Engineering For Better Reading Performance Improves Educational Outcomes: Applied Learning Engineering Practices

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Digital Readability   learning engineering   Personalized Learning

Reading

Introduction

Recent research demonstrates that text format characteristics—such as shape, size, and spacing—significantly impact reading speed, accuracy, and comprehension. By aligning text presentation with a reader's visual processing needs, these improvements are immediate and measurable. Personalized text formats enhance reading proficiency across all ages and proficiency levels. Digital environments offer greater control over visual presentation, benefiting learners across education, workforce development, and professional settings.

A cross-sector community of academic researchers, technology and edtech companies, educators, and nonprofits is driving this effort, ensuring personalized text formats are developed, tested, and implemented to maximize impact. This initiative reflects a broader shift in digital learning, where empirical research informs technological innovations that scale across diverse learning environments.

This position paper examines how a collaborative research ecosystem is advancing the adoption of personalized text formats through a rigorous, research-informed approach to implementation. By leveraging learning engineering principles, this work bridges the gap between scientific research and real-world application in education and professional

settings. The intended audience includes researchers, educators, technology developers, and policymakers engaged in digital learning, accessibility, and literacy initiatives.

Better Readability with Personalized Text Formats: A Learning Engineering Approach

The advancement of digital readability innovations highlights how Learning Engineering principles can guide the development and implementation of educational solutions. The nonprofit advocacy organization Readability Matters has united experts across disciplines to address individual learner needs, moving beyond the "average" student, as aligned with learning engineering principles (Goodell & Kolodner, 2022). This collaborative effort—encompassing researchers, technology companies, educators, and policymakers—has fostered significant advancements by integrating iterative design, data-driven adaptation, and human-centered development, all foundational principles of learning engineering (Baker et al., 2022).

This initiative follows a structured, research-driven roadmap that includes:

1. Expanding empirical research to deepen understanding of how text formats impact readability and comprehension, leading to evidence-based design recommendations.
2. Collaborating with technology and publishing companies to integrate personalized text formats into mainstream digital reading environments, ensuring accessibility and scalability.
3. Encouraging widespread adoption through policy engagement, industry partnerships, and disseminating research findings to support implementation across education and professional sectors.

The Evolution of Better Readability Work

The following roadmap charts the multi-year evolution of efforts to implement personalized text formats, from early research and prototyping to large-scale deployment in digital reading and learning platforms. These foundational efforts laid the groundwork for The Readability Consortium (TRC), a collaborative research group advancing personalized readability. The community, a case study of learning engineering in real time, continues to grow, reflecting the potential for personalized text formats.

Table 1

Highlights of the Better Readability Roadmap

2004	Small-scale studies: Struggling readers improve with individual text format changes - pervasive tech is required to scale
2015	Full classroom study: most readers (all proficiency levels) benefit
2018	Tech proof of concept: Adobe Reader Prototype
2019	Adobe funds UCF Readability Lab * Adult Readers gain as much as 10 pages per hour * Events: CHI

2020	Adobe releases Liquid Mode with Reading Settings * Events: CHI, VSS, Adobe MAX
2021	Readability Research Community forms * Events: Adobe Ed Summit, Adobe MAX, SXSW EDU
2022	The Readability Consortium announced with founding members Adobe, UCF, and Readability Matters; Google joins as a full member * Readability Wiki published * Events: Skoll World Forum: Readability @ Ecosystem Day, SSSR, CHI, SXSW EDU, Adobe MAX, ProLiteracy
2023	K-8 Study: 20% gain in reading speed and comprehension published * UCF receives $1M appropriation * Time Best Inventions of '23: Adobe Liquid Mode * Math Readability research * 30+ readability papers published * AI-based Oral Reading Fluency Assessment + Implementation study launched * UCF awarded $1M Florida State Appropriation * Events: CHI, VSS
2024	Monotype joins TRC * Exquisitive Readability Tutor launched * UDL Guidelines expanded to include customizing text formats for individuals * Events: VSS, HFES, UDL-Con, IEEE ICICLE
2025	Best format assessment tool * Pilot Implementations * Standards development and more…

Recent developments underscore the broader implications of personalized text formats beyond education, extending into knowledge-based industries where professionals benefit from improved reading efficiency. This initiative is laying the groundwork for a new standard in digital reading—one that broadens accessibility at scale.

Readability research has informed updates to the UDL 3.0 guidelines, highlighting the necessity of customizable text formats for accessibility and learning. Technology companies play a crucial role in this transition, ensuring personalized reading settings become standard features across platforms rather than niche accessibility options.

Engineering Personalized Reading

Small-Scale Research and Early Prototyping

The journey began with small-scale research aimed at understanding how text formats can impact reading fluency and comprehension. Early studies and prototyping focused on traditional oral reading fluency tests, setting the foundation for larger-scale investigations and technological innovations. In 2004, Shaver-Troup, Bunger, and Crowley of the Lexend project evaluated 15 students from second to eighth grade at a school for students with dyslexia, all reading two or more levels below grade level. The results were an average 42% increase in reading fluency when using sans-serif fonts with adjustments to size, character width, and character and line spacing. This finding suggested that even minor adjustments

to text formats could have a significant impact on reading outcomes for students with dyslexia (Shaver-Troup et al., 2017)

To assess the impact of text format on typical readers, in 2015, Jordan of the revReading project evaluated the impact of different text formats on 33 third-grade students with varying reading proficiencies. The research found that 95% of the students improved their reading, with an average fluency gain of 28%. Interestingly, several students reading above grade level had above-average gains. The study demonstrated that a simple change from a traditional textbook format to the clean, round font AvantGarde improved reading fluency for 55% of the students. Furthermore, 40% of the students benefited from additional modifications, such as increased character spacing or character width expansion. This validated the benefit of personalized text formats across diverse learner populations. (Crowley & Jordan, 2019)

Scaling with a Large Technology Partner

Building on these initial studies, the next phase of research focused on expanding these findings through partnerships with major technology companies, such as Adobe, to explore how technology could scale these insights. In line with the learning engineering principle that technology can be a powerful tool for scaling educational innovations (Goodell, 2024), a significant partnership with Adobe began in 2017. This collaboration was timely, as Adobe was developing Liquid Mode for their Adobe Reader product. Liquid Mode, powered by AI and machine learning technology, improved the readability of PDFs on mobile devices by reflowing the text to fit the screen size better.

A prototype was developed at an Adobe Hack Week event, allowing the user to adjust five text format features. This prototype was used to modify text formats for a four-classroom study using iPads, generating the same positive results as seen previously using paper reading materials. Coincidentally, both the slowest and fastest readers in the third grade jumped 27 Words Correct per Minute (WCPM); readers of all levels signaled sensitivity to text format. The proof of concept demonstrated the potential to use technology to enhance individual reading performance on a larger scale. (Treitman, 2021; Jordan & Crowley, 2019)

As a result of its collaboration with Readability Matters, Adobe integrated new text format features—such as text size, character spacing, and line spacing—into Adobe Reader's Liquid Mode. By 2023, Liquid Mode had been used to read over a billion files, demonstrating widespread adoption of personalized readability enhancements. Time Magazine recognized Adobe as "One of the Best Inventions of 2023" (Still, 2020; Adobe Communications, 2024).

Launching Academic Research and Cross-Discipline Collaboration

After evaluating the results of the four-classroom study and recognizing the potential for Adobe's future PDF advancements, the Adobe Readability initiative (adobe.ly/ readability) began. This initiative includes funding a dedicated readability research lab at the University of Central Florida (UCF). (Treitman, 2021; Adobe Research, 2022)

Researchers from Brown University, Adobe, and UCF published their first peer-reviewed study on the impact of personalized text formats on adult readers in 2019. Wallace et al. noted, "Potential increases of 10 additional pages an hour is of real-world significance" (Wallace et al., 2020).

Adobe, UCF, and Readability Matters have been building a global community dedicated to advancing this emerging field, including a readability seminar series to provide a dynamic platform for experts from academia, industry, and education to present findings, explore emerging trends, and collaborate on innovative research initiatives. As part of this effort, consistent with Learning Engineering practices (Baker et al., 2022), the community is developing an ecosystem where researchers can more easily build on each other's findings and research code. A key focus of this planning is open source and data sharing with the goal of enhancing collaboration, driving innovation, and ensuring broader access to research that can improve reading outcomes for diverse populations. A significant achievement of this community was the publication of a comprehensive readability research methods paper, now an essential reference for researchers (Beier et al., 2022).

Expanding the Research with The Readability Consortium (TRC)

These cumulative efforts across academia, industry, and education have transformed readability research into a global movement, expanding to include diverse learners and educational contexts. Research expanded with the formation of TRC, a consortium among Adobe, Readability Matters, and UCF, later joined by Google and Monotype, dedicated to advancing academic research in text format readability to deepen the understanding of text format changes on reading behaviors. The research includes potential new diagnostic methods, such as technologies like eye-tracking and EEG. TRC is evaluating the intersection of format and content readability using GenAI. (https://thereadabilityconsortium.org/)

To date, the broader Readability Research Community has published over 30 papers. (See the [Readability Matters](#) and [TRC](#) websites.)

Expanding Education Research

Readability research expanded further into the impact of reading formats on K-12 student reading success. The following research findings demonstrate how, by embracing adaptive and personalized approaches in education, learning engineers can create solutions that improve outcomes across all levels by embracing adaptive and personalized approaches in education. (Goodell & Kolodner, 2022)

Personalized Text Formats on Comprehension in K-8 Students: Speed and accuracy are interesting measures, but comprehension is the ultimate goal of reading. In 2023, a learning engineering team comprised of Chapman University (cognitive neuroscience), ReadWorks (nonprofit edtech reading platform), the Royal Danish Academy (typography), and Readability Matters (readability advocate) evaluated the impact of text formats on K-8 student comprehension using semantic word and passage tasks with comprehension questions. Students demonstrated an 18% improvement in reading comprehension on the word task

reading with their best text format and a simultaneous 21% improvement in reading speed and comprehension on the passage task.

Sheppard et al. note, "It is likely that making font recommendations based on group-level findings will disadvantage many readers." This finding emphasizes the importance of aligning educational tools with each student's unique visual processing abilities and reinforces that no single text format suits all students. The researchers conclude, "Educational technology, publishing, and assessment tool companies should consider the development of font personalization features, which are currently unavailable for many educational tools, to improve reading outcomes in children." (Sheppard et al., 2023)

Mathematical Problem-Solving Efficiency: A 2023 study evaluated if solving mathematical problems would be more efficient or less challenging if presented in the student's best reading format. University-aged participants took an online assessment to evaluate their optimal text format. They completed mathematical problems in a control format and their best format. An individualized text format significantly reduced task completion time for basic arithmetic without affecting accuracy. "The use of custom typography settings may have the ability to reduce cognitive load for students, enabling them to process and solve basic arithmetic problems more efficiently." (Azzarello, 2023)

Studying Format Readability in Children: Supported by a $1M appropriation from the State of Florida, UCF is expanding research to improve reading outcomes for young learners. One study focused on the impact of font and inter-letter spacing on reading performance in third- to fifth-graders. The findings showed that silent reading speed improved, while no single font or spacing setting worked for every student. Importantly, these speed improvements did not compromise reading comprehension. The team noted that "this research presents important implications for building more supportive educational technology platforms for students to improve reading outcomes." (Day et al., 2024)

Implementation Research in Educational Settings: Designing solutions for reading format assessment and personalized content delivery requires seamless integration into existing systems, scalability, and minimal additional burdens for educators. A readability implementation research project involving literacy experts at the University of Oregon, the edtech nonprofit ReadWorks, and Readability Matters evaluated an implementation model and the impact of personalized text formats on student reading outcomes over time. Students were assessed to identify their best reading text format using an AI-based natural language processing (NLP) fluency assessment tool. The student's best text format was passed to the ReadWorks platform, which then delivered daily reading content in the best format for the treatment group and the standard format for the control group. (results forthcoming)

Consistent with Learning Engineering principles, this approach emphasized continuous analysis and iterative design, ensuring that these tools are optimized and effective before broader adoption (Goodell & Kolodner, 2022). Additionally, in line with Baker et al. (2022), the project aimed to improve the integration of data between classroom practices, student and learning experiences. This integration will help assess which practices around personalized text formats are most effective and scalable in real educational settings. Conducting

research in natural classroom settings presents challenges but also provides valuable insights for integrating personalized text formats into mainstream educational practices.

Implementation Examples in Education Settings

Real-world applications of personalized text formats demonstrate their impact across diverse educational and professional environments. Data-driven personalization and scalable technology solutions are being applied to improve reading outcomes. By integrating personalized text features into widely used educational technologies, information platforms, and reading apps, technology companies are expanding access to adaptive reading solutions and establishing them as a standard in digital reading and learning environments.

Adobe + World Education. World Education works to mitigate the challenges that smartphone-dependent adults face when accessing information online. To this end, it has partnered with Adobe to explore the value of improving the readability of digital text. Their work includes field testing Adobe Reader with Liquid Mode and Reading Settings in diverse contexts.

The Maryland Commercial Driver's License (CDL) testing project utilizes Reader to enhance the readability of CDL manuals and test materials, empowering adults to better prepare for CDL exams and secure meaningful employment. (Lee, 2022)

In Malawi, World Education is equipping 1,200 Community Case Workers (CCWs) focused on educating HIV-positive families with mobile PDFs. Enabling CCWs to access materials on mobile phones, adjust text for better readability, and quickly navigate documents. During a three-month pilot, CCWs reported decreased time spent at each household, allowing them to serve more families each day. (Schade & Vanek, 2024)

ReadWorks + Readability Matters. Research is the driving factor of all ReadWorks platform updates. Based on the results of the readability research to date and with grant funding from being a research partner in this work, ReadWorks has begun to expand its offering. ReadWorks has increased the text sizing options so that students can make some updates to their text format. The above-mentioned University of Oregon-led research study supported ReadWorks in modifying its platform to store a personalized text format in a student's reading profile, allowing students to read the ReadWorks passages and comprehension questions in their stored personalized text format. When the student assessment tool is ready for broader use, ReadWorks will leverage this technical capability built for research studies to roll out personalized text formats to the millions of ReadWorks students.

Readability Matters + Exquisitive. The partnership between Readability Matters and Exquisitive demonstrates an additional scalable approach for assessing a student's best text format. An assessment delivered through an interactive digital tutor, a naturalistic environment, is being rolled out to the Exquisitive user base, allowing learners to engage with content aligned with their individual needs.

Personalized Text Formats in the Universal Design for Learning (UDL) 3.0 Guidelines

UDL is a powerful framework that guides educators and edtech creators in the design of learning environments that are accessible, inclusive, and equitable. "When environments are intentionally designed to reduce barriers, every learner can engage in rigorous, meaningful learning." (CAST, 2024)

In July 2024, CAST.org released version 3.0 of the UDL Guidelines. A significant update to Consideration 1.1 focuses on customizing the display of information, offering information in formats that allow users to customize perceptual features such as font, text size, spacing, and background colors. The development of these guidelines was supported by research from six academic papers from the border readability research community. (CAST, 2024)

Limitations, Challenges, and Future Directions

While personalized text formats show great promise, there are several challenges to widespread adoption. Awareness remains low, and many digital platforms lack robust personalization features, limiting access. Integrating these formats into standardized assessments and curricula also presents logistical and policy hurdles.

Scaling research, a critical first step to better understand how text adjustments impact diverse readers, requires greater funding to refine how text adjustments impact diverse readers. While initial studies show strong results, broader implementation depends on sustained investment from government, industry, and research institutions.

Technical and infrastructural gaps further hinder adoption, particularly in resource-limited settings. Collaboration among edtech companies, policymakers, and funders, guided by learning engineering principles, is essential to making personalized readability a standard digital feature.

The transformative potential of personalized text formats requires collective action:

1. Educators: Implement personalized text formats in classrooms and professional learning. (https://readabilitymatters.org/readability-tech-tips)
2. Researchers: Expand studies to refine assessment methodologies and impact measurement.
3. Technology, Edtech, and Publishing Companies: Leverage research insights to build reader-centric platforms. Join TRC to collaborate as a leader in this important work.
4. Advocacy Organizations, Policymakers, and Funders: Support policies and funding to scale solutions.

Conclusion

Personalized text formats have the potential to significantly improve reading speed, accuracy, and comprehension. By aligning text presentation with a reader's visual processing

needs, these improvements are immediate and measurable, benefiting learners in education, workforce development, and professional settings.

To fully unlock this potential, Learning Engineering principles must guide implementation. A research-informed, rigorous approach ensures that personalized text formats are effective, accessible, and scalable across digital environments. By embedding personalized text formats into mainstream digital learning and information platforms, we can create a future where all individuals—regardless of ability or context—can read and learn more effectively.

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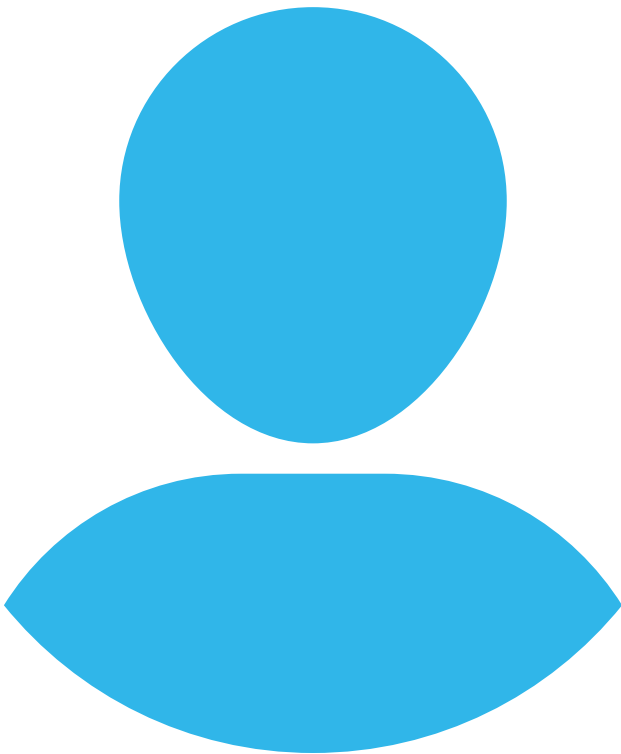
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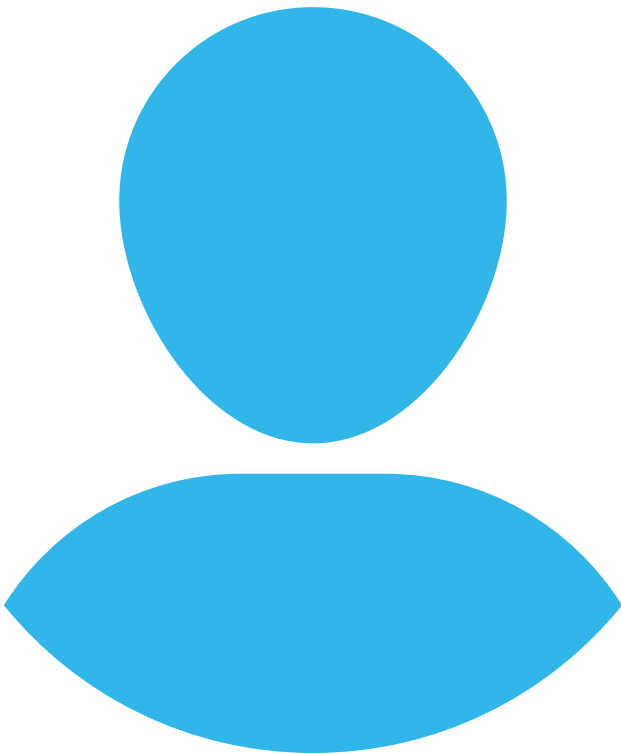
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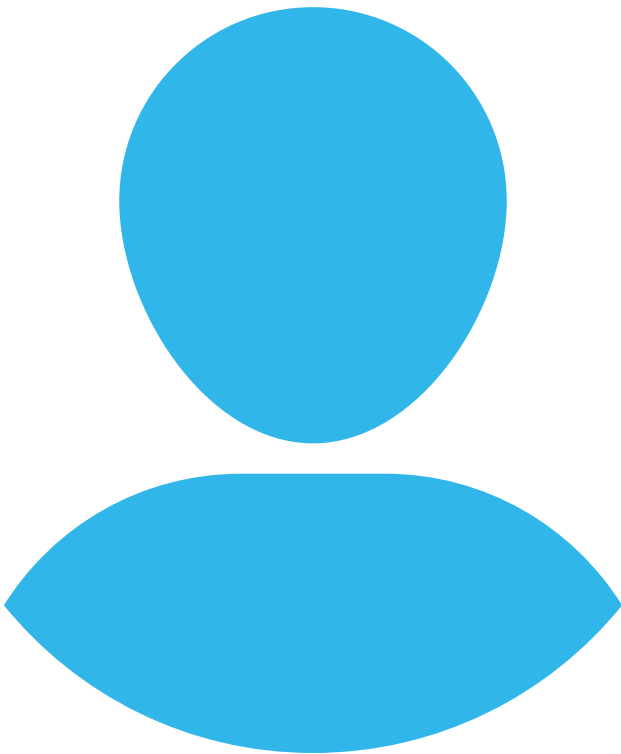
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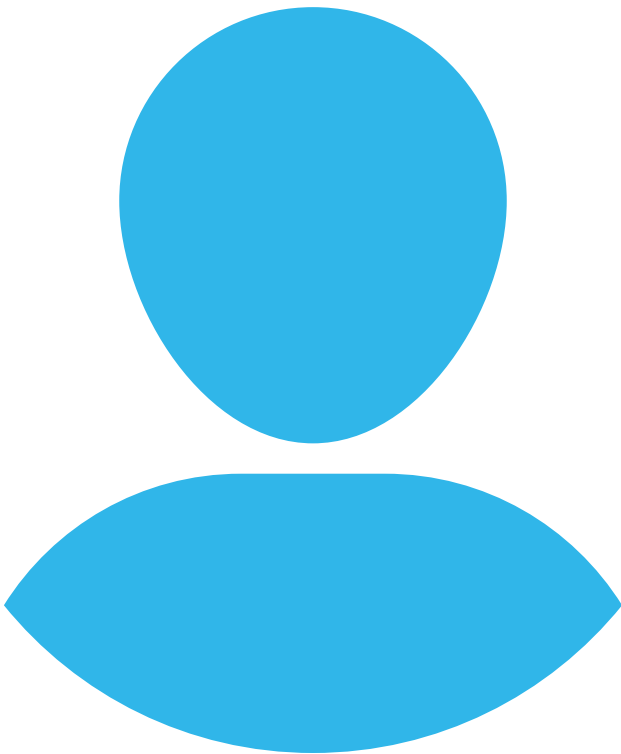
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