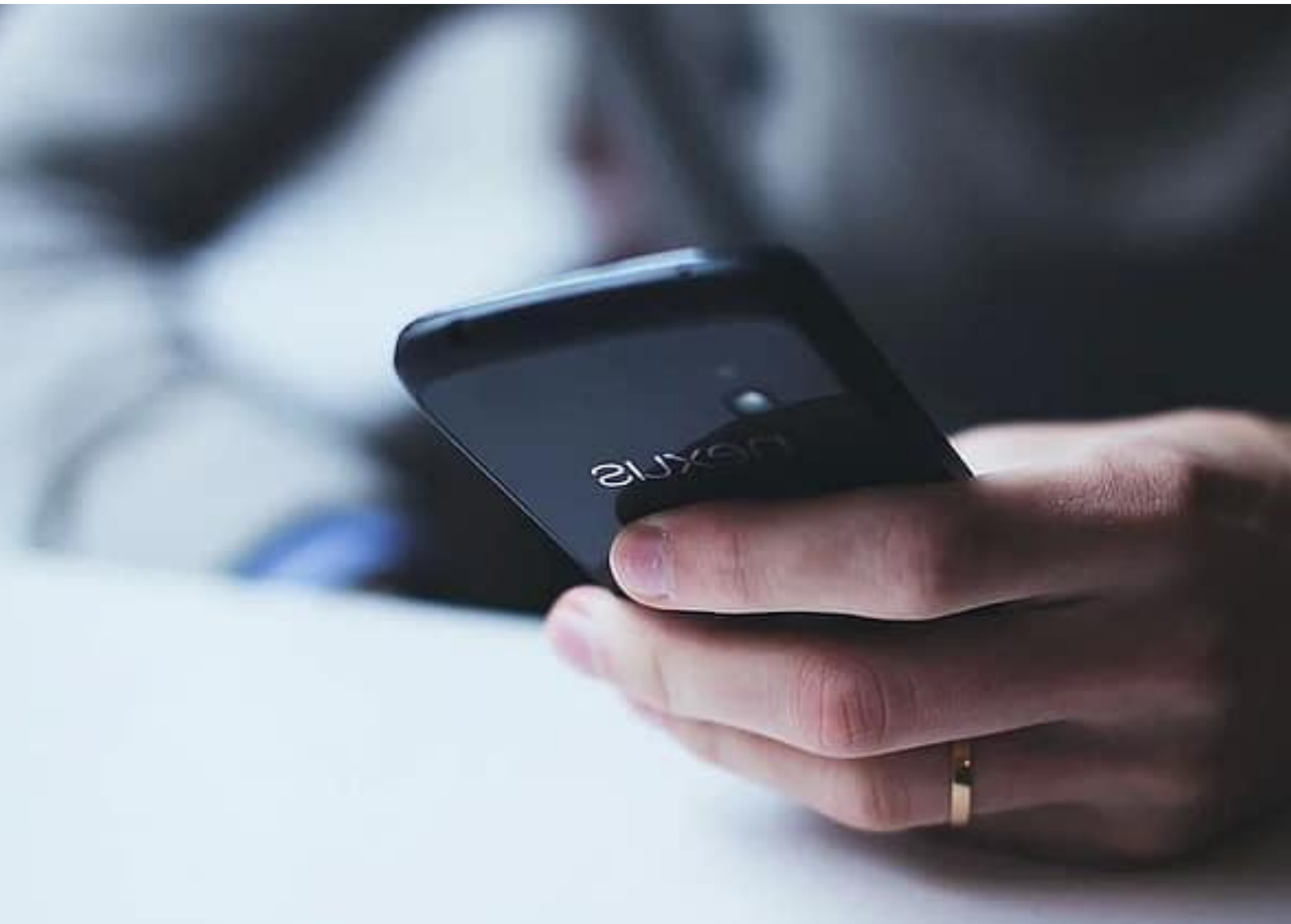
WORLD EDUCATION

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Executive Summary

Since 2019, the EdTech Center @ World Education has partnered with Adobe and The Readability Consortium to advance the field of digital text readability. Our contribution to this work is to help mitigate the challenges that adults who are dependent on their smartphones for accessing information online face when reading digital text. Many adults enrolled in English language, literacy, and vocational certification classes in the U.S. encounter this barrier to information. To that end, we have field-tested Adobe Acrobat Reader with Liquid Mode for mobile devices, a mobile technology that reflows text in PDF documents. That is, it reorganizes text, changing its presentation and making it possible for learners to control how they view it. It also offers personalized settings, allowing readers to change line spacing, letter spacing, font size, and paragraph formatting.

We have field-tested Adobe Acrobat Reader and the feature Liquid Mode in diverse contexts, reaching dozens of teachers, administrators, and learners in adult education and workforce development settings, and more broadly. Through this research, we found that adult readers feel more comfortable, comprehend more easily, and read more quickly when they can control digital text. Specifically, we've learned that:

1. The initial task of downloading the application and getting used to opening it to read a PDF took some training and support, but once learners gained fluency with that process, it actually made it easier to return to PDFs for future reading.

2. Liquid Mode makes reading of PDFs on smartphones easier, enabling learners to read texts on-the-go (e.g., school forms, health records, and personal reading).

3. When using Liquid Mode, learners see expandable sections that they can collapse and expand for easier navigation, which aids comprehension for adult English language learners reading in English because it supports focus on one section at a time.

4. Many readers did not adjust Liquid Mode text settings because the default settings were sufficient.

5. Most of our participants who did change settings, like font size and spacing, initially over-adjusted, which made the text difficult to read because of where word and line breaks occurred. However, a few participants strategically made text larger to ease eye strain and facilitate reading in distracting environments, such as on a bus.

We see great promise in Liquid Mode as a tool to help adult literacy learners engage with digital text in PDFs. Its adoption in reading instruction provides practice for learners that can buoy their success with digital texts they encounter in their work and daily lives. In that way, it has potential as a tool to support digital equity for learners from historically marginalized communities.

Introduction

Readers regularly encounter digital text in their learning, daily life, and workplace, but for adults developing literacy, reading in a new language, or new to using digital technologies, making sense of digital text can be complicated. World Education, together with its partners Adobe and The Readability Consortium, is working to ease the complexity of reading digital text through the interdisciplinary field of readability. Readability explores reader engagement with digital text from the perspectives of neuroscience, physics, design, engineering, linguistics, and education. Prior readability research suggests that readability technologies that help readers alter text format to meet individual reading needs can ease the burden of reading digital text (Beier, 2022; Wallace, et al., 2021). World Education's role in this work to date has been to meet the needs of adult learners working to develop English literacy proficiency and foundational education skills, many of whom can only access information online with their smartphones. Without Liquid Mode, when smartphone-dependent readers encounter a Portable Digital Format (PDF) document, they need to manually expand it and zoom in to different sections to make text legible (see Figure 1 for an example). This adds a layer of complexity to a task already challenging.

This publication shares findings from our field-testing of Liquid Mode, a readability technology embedded into the free mobile application Adobe Acrobat Reader. Liquid Mode is a feature that reflows texts in PDFs when they are opened in Adobe Acrobat and on mobile devices. That is, it reorganizes text, changing its presentation and makes it possible for learners to control how they view it. It also offers personalized settings, allowing readers to change line and letter spacing, letter size, and paragraph formatting. This presents a promising solution for adult readers who do not have computers but who do need to read PDFs as part of their schooling, work, and daily life. In the U.S., 15% of adults who have a smartphone can access the internet only through that device; that's 38.7 million adults whose phones are a lifeline (Perrin, 2021). They have no choice but to read PDFs on them despite how challenging it can be. For these readers, Liquid Mode has the potential to be a tool for equity and inclusion.

Figure 1. Screenshot of PDF on mobile device without Liquid Mode enabled.

What exactly is Liquid Mode?

Liquid Mode is a relatively new feature on the Adobe Acrobat Reader application. It draws on AI to reformat digital text in PDF documents, making them easier to read on mobile devices. It helps in these three ways, also illustrated in Figure 2.
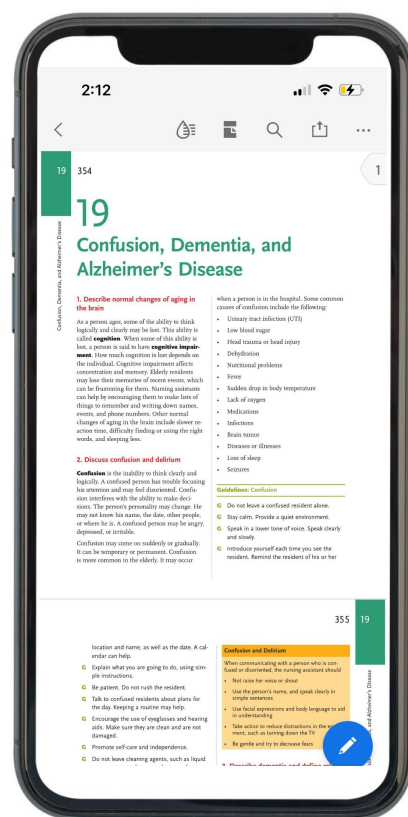
1. Readers do not have to manually manipulate PDFs by pinching, zooming, and moving the documents around on the screen in order to read the text.

2. For PDFs formatted with headings, Liquid Mode creates expandable sections that allow readers to more easily control which part of the document they see on the screen.

3. Liquid Mode gives readers control over font size, letter spacing, and line spacing to personalize the text.
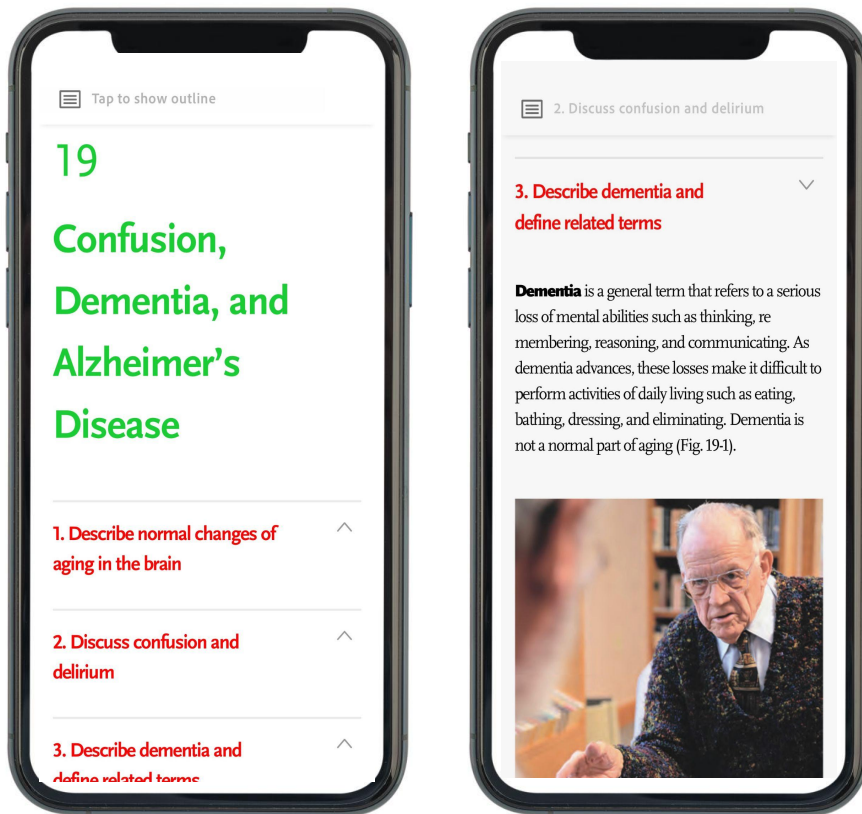

Figure 2. Screenshot of PDF on mobile device using Liquid Mode.

We know that many of the learners enrolled in adult education programs rely on their phones to read -- whether because of demanding schedules that require reading on the go or because their phone is their only device for reading digital text -- so we saw the potential of Liquid Mode to help struggling readers better access information on their phones. To understand how it could be used to mitigate barriers to reading digital text, we field-tested Liquid Mode in diverse contexts, reaching dozens of teachers, administrators, and learners in adult education and workforce development settings, and more broadly.

Methodology

Our descriptive research employed a general qualitative approach to understand how Liquid Mode supported adults' reading in adult literacy programs and everyday reading activities.

Data Collection Activities

In the fall of 2020, we began collecting data through a range of activities that introduced Liquid Mode to practitioners and directly to adult learner readers. These activities included professional learning events held at national conferences or in webinars; info sessions for teachers in adult education programs in four metropolitan areas in the states of California, Minnesota, Michigan, and Maryland; exploration of learner use in Minnesota and Maryland; and facilitation of an open digital reading initiative. Across these contexts, we gathered data such as transcripts and notes from interviews, focus groups, and meetings; questionnaire responses; and classroom observations notes.

We also leveraged a resource called the Virtual Readability Lab (VRL), a brief reading assessment that tests users comprehension and reading speed when reading texts with different character spacing. The tool was developed by the University of Central Florida (UCF) for research purposes. For our study, the UCF team created a version of [the tool](#) that draws text from World Education's The Change Agent. Upon completion of the short test, readers are given suggested spacing to help them read digital text more easily.

Participants

Our participants were teachers that we introduced to Liquid Mode in online professional development events, teachers who used Liquid Mode in their classrooms, the students in those classrooms, and adults who accessed leveled readings through our website in our Open Digital Reading Program. Across all sites, we engaged approximately 350 teachers and 35 adult learners (including students enrolled in formal education programs).

Teacher participants were adult educators in the U.S. who used PDFs as instructional resources or were open to converting documents from Google Docs into PDF to help students access them off-line. These teachers either attended info sessions and completed engagement activities (e.g., questions in chat log, practitioner Liquid Mode use questionnaire, Liquid Mode feedback form), introduced Liquid Mode to their students, or both. A subset of this larger group of teachers was chosen to be focal participants if they had students who agreed to access course PDFs and use Liquid Mode on their phones.

Adult learners read PDFs on their phones, either as part of a class or as individual participants. In either case, focal learner participants were those who demonstrated having completed reading, shared feedback about Liquid Mode via questionnaires, and/or completed a VRL test. For the Digital Reading Program focal participants, we reviewed questionnaire data, VRL test results, gathered feedback via text messaging, and held interviews. Because we had more time with learners in the classroom sites, our process was more complex. We reviewed questionnaire data and considered learning engagement in classroom observations, then we identified focal participants who demonstrated Liquid Mode use and VRL completion. We invited these focal participants to experiment with using recommended VRL settings, complete reading logs about their experience, and then we conducted interviews to better understand their digital text personalization preferences and gather their views on how Liquid Mode helped them or not.

Analysis

To understand both learner and teacher experience with Liquid Mode, we employed a general qualitative approach to review data and analyze data. We recorded and carefully read notes and transcripts of teacher info sessions, teacher interviews, classroom observations where possible, and learner focus groups and interviews. Along the way, we noted learners' or teachers' observations, feedback, and reports of experience. We then considered what we learned from questionnaires, reading logs, participant reported Liquid Mode settings, and learner results from the VRL.

These data collection and analysis procedures were repeated across several phases of the research beginning in the fall of 2020. Table 1 provides a high-level overview of the data sources, participants, and methods we employed in the different contexts. Given the different constraints and affordances at each of the sites, we customized our data collection approach slightly at each site.

Table 1: Data Collection Sites and Activities

	CNA class	CDL class	ESOL class	Teacher PD events	Digital reading program
VRL	✔		✔		✔
Student interviews	✔	✔	✔		✔
Student questionnaire	✔	✔	✔		✔
Remote classroom observation	✔	✔	✔	✔	
Teacher questionnaire				✔	
Teacher interview	✔	✔	✔	✔	
Learner reading response	✔		✔		

The sections that follow provide descriptions of the different sites and what we learned through the different data collection activities.

Teacher PD Events: Early Feedback from Educators

Beginning in October 2020, World Education facilitated several teacher professional development events including webinar info sessions, conference presentations, and informal meetings or email correspondence with teachers across the U.S. on using Liquid Mode in Adobe Reader to improve the readability of PDFs. This section includes feedback and comments from these sessions as well as feedback shared in a Teacher Feedback form.

We introduced Liquid Mode to adult education and ESOL teachers and program administrators at four national conferences, four webinar info sessions, and training sessions in four states between October of 2020 and Fall of 2022. Through these touch points we reached 350 educators who shared comments during live webinars, contributed feedback forms, or participated in virtual meetings to explore using Liquid Mode with their students.

Findings

Overall, teachers noted that they saw promise in using readability technologies to make digital text more accessible. With Liquid Mode in particular, teachers said they felt empowered by the ability to see text changes in real-time. One teacher shared, "I found it illuminating to come to realize what settings might be more preferable for me as I was experiencing the setting changes." Another said, similarly, "I really liked the ability to tap images to zoom in. Much smoother than trying to zoom in on an image while also contending with the surrounding text." Teachers reported finding the interface usable; features like a progress bar showing timing for text conversion, the placement of the personalization settings at the top of the app, and seeing changes in "real time." They also generally appreciated how simply and clearly the icons represented the control affordances within the app.

However, teachers were also concerned about the level of digital literacy skills required to successfully open PDFs in the Adobe Acrobat Reader mobile app. One teacher noted, "I like Liquid Mode, and I'm excited about it, but I don't know yet if it's accessible enough for my adult learners or if it's the best tool available in competition with browser read modes, edtech tools like Kami, and others."

Based on these observations, gleaned from event notes and transcripts, we sought out opportunities to work with teachers together with their classroom learners, to better understand how Liquid Mode could be used in instruction.

"It's Friendly!": Liquid Mode in an ESOL Class

The Ronald M. Hubbs Center for Lifelong Learning (Hubbs Center) is the Adult Basic Education (ABE) program of the Saint Paul Public Schools' Community Education Department. The participant class was a high-intermediate to advanced level ESOL class that met remotely four days a week for one hour from September to mid-June (2020-2021). The class met via Google Meet. Depending on the day, the class consisted of a diverse group of 15-20 learners,

multilinguals speaking Spanish, Italian, French, Kazakh, Hindi, Ukrainian, Russian, Japanese, Arabic, Vietnamese, and Somali. Most were highly educated in their home country. As a whole, the teacher reported they were very engaged and sustained strong attendance throughout the academic year, with new students added each month.

With this group we conducted two remote class observations, which included conversation with learners about their use of Liquid Mode; we noted learner questions, observations, and the problems they encountered downloading Adobe Reader and calling it up to read a PDF using Liquid Mode. We followed these class meetings with the following activities:

- Debriefing conversations with the teacher to ensure they understood how to help learners make use of the application

- Providing a learner questionnaire to gather information about devices used, frequency of Liquid Mode use, and general observations (12 of 20 learners completed this task)

- Conducting interviews and assigned reading activities with three learners to discuss their ongoing use of Liquid Mode

Findings

With this group, we found that only three of the 20 learners did not have the digital skills to call up the app to use for reading the PDF. We also heard from the teacher that it was challenging to remember how to open a PDF in Adobe Reader on her phone; she was also confused about where the media was saved on her phone.

The devices that the learners used was a complicating factor of the field-test. There was no uniformity in the devices they used. There were four Android phone users who all had different devices (Samsung A51 5G, Huawei P2, Nokoa TA-1274, Oppo A5). The rest used iPhones ranging from iOS 6 through 11. Several learners did not have enough memory to download the app, and one learner was trying to participate in class using her phone as both the connection to Google Meet and the exercise of using Adobe Reader. She struggled to do both on one device.

Despite these challenges, we gleaned useful information about the use of Liquid Mode in an ESOL setting.

- Seven learners (out of 200) used Liquid Mode on their own, without being assigned text by the teacher.

- Several learners over-adjusted the size and spacing initially. Making font and spacing too large broke up the text too much and required too much scrolling to make sense of the text.

- Several students noted that they wanted to be able to highlight and annotate the text.

One student noted that the extra step needed to first download and then choose Adobe to open the PDF seemed "impractical" and probably only something they would do for "very important" content. Learners also were frustrated when they went through the steps but the PDF did not

work with Liquid Mode; this impacted students who wanted to open files that were too large, forms, or scanned-image docs. Generally, the learners were enthusiastic about control they had over the text and several noted that it made it easier to read. "I liked the way I can read the documents. It's friendly!"

Accessing Text in a Commercial Driver's License Class

Frederick Community College offers a course to prepare learners to take the Maryland Commercial Driver's License (CDL) exam. The course text book is the Maryland Commercial Driver's License Manual, a 168-page PDF available on the Maryland Motor Vehicle Administration website: https://mva.maryland.gov/Documents/DL-151.pdf. Because the manual is only available as a PDF, the class, which met via Zoom in fall 2021, was a perfect setting to test Liquid Mode. The class included six multilingual students, who were all using Android phones.

At this site, we observed a class session where students were oriented to Liquid Mode, to glean observations about how best to structure onboarding sessions and get initial reactions from students. A few weeks after the onboarding, learners completed a questionnaire that asked about the devices used, frequency of Liquid Mode use, and general observations on their use of the app. Five of the six learners completed the form. Then, we held a focus group discussion with three students toward the end of the course.

Findings

The CDL course generated some interesting findings about Liquid Mode. First, we saw the power of a strong onboarding session to ease learners' initial use of the application. Specifically, we noted that it was necessary to teach relevant digital literacy skills while introducing Liquid Mode (e.g., downloading an app, logging into an app on a phone, opening a document with a specific application). Additionally, English was not the first language for the students, so conveying the step-by-step process took time. Despite this, students were persistent. Many of them needed to read the CDL manual on their phones, so they were glad to have a technology solution to support them. They seemed to be most excited over the search function and the PDF content outline, which is not surprising given the size of the document. To ease the onboarding process, the teacher started with a demo, and showed the full path from locating a PDF in the course Learning Management System to opening it in Adobe Liquid Mode. She justified this approach stating, "Saying 'Liquid Mode makes it easier to read on your smartphone' is not nearly as impactful as seeing it in action." Indeed, all three students noted that after downloading the Adobe Reader app and using it in class for the first time, it was easy to use independently.

These CDL students had observations that were similar to those made by the ESOL students described in the previous section. They saw promise in using Liquid Mode to help them read on their phones, and they looked for opportunities to use Liquid Mode outside of assigned course

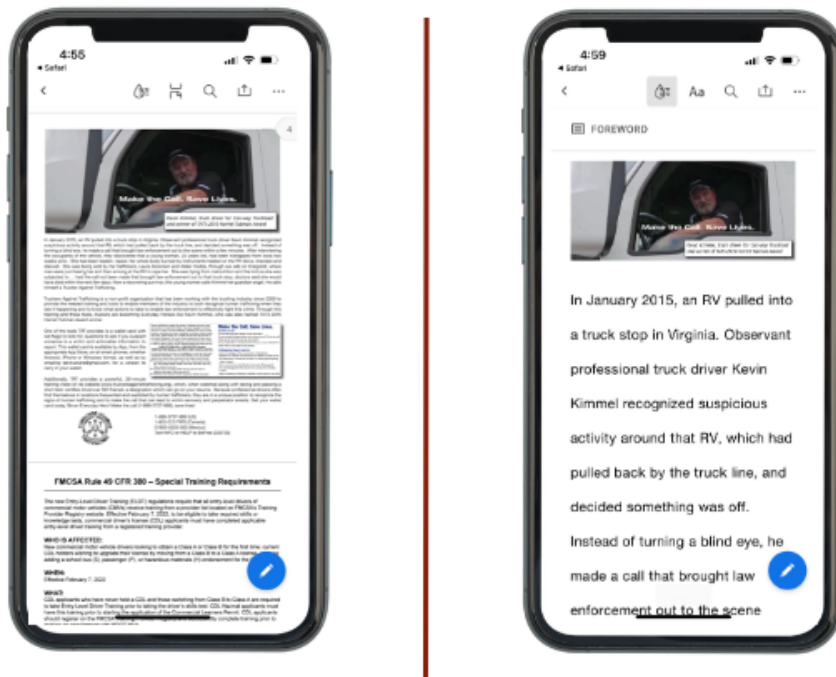reading, enjoying being able to read anywhere and anytime. There were also findings unique to this site.

Figure 3. Screenshots of the CDL manual used without Liquid Mode (left) and with Liquid Mode (right) in use.

Firstly, as part of their onboarding, the teacher led the students through the process of setting up Google single sign-on, a feature that had not been developed when the ESOL students tested Liquid Mode. This feature allowed the app to save the user's documents and seemed to make it easier to find them again. This was likely an important feature at this site because all three students used Android phones equipped with Android OS, designed by Google to run Google applications. At least one learner was able to set a preference for his phone to always open PDFs in Adobe Reader.

The size of the CDL manual created opportunities for findings unique to this site. Because Adobe Reader stores the PDF locally, it only needs to download once. Large documents take a long time to open when directly downloaded from the internet, a barrier that they were able to avoid. For this reason, one participant noted that the app was now his preferred option for large files. "When I open the app, it's faster -- easy to find the document because I already signed in, and the document stored in the app loads quickly. Also, [it] seems more secure."

Finally, none of the students took the VRL reading settings test. Interestingly, all three continued to use the default Liquid Mode settings. They did not make any changes to letter size, kerning, or line spacing, a trend we noticed in other sites.

Easing Reading in a Certified Nursing Assistant Course Class

Certified Nursing Assistant (CNA) programs prepare learners to pass CNA certification exams across the U.S. The CNA job is entry-level service work and a common entry to a health career for immigrant workers. Saint Paul Public Schools' Community Education Department offers CNA classes at the Ronald M. Hubbs Center. The class for our research met remotely and in person four days a week for two hours from February to April 2022. The curriculum for the course featured a series of topical readings shared with learners as PDF documents. The class consisted of nine multilingual adult learners and was taught by one instructor. About half of the students had Android phones and the other half had iPhones. Liquid Mode was of interest to the instructor because students were challenged by the need to control multiple browser tabs or applications in order to simultaneously attend class via Google Meet and access the PDFs.

We started data collection by observing remote classes two times in a one month period. In the first class, we provided an orientation to Adobe Acrobat Reader and Liquid Mode and helped learners download and start using the app. We noted questions, comments, challenges, and learner observations about Liquid Mode. One month later, we attended a second class to talk with learners about their use of Liquid Mode, get feedback, and provide additional support to learners having trouble. Following this observation, we held a debriefing conversation with the teacher. As with the other sites, we asked learners to complete a questionnaire for gathering information about devices used, frequency of Liquid Mode use, and general observations, but only two out of nine learners completed the form. We conducted an interview with one of those learners, who also participated in the reading reflection activity.
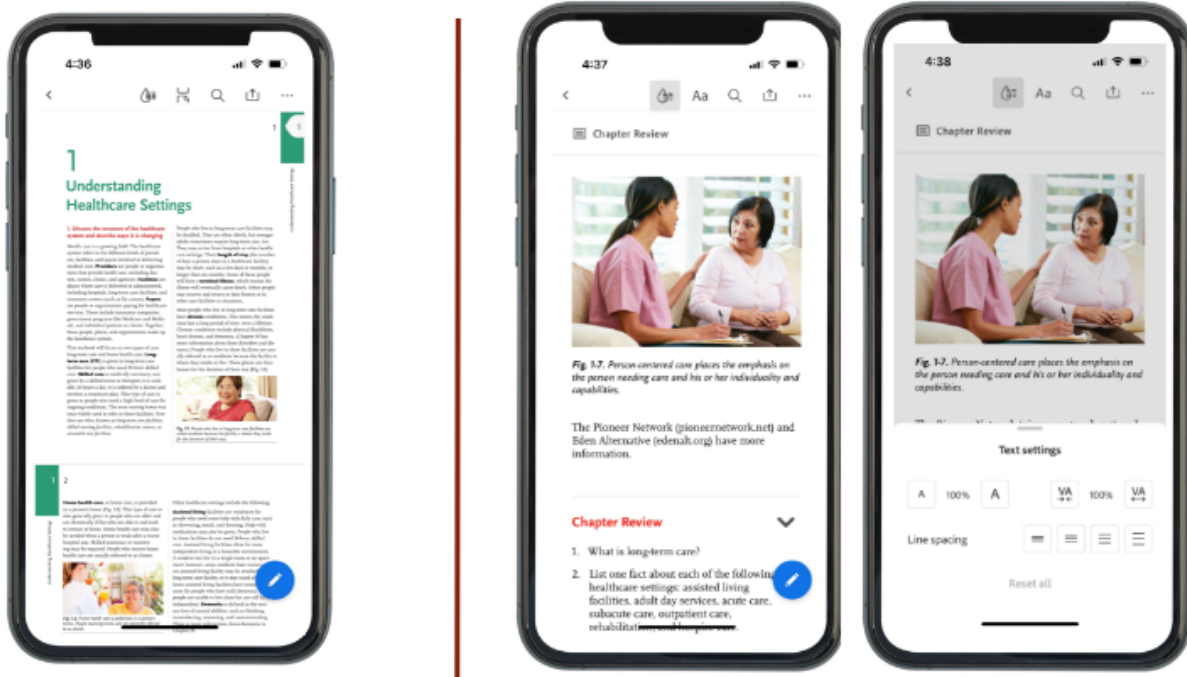
Figure 4. Screenshot of one of the readings in the CNA course without Liquid Mode (left) and with Liquid Mode (right) in use.

Findings

From research at this site, we extended our knowledge about onboarding gleaned at the CDL site in Maryland. Based on that work, we developed a step-by-step user guide to illustrate all of the steps needed for downloading the application and making use of Liquid Mode. In our debrief after the first class meeting, the teacher noted the value of the live demonstration of Adobe Liquid Mode and said that the most useful resource was the user guide. The teacher said she would like to have these resources available in other languages, specifically Spanish, Somali, and Karen (a minority language spoken in Myanmar).

Overall, use of Liquid Mode helped the learners access and read assigned class materials. Examples of these reactions include: "The first time I opened PDF, I didn't have the app. Now I have the app it helps me read. More easy to find information," and "I feel more comfortable on liquid mode, without it, I would feel more difficult." Several students noted it was confusing to navigate the process at first, but that overtime, all but three remembered and felt comfortable exercising the required steps to open a PDF with Adobe Reader. One learner described this persistence as follows, "Something to learn, need to play a little bit -- follow the steps."

Three students used the app multiple times after the initial onboarding; they shared that they regularly used it for coursework and also for opening documents from their children's schools. One of these learners said that she used different text settings depending on the context of the PDF. When reading at home, she preferred the VRL recommended settings; when reading outside or on-the-go, she preferred larger settings. This flexibility supported her reading in different settings: "More available to read since using Liquid Mode. Using Liquid Mode at home and also when outside, picking up [my] daughter."

Using Adobe Reader and Liquid Mode also eased the logistics of accessing the course PDFs. One student noted that it was helpful to have all PDFs open automatically in Adobe Acrobat Reader after they set up the process. The teacher shared that it was indeed helpful for learners to have PDFs available on their phones during remote online instruction, "The thing with occupational classes, we usually provide a laptop or tablet, so most of them are not doing the learning on their phones. But what many do is pull up PDF on phone and then go through assignments on their computer -- instead of doing split screen on their computer."

Overall, the CNA class learners benefited from being able to use Liquid Mode to support their reading PDFs required by the curriculum. With a thorough orientation and supported use, it allowed them to use their phones to provide more options for when and how they read.

Considering Program Needs and Constraints for Choosing Relevant Technologies

Liquid Mode was not a chosen technology solution at every site we tried to recruit. This section describes challenges encountered from two prospective sites that did not participate in the field-test. One was a large multisite agency in the California Central Valley, where we held multiple meetings and onboarding sessions, including a training with 60 teachers in August of 2021. The other site was in a large ESOL program in metropolitan Detroit, where we worked with 20 teachers over three months from July to October in 2021.

Findings

There was early excitement about the potential of Liquid Mode in both sites, characterized by these quotes from administrators, "I was just like YAY! when I first saw this tool. I am so excited to find out more," and "Phones are a lifeline for students; I can see the immediate value and huge benefit for students." Despite this enthusiasm, we saw obstacles that made it difficult to get teacher buy-in for adding a new technology to their instruction. Firstly, as in St. Paul, there was a need for multilingual onboarding resources. But unlike in St. Paul, this was a huge barrier because of the literacy levels of the students. This was especially true in the California program, whose learners were migrant workers and many of whom had literacy gaps in their home language(s). Another challenge was that, unlike in the CDL and CNA classes, the curricula did not include readings that were already PDF documents. For example, in California, the assigned reading for the learners in the California program were at such low-literacy levels that there was not much text to format, so there was not a need for an app that could reflow text.

There were also technology challenges introduced by the sites themselves. For example, the site in Detroit had security and single sign-on protocols in place that made it hard for students to sign into Adobe Acrobat Reader with their school Google accounts. Teachers were also frustrated that the scanned PDF documents they tried to read with Liquid Mode did not work. These scans, essentially images of text, do not actually contain digital text so there is nothing to reflow. In both sites, teachers were wary of asking their students to learn the multiple steps required to download Adobe Reader and then call up a PDF in it to use Liquid Mode. Teachers said things like, "Need to find an easier way for teachers and students to open PDFs in Adobe Reader." There were also bandwidth issues at the sites, and there were concerns about students not having enough data to get started: "Takes a lot of data to download app. Having trouble downloading Adobe Reader app."

The learner audience, instructional content, and technology context of these sites created challenges that worked against Liquid Mode as a relevant technology tool in those sites. However, the info sessions and early training with teachers provided valuable information about characteristics of settings where Liquid Mode has the potential to help students access and read course materials.

Supporting Individuals Adults' Literacy Development: Digital Reading Program

In our final phase of U.S. field-testing in the summer of 2022, World Education launched the Digital Reading Program, an initiative to help adults studying independently and looking for leveled readers to support their literacy development. We provided free [access to over 100 articles previously published in The Change Agent,](#) an online publication featuring authentic writing by adult learners. We also shared a [support video showing how to download Adobe and start using Liquid Mode](#).

Our intended sequence for data collection included several of the research activities utilized in the sites described above. Essentially we wanted readers to put Adobe Acrobat Reader on their phones and share observations about their experiences reading PDFs using Liquid Mode. Key activities included their taking the VRL, responding to questions and nudge reminders sent via the Remind app about how much they had read, and, for a few, participating in an interview about their experience. Through our outreach, we reached over 150 potential participants. Ten participants took the VRL, 21 responded to at least one message about their experience over the course of a one month period, and two were interviewed. We ran this data collection from August 2022 through February 2023.

Findings

In this final phase of field-testing, many of the observations made previously were confirmed. Firstly, we heard that using Liquid Mode did indeed make reading PDFs on phones easier. Readers liked that they could increase font size and that viewing content sections was easy to manage. Participants echoed observations made by classroom learners, for example this reader commented on controlling the amount of text visible on the screen, "Liquid Mode changes the way I read; each time I want to read, I make the page shorter so it is faster to read." Readers also commented on the importance of personalization to meet demands of reading different kinds of text. One reader noted, "Have to use this feature often -- regularly changing to adjust based on content. Novels and documents have different settings, for example. For a novel, adjusting the spacing and increasing/bolding font size makes it more enjoyable. Most of the time, I'm reading novels with children, I can see the text and they can see it."

Readers said they appreciated the convenience of the app tracking their progress through a document. When logged in and reading on the app, a reader can save progress so they will be returned to their place in the PDF after they have left and returned to it. "[E]ach time you open a document [after] you closed the Adobe app and return, it will give you a prompt to save or start a new document. This is great because you can see where you left off previously. The auto-save is very helpful."

Finally, readers expressed nuanced reactions to the options for text personalization. There were some readers who noted the value of increasing font size to ease eye strain when reading. "I would recommend it to anyone that is interested in reading and doesn't want to get bored or stretch your eyes." However, almost all of the program participants did not change their reading

settings. As mentioned in the classroom field-tests, they found the default settings and simply having access to reflowed text sufficient.

Important Takeaways

"I increased the font size while reading the article because I couldn't see the words clearly. **It was quite easy and convenient using the Liquid Mode to read.**"

- Digital Reading Program reader

Throughout this research, we heard from adult readers and their teachers that they felt more comfortable, comprehended more easily, and read more quickly when they could control digital text. Specifically, we learned that:

- Liquid Mode made reading PDFs on smartphones easier, enabled learners to read texts on-the-go (e.g., school forms, health records, restaurant menus, and personal reading).

- When using Liquid Mode, learners saw reflowed text formatted into expandable sections, which aided their comprehension because it supported focus on just part of the text -- one section at a time.

- Many readers did not adjust Liquid Mode text settings, instead relying on the default settings.

- Many participants who did change settings like font size, letter spacing, and line spacing over-adjusted, which made the text difficult to read because of where word and line breaks occurred. However, a few strategically made text larger to ease eye strain and facilitate reading in distracting environments, such as on a bus.

- The initial task of downloading the application and getting used to opening it to read a PDF took some training and support, but once learners gained fluency with that process it actually made it easier to return to PDFs for future reading.

Perhaps the most important contribution Liquid Mode is making for this audience is the reflowing of text and the ability to put text into expandable sections. Most students did not change text and line size and spacing, and when they did, it slowed them down. With a solid and supportive foundation, for example, a demo showing the process for opening a PDF and setting up Adobe as the default reader, adult learners, even those who were literacy learners and relatively new to using technology for learning, had an easier time accessing PDFs on their phone.

Looking Ahead

We see great promise in Adobe's Liquid Mode as a tool to help adult literacy learners engage with digital text in PDFs. Its adoption in instruction provides reading practice and digital skills development that learners can leverage to buoy their success with digital texts they encounter in their work and daily lives. In that way, it has potential as a tool to support digital equity for learners from historically marginalized communities.

Additionally, the offline functionality of the Adobe Acrobat Reader app is another feature that shows promise in environments with unstable, limited and/or no connectivity. Our team is expanding research and field-testing to sub-Saharan Africa to learn more about the use of the app and Liquid Mode in these contexts.

We look forward to continued opportunities to support the use of Liquid Mode in settings where the use of PDFs is required and readers might benefit from taking control of the digital text they read.

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