JOAN GANZ COONEY CENTER SANDBOX | SESAME WORKSHOP Joan Ganz Cooney Center

Translating literacy research to edtech:

What we have learned to support product development

ANGELICA DASILVA, PHD
DIANE GIFFORD, PHD

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ANGELICA DASILVA, PHD

Dr. Angelica DaSilva is a Postdoctoral Fellow for Literacy and Technology at the Joan Ganz Cooney Center, where she collaborates with multiple partners to support the development and iteration of literacy-focused technologies. Her focus areas are multilingual learners, writing, and educational technology. As a former educator with experience across K-12 and higher education settings, Angelica brings practitioner-informed perspective to her research. She has also led and contributed to multiple research projects, presented at national and international conferences, and is committed to advancing equitable, research-based literacy instruction.

DIANE GIFFORD, PHD

Dr. Diane Gifford is a Senior Fellow at the Joan Ganz Cooney Center, contributing expertise in literacy research, curriculum design, and educational technology to support equitable literacy. She is a literacy research specialist and former Clinical Associate Professor, now an adjunct professor at Southern Methodist University's Simmons School of Education. Since earning her Ph.D. in Educational Research in 2013, she has taught graduate literacy courses and conducted research at SMU. A former teacher and administrator in Dallas, she has contributed to projects including the K-8 Istation Indicators of Progress (ISIP) and the Enigma Project, supporting adult literacy.

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Foreword

In recent years, educational technology has opened new possibilities for supporting children's learning. From AI-powered reading coaches to interactive story worlds, digital tools are increasingly present in classrooms, homes, and the everyday spaces where children spend their time. These innovations carry enormous promise. They can expand access to learning opportunities, provide individualized practice, and connect children and families to new forms of literacy experiences. Yet realizing that promise requires more than creativity or technical ingenuity. It requires grounding design in what we know about how children learn.

Over the past several decades, the science of learning and the science of reading have produced a rich and growing body of knowledge about how literacy develops. Research has shown the foundational importance of oral language, vocabulary, and conversation in the early years. It has demonstrated the value of systematic instruction that helps children understand how written language works. And it has underscored the importance of opportunities to practice, apply, and discuss new knowledge in meaningful contexts. In short, literacy develops through interaction—between children and texts, between children and teachers, and between children and the people who care most for them.

Yet the rapid growth of educational technology has not always kept pace with this research. Too often, products are designed around novelty, engagement, or technical capability without fully drawing on what decades of research have revealed about how learning unfolds. Engagement matters, of course. Children must want to participate in learning. But engagement alone is not enough. Tools that genuinely support literacy must also provide structure, guidance, and opportunities for children to think, talk, question, and make sense of what they encounter in the world.

This is why initiatives like the Cooney Center Sandbox are so important. By bringing together researchers, designers, educators, and children, the Sandbox seeks to close the long-standing gap between research and design. Rather than treating research as something that comes after a product is built, this approach places learning science at the heart of the design process from the beginning.

Equally important, the Sandbox recognizes that children are not simply users of educational technology—they are invaluable participants in its design. Their perspectives, curiosities, and ways of interacting with media provide essential insights into how learning experiences can be made both engaging and developmentally meaningful. When children, educators, and researchers are included in the design process, innovation becomes more responsive to the realities of children's lives and learning environments.

The projects highlighted in this report reflect the creativity and commitment of organizations working to translate research into practice in thoughtful ways. Their efforts span a wide range of approaches—from supporting early oral language development to strengthening decoding, comprehension, and family engagement in literacy. What connects them is a shared recognition that technology is most powerful when it amplifies sound scientific instructional principles rather than replaces them.

The future of educational technology will not be determined solely by advances in artificial intelligence, new platforms, or increasingly sophisticated interfaces. It will depend on whether these innovations remain anchored in a deep understanding of how children learn.

When research and design move forward together, educational technology can become more than a tool for engagement. It can become a powerful support for the kind of learning experiences that help children build knowledge, language, and the confidence to become lifelong learners.

SUSAN B. NEUMAN, PHD
Professor of Childhood and Literacy Education
New York University

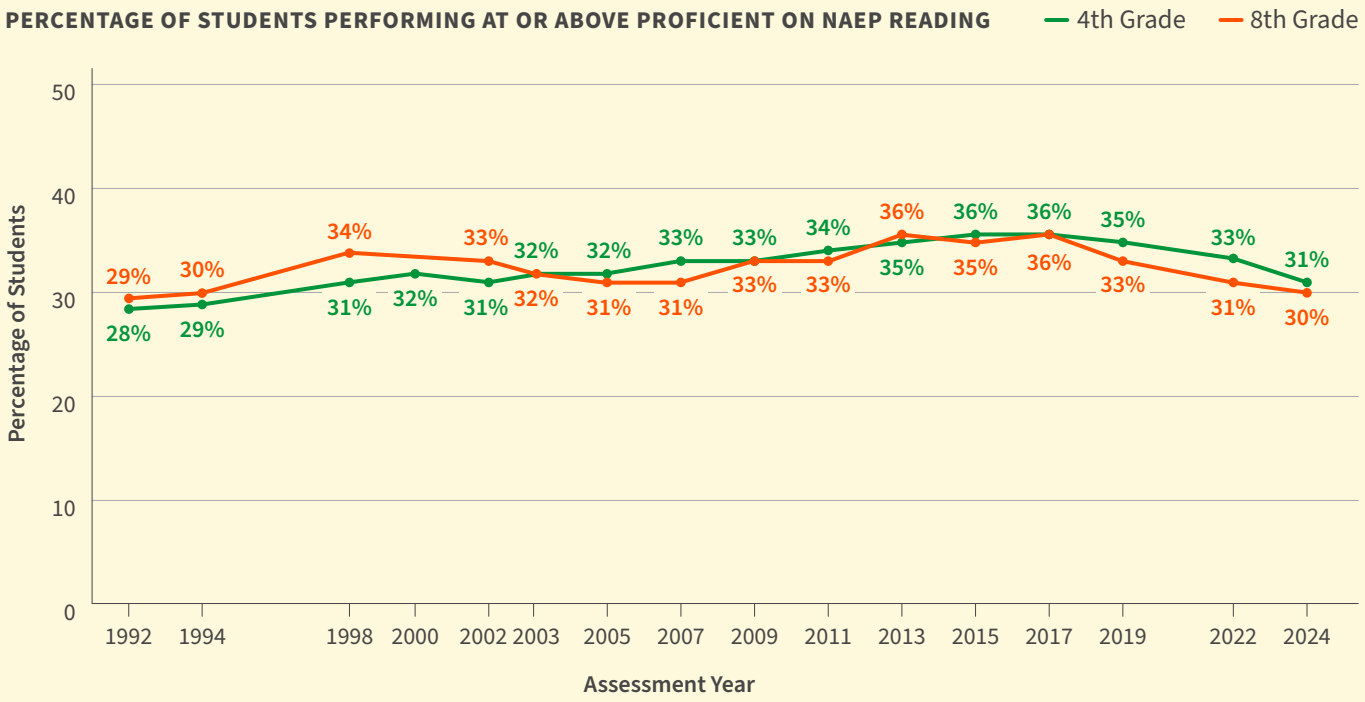
Introduction

In recent years, a surge of new digital learning tools has emerged in response to growing market demand for creative solutions to persistent reading challenges (Reich & Ito, 2017). Stagnant achievement scores on the Nation's Report Card (National Center for Education Statistics [NCES], 2025) show that current instructional approaches have done little to change outcomes for many students (Figure 1), and continue to reveal significant ongoing gaps in literacy learning for multilingual learners, students with disabilities, and under-resourced communities (Figure 2). Despite decades of effort, too many children still struggle with foundational reading skills, and opportunity gaps continue to widen.

At the same time, the body of evidence known as the **science of reading** has risen to prominence as its research base has become more widely accessible and discussed beyond academic circles (The Reading League, 2021). As the science of reading movement has gained momentum, tremendous progress has been made in understanding how the components of reading work together and the type of instruction children must have to advance in their literacy skills. In this paper, we use the term science of reading to encompass the full body of research on reading, writing, language development, and meaning-making processes.

FIGURE 1

PERCENTAGE OF STUDENTS PERFORMING AT OR ABOVE PROFICIENT ON NAEP READING



National Center for Education Statistics. (2026). NAEP Data Explorer. U.S. Department of Education, Institute of Education Sciences. https://www.nationsreportcard.gov/ndecore/xplore/NDE

FIGURE 2

Differences in 2024 NAEP Reading Proficiency Among U.S. 4th-Grade Student Groups

For more information on NAEP Student Group definitions: https://nces.ed.gov/nationsreportcard/guides/groups.aspx

National Center for Education Statistics. (2026). NAEP Data Explorer. U.S. Department of Education, Institute of Education Sciences. https://www.nationsreportcard.gov/ndecore/xplore/NDE

This expanding understanding of the science of reading has coincided with rapid innovation in educational technology (edtech), including the emergence of generative artificial intelligence (AI). Together, these trends position edtech designers to better integrate the science of reading into their products. This unprecedented opportunity creates potential for far-reaching access to quality literacy alternatives that can personalize instruction, model language development, scaffold word recognition and comprehension, and offer immediate feedback in ways previously thought impossible. At the same time, such tools should complement, not replace, high-quality print-based reading experiences and the relational, dialogic instruction between children, teachers, and caregivers. Ideally, thoughtfully designed digital tools will extend and support learning without displacing the central role of books, discussions, and human interaction.

Even with strong interest and good intentions, designing tools that accurately reflect literacy development is challenging. Developers must make complex choices about which skills to target, how to sequence instruction, and how to design for learners with widely varying needs. At the same time, they must respond to market pressures, technical setbacks, timelines, and funding constraints. At the Joan Ganz Cooney Center, we have worked to address these challenges through the Sandbox for Literacy Innovations initiative, a grant-funded partnership in which literacy researchers and edtech teams collaborate closely. The initiative kicked off in November 2024 by bringing together advisors and experts from education, developmental psychology,

FIGURE 3

and human-computer interaction backgrounds to assess the current state of literacy edtech, and to outline areas of greatest need and opportunity, later summarized in a report published by the Cooney Center. In our subsequent partnerships with edtech developers, we help designers situate their tools within the continuum of literacy development, and align them with evidence-based practices through in-depth consultations, iterative design feedback, and shared analysis of product goals. Each of our Sandbox product engagements has three core components: a series of literacy consultations, a workshop on designing for learner variability and Universal Design for Learning (UDL), and co-design sessions with children (Figure 3). This work is structured as a time-bounded, early-stage engagement, intended to inform design decisions during initial development. Although the Sandbox initiative does not serve as an ongoing iterative process across a product's full lifecycle, its purpose is to influence literacy alignment from the ground up.

Our work with the first cohort of Sandbox product partners has underscored both the promise and the complexity of this kind of collaboration. Developers bring creativity, technical expertise, and a deep understanding of user experience; researchers offer clarity about the mechanisms of literacy development and instructional design. This report outlines the most critical lessons emerging from the Sandbox, demonstrating how collaborative teams can harness the strengths of both developers and researchers, navigate common pitfalls, and translate the science of reading into a new generation of digital learning tools capable of addressing today's literacy crisis.

What is the Science of Reading?

The science of reading refers to a large and continually expanding body of research that explains how the human brain learns to read and write, how it processes spoken and written language, what skills readers and writers need to become proficient, and what kinds of teaching are most effective (Petscher et al., 2020). The science of reading is not a single method or commercial program. Rather, it encompasses five decades of interdisciplinary evidence from cognitive psychology, linguistics, neuroscience, and education; and describes how literacy develops, is assessed, and is taught.

One of the most important findings from this research is that reading is not something that humans are naturally wired to do (Gotlieb et al., 2022). Unlike oral language, which develops primarily through meaningful input and interactions, learning to read often requires explicit instruction to form new neural pathways in the brain. While some children make these connections with little effort, studies consistently show that most children need significant support to become proficient readers (Castles et al., 2018; Moats, 2020). These findings are consistent with NAEP reports indicating that only one in every three children can read proficiently (NCES, 2025).

Misunderstandings About the Science of Reading

Despite its growing prominence, the science of reading is often misunderstood or oversimplified in practice (Petscher et al., 2020). Many people assume it refers only to phonics. While phonics is a strong predictor of early reading success (National Reading Panel, 2000), literacy development also depends on a broader set of knowledge and skills. Because phonics is relatively easy to measure and standardize, it has often received disproportionate attention in research translation and product design (Duke & Block, 2012; Mancilla-Martinez, 2020, Mancilla-Martinez et al., 2021; Silverman et al., 2025), contributing to an abundance of narrowly focused tools that promise quick, measurable gains while representing only a partial view of reading development. Comparatively less attention has been devoted to supporting students' understanding of the printed words they are able to decode. To clarify what the science of reading represents, four key misconceptions should be identified:

Misconception #1: The science of reading is limited to phonics.
It actually encompasses the full spectrum of literacy development, including phonological awareness, fluency, vocabulary, background knowledge, and comprehension, as well as indirect factors such as motivation and engagement. Phonics alone cannot develop independent, thoughtful readers (see Lonigan et al., 2008; Scarborough, 2001).

Misconception #2: It is a program or method.
The science of reading is a rich interdisciplinary research base, not a prescribed curriculum. Educators and developers must interpret and apply the evidence with professional judgment and adapt it to diverse learners.

Misconception #3: It is incompatible with multilingual learners.
A common misconception is that the science of reading does not apply to linguistically diverse populations. In reality, foundational theories such as the simple view of reading (Hoover & Gough, 1990) were developed using data that included Spanish-English bilingual learners, and a substantial body of research demonstrates that evidence-based reading components such as decoding, language comprehension, and vocabulary are essential for multilingual learners. What differs is not the underlying constructs, but how instruction is scaffolded (Hoover & Gough, 1990; Lesaux & Kieffer, 2010; Proctor et al., 2005).

Misconception #4: Phonics is a building block that automatically leads to comprehension.
While foundational skills require explicit, systematic instruction in early grades, comprehension likewise benefits from explicit modeling and guided practice. Effective literacy instruction integrates foundational skills with rich reading, discussion, and writing experiences that promote meaning-making, curiosity, and joy.

What is Skilled Reading?

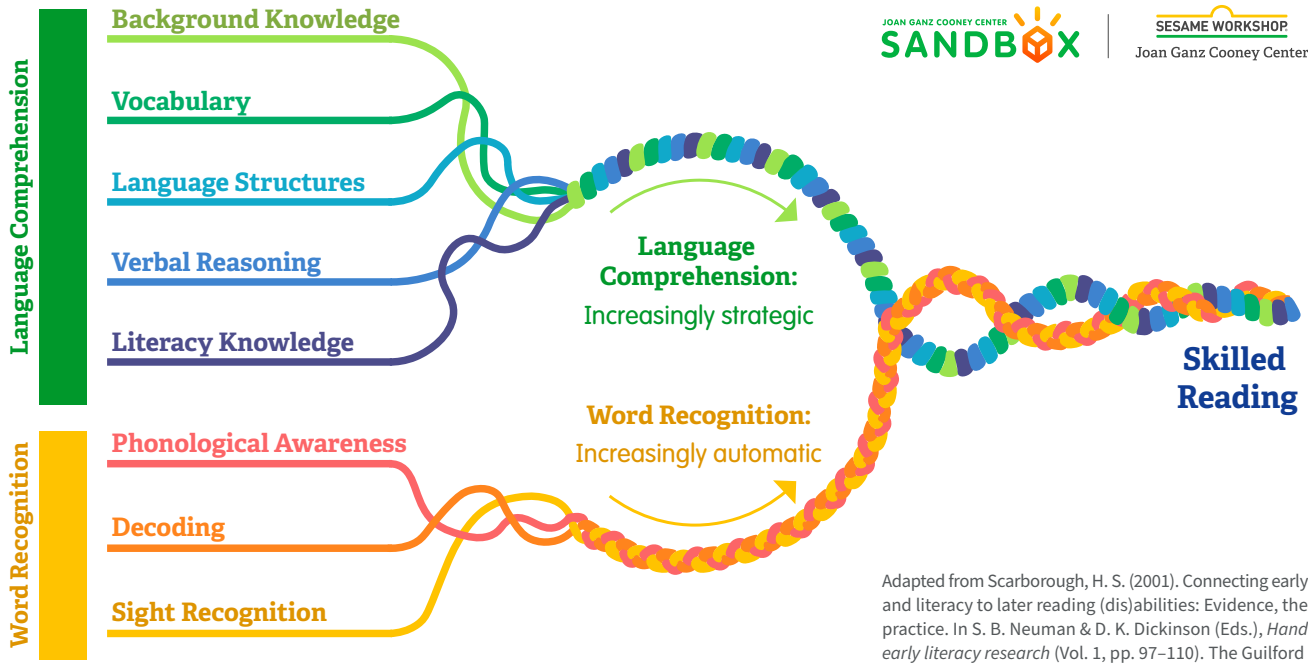
Scarborough's reading rope (2001) provides a clear framework for understanding how the components of skilled reading develop over time and ultimately support reading comprehension (Figure 4). The model illustrates two tightly connected strands:

- Word recognition (the lower strand) is the ability to identify words quickly and accurately through phonological awareness, decoding, and sight word recognition. These skills are expected to become increasingly automatic by the end of the primary grades, freeing cognitive resources for comprehension.
- Language comprehension (the upper strand) is the ability to make sense of what we read by drawing on background knowledge, vocabulary, language structures, reasoning, and an understanding of print and text. Language comprehension precedes reading and continues to develop across the lifespan as knowledge and language grow.

As both strands strengthen, they weave together to support fluent, meaningful reading. Skilled reading is therefore not a single ability but the integration of multiple interdependent skills.

FIGURE 4

SCARBOROUGH'S READING ROPE



Adapted from Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 97–110). The Guilford Press.

The Role of Decoding

Within the word recognition strand of the reading rope, decoding, or the ability to translate written symbols into sounds, is a critical gateway to reading (Gough & Tunmer, 1986). Once children begin to decode letter-sound combinations, the brain starts to store word patterns automatically, a process known as orthographic mapping (Castles et al., 2018; Ehri, 2005). As word reading becomes more fluent, this gradually frees up the cognitive space needed for comprehension and higher-order thinking. Weaknesses in phonological awareness (the ability to perceive sounds in language) can significantly delay this process and lead to long-term reading challenges.

Research clearly shows that early, explicit decoding instruction in kindergarten through second grade benefits all learners, and is especially effective for students at risk for reading difficulties, including dyslexia (Ehri et al., 2007; Torgesen et al., 2001). While intervention with older students is always possible and valuable, the effort and time required often increase substantially, making early intervention both more effective and more efficient.

Phonics instruction necessarily includes practice with isolated word-level skills as well as application in connected text. The goal of phonics is to develop accurate and automatic word recognition so that cognitive resources can be allocated to comprehension. However, in many edtech contexts, phonics is reduced to decontextualized drills that do not provide opportunities for transfer to meaningful reading. Such designs risk overclaiming effects on higher-order literacy outcomes. When decoding instruction is integrated with connected text, appropriate scaffolds, and engaging design, the learning experience can be both joyful and instructionally effective.

The Bigger Picture of Reading

While the reading rope illustrates the many skills that come together to create skilled readers, it also highlights an important truth: effective literacy instruction extends beyond decoding to include the full range of language and meaning. To this end, decoding instruction must always be paired with rich oral language experiences. This is because comprehension ultimately depends on a reader's ability to make meaning from language. If students cannot interpret vocabulary or sentence structure, or connect ideas to prior knowledge, accurate word reading alone will not result in understanding. From early on, students need opportunities to talk about texts, explore how sentences and paragraphs work, and read across genres, including narrative, informational, and argumentative texts. These experiences deepen comprehension and foster flexible thinking about language and meaning.

Reading therefore is not just about recognizing words on a page. It is understanding, connecting, interpreting, and imagining. Instruction must reflect this complexity if we are to cultivate readers who can think critically and engage meaningfully with text.

At the same time, one of the most overlooked aspects of literacy learning is the role of writing, which was identified as the neglected "R" of reading, writing, and arithmetic (National Commission on Writing, 2003). Writing is not only an outcome of literacy instruction but also a powerful driver of it. When students engage in the writing process (see Figure 5), they strengthen sentence-level skills, deepen their understanding of texts, and reinforce their vocabulary and content knowledge through active meaning-making.

FIGURE 5

Components of the Writing Process

The diagram shows arrows moving in both directions to illustrate that writers continually move back and forth among planning, goal setting, drafting, evaluating, revising, and editing as their ideas develop throughout the writing process.

Adapted from Graham, S., Bruch, J., Fitzgerald, J., Friedrich, L. D., Furgeson, J., Greene, K., ... & Wulsin, C. S. (2016). Teaching Secondary Students to Write Effectively. Educator's Practice Guide. What Works Clearinghouse.™ NCEE 2017-4002. What Works Clearinghouse.

Strengths of Edtech Partnerships

The opportunity to partner with edtech designers has highlighted the many strengths they bring to creating engaging, child-centered literacy tools. Teams join the Sandbox at different stages of product development: some are refining existing products, others are building new ones, and some are seeking knowledge about foundational literacy before development begins. Across these varied entry points, we have found areas for better alignment with the science of reading, and all our partners have shared a commitment to improving their products and the learning experiences they offer children.

A key strength is developers' ability to understand current market trends and respond quickly with innovative products. Particularly, developers aiming to enter the education market must be mindful of the latest policy and compliance expectations, including state legislation, standards alignment, district procurement requirements, and student data privacy regulations. As interest in artificial intelligence expands, developers are also exploring ways to use AI to personalize learning, improve diagnostics, and enhance feedback while maintaining safe, developmentally appropriate design.

We have also found that most developers are genuinely open to collaboration. Many seek short-term guidance from advisers early in the design process to shape ideas, review prototypes, and strengthen alignment with literacy research. Several hire individuals with literacy knowledge to serve as a bridge between technology and curriculum design.

These collaborations demonstrate openness to professional input and a readiness to learn more deeply about the content they are creating. They also support a growing recognition of the importance of research in product design. "Too many edtech tools are created without the rich insights from learning sciences," shared Natalia Kucirkova, PhD, director of the International Centre for EdTech Impact (WiKIT). "Collaboration helps academic know-how make its way into products and ultimately into classrooms."

> *"Too many edtech tools are created without the right insights from learning sciences. Collaboration helps academic know-how make its way into products and ultimately into classrooms.*
>
> NATALIA KUCIRKOVA, PHD

The Sandbox as a Response to Design Challenges

While partner teams enter the Sandbox with considerable expertise, the work of translating the science of reading into digital experiences remains complex. Across our product audits and consultations, a few recurring challenges have emerged as edtech teams attempt to bring the science of reading into digital spaces. These challenges arise from the inherent complexity of representing literacy, a multidimensional process, within the constraints of product design. Many product teams come with noble intentions and expertise in certain areas, yet gaps remain when translating reading research into coherent, instructionally sound digital environments.

A common issue is the tendency toward a one-size-fits-all model of literacy instruction. Early product versions often target an imagined "average" learner, despite the fact that real settings and classrooms come with linguistically, cognitively, culturally, and experientially diverse learners (Rose, 2016). Designing around the middle of the bell curve can unintentionally overlook the very learners who need the most responsive, thoughtfully scaffolded instruction. Although UDL offers a framework for inclusive design, its implementation in edtech is often surface-level, centered on interface preferences rather than instructional scaffolding. Similarly, adaptive algorithms tend to personalize pacing or sequencing rather than pedagogy. A child struggling with complex multisyllabic word structures or academic language will not benefit from faster or slower lesson delivery; they need targeted supports, explicit teaching, and meaningful opportunities to make sense of language.

We also frequently observe hyperfocus on one literacy skill (e.g., phonics, vocabulary) without attending to the interconnected skills that support reading development. When components are isolated rather than orchestrated, digital tools risk presenting literacy as a set of discrete tasks rather than as a holistic, meaning-making process. This fragmentation is often intensified by misinterpretations or partial understandings of research. For example, a tool may drill consonant blends with impressive precision yet offer no opportunities for students to apply those skills in connected text, inadvertently reinforcing the misconception that mastery of subskills alone leads to proficient reading.

> *"We also frequently observe hyperfocus on one literacy skill (e.g., phonics, vocabulary) without attending to the interconnected skills that support reading development.*

These patterns point to a broader need: structured opportunities for edtech teams to engage deeply with research, examine assumptions about learners, and translate complex literacy processes into actionable design decisions. This is where the Sandbox becomes a powerful model. By convening researchers, developers, and learners in collaborative cycles of analysis and feedback in early product development, the Sandbox helps teams move beyond one-size-fits-all thinking, integrate skills rather than isolate them, and build a more panoramic understanding of literacy. It provides the guidance needed to interpret research accurately, consider learner variability from the outset, and design tools that reflect the full complexity of how children learn to read.

Recommendations for Edtech Developers and Designers

Guided by lessons learned across collaborations with the first cohort of Sandbox partnerships, this report highlights several opportunities to strengthen the ties between literacy research and edtech design. As discussed, developers bring technical expertise, creativity, and a deep commitment to supporting learner needs. Yet literacy acquisition is complex, and many design decisions require intentional, evidence-based choices to truly optimize literacy development and instruction.

The recommendations that follow reflect the gaps we have observed in the field, including areas where design teams would benefit from clearer guidance and stronger connections to established research. These recommendations are intended to support developers as they create, refine, and implement tools that embody the science of reading, and expand access to high-quality literacy experiences for all children.

Anchor product design in the science of literacy

- Design literacy experiences that reflect both how reading develops (across word-level and language-level skills) and how writing develops (through strategic, self-regulated processes). Instruction should support learners from early childhood through adolescence and account for growth over time.
- Sequence content according to developmental progression, especially for phonological awareness, decoding, fluency, and vocabulary.
- Ensure instruction is explicit and systematic: products should directly teach skills through modeling, guided practice, feedback, and review, rather than assuming students will infer skills through exposure alone.
- Provide explicit foundational skills instruction prior to meaningful reading, listening, and writing experiences so students can apply those skills in authentic contexts rather than within isolated drills.
- Emphasize learning processes and not just outcomes. In reading, this means looking beyond accuracy or comprehension scores to understand how learners integrate ideas to make meaning from text. In writing (see Figure 5), this involves examining how learners plan, draft, revise, and regulate their writing, consistent with self-regulated strategy development (SRSD)[1] approaches.

Design for authentic literacy experiences

- Use rich texts, oral language routines, and opportunities for discussion to support comprehension and knowledge building.
- Encourage children to apply new decoding or vocabulary skills in meaningful contexts.
- Connect foundational skill practice with real reading and writing tasks, not only gamified exercises.
- Keep the reading experience focused on understanding the text. Game-like elements inserted during reading can distract children from meaning-making and disrupt comprehension. If interactive components are included, use them before or after reading rather than during the reading experience itself.

[1] Self-Regulated Strategy Development (SRSD) is an evidence-based model of explicit writing instruction that combines strategy teaching with self-regulation supports such as goal setting, self-monitoring, and guided practice. SRSD has demonstrated positive effects on writing quality across grade levels and diverse learner populations (Harris & Graham, 2016).

Build expertise into teams

- Involve literacy researchers, educators, and designers early and consistently throughout the design cycle.
- Hire literacy specialists who can bridge curriculum design and product development.
- Create internal processes that ensure ongoing research review, not a one-off consultation.

Support teachers/caregivers as key users

- Include dashboards and reporting tools that provide actionable, instructionally relevant insights, such as alerts about specific phonics patterns a student is struggling with, recommendations for targeted vocabulary scaffolds, or summaries of writing strategy use aligned with SRSD that can guide next-step instruction.
- Offer guidance to help teachers/caregivers understand why a task matters and how it aligns with literacy development.
- Build options so tools can be used in centers, small groups, intervention, or home practice.

Design for engagement, access, and equity

- Use inclusive design principles to create tools that are accessible for multilingual learners, children with disabilities, and students with varying literacy backgrounds.
- Provide multiple entry points and supports so learners can successfully navigate tasks regardless of skill level.
- Ensure cultural and linguistic representation in texts, audio, examples, and interactions.

Use AI to enhance (not replace) instruction

- Use AI to support personalization, diagnostics, and targeted feedback, while maintaining alignment with literacy development research.
- Prioritize safety, transparency, and data privacy, especially when working with young children.
- Design AI-driven features that extend teacher capacity, rather than automate pedagogical decision-making in ways that may oversimplify instruction.

Prioritize iteration and evidence gathering

- Co-design and pilot products with diverse learners, and use iterative cycles of refinement.
- Gather data not just on item correctness but on transfer, engagement, and growth across multiple literacy strands.
- Set a goal to conduct and share results from independent efficacy studies that evaluate learning impact.

Make research communication clear and accurate

- Avoid making broad claims such as "we follow the science of reading", as this oversimplifies and often misrepresents the broader body of literacy research.
- Use language that reflects the broader science of literacy, acknowledging your product supports vocabulary, comprehension, oral language, writing, and/or background knowledge.
- Ensure marketing claims about "research alignment" are transparent, specific, and supported by evidence.

Success Stories

Our consultation model is designed to serve as a collaborative, research-informed partnership with each organization. For each engagement, we begin by identifying literacy goals, instructional challenges, and product aspirations specific to the partner. Drawing on established frameworks and scientific evidence, we conduct a targeted review of the product, generate a set of tailored recommendations, and collaborate with teams through iterative discussions.

Across these partnerships, we have seen meaningful early impacts: clearer literacy pathways within products, strengthened alignment to evidence-based instructional principles, more intentional scaffolds for diverse learners, and improved design rationales that support both educators and children. The success stories that follow exemplify how different partners have applied consultation insights to enhance their tools, along with positive shifts we have observed to date. These stories represent both the progress made and the continuing potential for collaborative, literacy-centered design.

At the time of this writing, we are moving through the second year of the Sandbox Initiative for Literacy Innovations and are putting these lessons into practice by refining our approach, asking sharper questions earlier in the engagement, and working more closely with partners to ground their products in strong literacy research aimed at efficacy. We see this work not only as a series of individual collaborations, but as part of a broader effort to elevate the quality, coherence, and impact of literacy-focused edtech. By sharing these lessons, we invite developers, researchers, educators, and funders to engage in a more intentional, evidence-driven approach to product design—one that centers learners, honors the complexity of literacy development, and advances the field toward more equitable and visible learning.

→ LitLab

→ LeapFrog

→ E-Line Media

→ Sago Mini

→ Lirvana Labs

LitLab

Strengthening Literacy Through Innovation
LitLab.ai is a school-based platform that uses AI to generate decodable books aligned to phonics curricula to support student decoding and fluency practice. Through the engagement with Sandbox, LitLab has made significant strides in advancing literacy supports for young learners. The company began with a strong foundation—an AI-enabled decodable text platform—but their early iterations left room for improvements in accessibility, inclusivity, and instruction alignment. Throughout their engagement with Sandbox consultations, LitLab responded to targeted recommendations, enacting measurable improvements that transformed their tool into a more comprehensive, classroom-ready literacy solution.

Enhancing Decodables with Explicit Supports
One of the earliest changes was the integration of scaffolds into decodable texts. Initially, students encountered texts without consistent supports for unfamiliar words. Based on recommendations, LitLab incorporated vocabulary pop-ups with word definitions and the ability to hear the word pronounced (see Image 1). These tools not only help emerging readers decode text more effectively but also increase their comprehension and confidence.

Prioritizing Multilingual Learners
Recognizing the diverse linguistic backgrounds of classrooms, LitLab added multilingual features. The platform now offers home-language support and translation options, ensuring that multilingual learners can access texts in ways that affirm their identities while building English proficiency. These changes aligned directly with inclusive design recommendations and demonstrated LitLab's commitment to equity.

Improving Teacher Tools and Feedback Loops
Originally, teachers had limited insight into how students were engaging with texts. In response to feedback, LitLab updated its teacher dashboard to include error analysis, track student progress, flag decoding challenges, and recommend next steps. This enhancement reduces teacher workload while strengthening instructional decision-making.

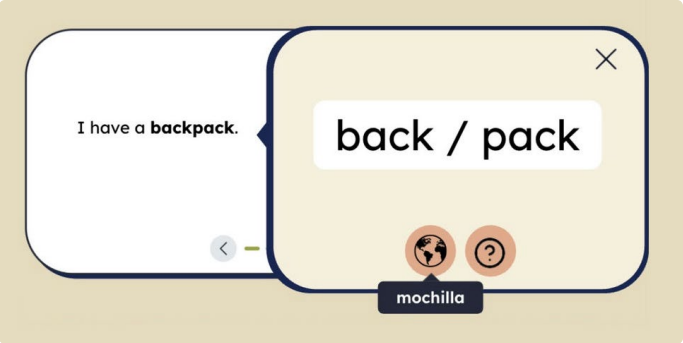
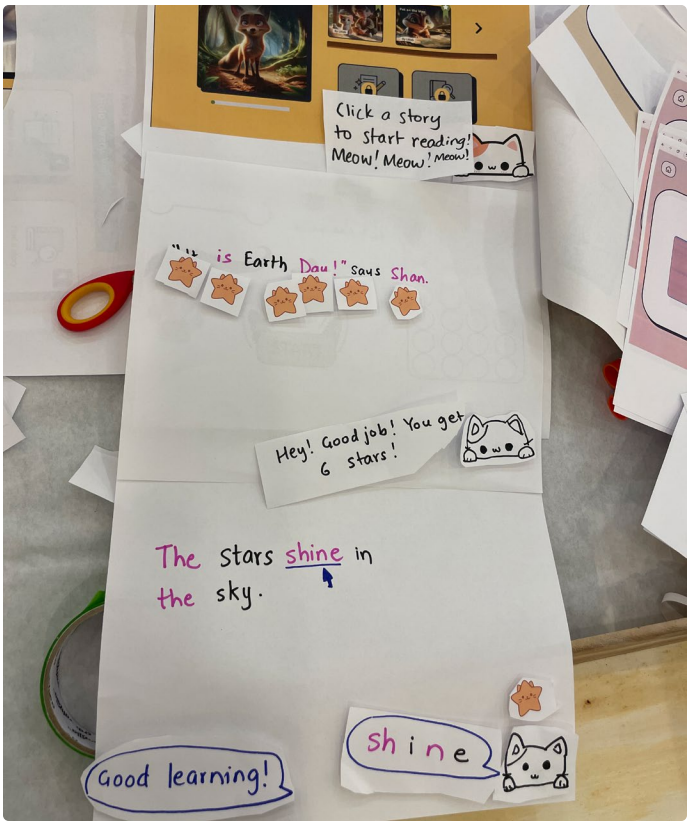


IMAGE 1: An example of a vocabulary pop up with multilingual features in LitLab's digital decodable books.



IMAGES 2–3: Kids co-design ideas for scaffolds in LitLab's digital reading experience.

Impact and Outlook

The literacy-focused changes made by LitLab illustrate how evidence-based recommendations, when acted upon, can transform a promising idea into a powerful instructional resource that supports teachers and students alike. Teachers have access to an easy-to-use platform, aligned with research-based reading practices; while students, particularly multilingual learners and those at risk for reading difficulties, can experience more personalized and effective literacy instruction.

> *The literacy consultations provided research-backed recommendations that helped us align our designs more closely with the science of reading and structured literacy principles. The feedback didn't only validate our work. It has pushed us further, guiding product development and design decisions that support all dimensions of reading development.*
>
> DREW MCCANN, HEAD OF LEARNING AT LITLAB.AI

LeapFrog

Advancing Literacy Through Universal Design and Reader Supports

LeapFrog has long been recognized for its commitment to early literacy and playful learning. LeapFrog's digital library delivers a growing collection of e-books and interactive titles by digitizing select books from its LeapStart and LeapReader catalogs and creating new storybooks designed for young readers. Through collaboration with our literacy consultancy, the company has taken meaningful steps to strengthen its digital reading offerings and related experiences to foster autonomy, engagement, and comprehension for young readers.

Explicit Instruction and Scaffolding

LeapFrog responded to the need for clearer guidance by exploring new techniques that integrate auditory instructions and modeling within story narration. This helps children understand the "Word-by-Word" highlighting feature and its value in following along with text. As new e-books are developed, the narrator will demonstrate how highlighting supports tracking and comprehension, an important step in building independent reading strategies.

Universal Design Features for Diverse Readers

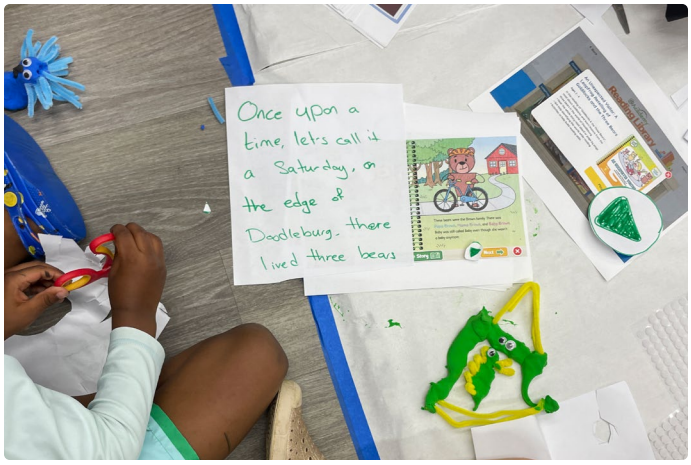
The company is exploring different techniques that might be beneficial for universal design for diverse readers, including adjustable font colors, audio read pacing and speed, and user controls for story read and page turning to make the e-book experience more accessible for children with different needs and preferences. These refinements align with UDL principles by ensuring multiple pathways for access and engagement.

Improved Comprehension Supports

Based on initial insights from the Sandbox co-design sessions, LeapFrog is actively prototyping ways to guide attention to illustrations, frontload vocabulary, and streamline visuals in future books. This demonstrates an awareness of how design choices affect children's ability to connect meaningfully with text.

Impact

These literacy-focused changes reflect the company's desire to move toward an even more inclusive, research-informed design. By embedding scaffolds, enhancing accessibility, and aligning features with literacy science, LeapFrog is better equipping young readers to develop the foundational skills needed for lifelong reading success.



IMAGES 4–5: Preschoolers co-designing comprehension supports in a co-design session with LeapFrog.

E-Line Media

Elevating Literacy with RiSi

RiSi is a patented voice-activated early-reading app that animates storybook illustrations when a child reads aloud and offers a friendly octopus book-buddy to provide corrective support and encouragement, or to read aloud. Through focused literacy consultations, the company has taken significant steps to strengthen RiSi's role in supporting children's reading development. Two major outcomes stand out: 1) a sharpened attention to reading levels and vocabulary usage, especially when guiding children's independent reading; and 2) the creation of a logic model, or a one-page visual that shows how product features are designed to work together to help users, ultimately ensuring that all literacy features are strategically designed for impact.

IMAGE 6: A co-designer playing with a RiSi prototype.

Mindful of Reading Levels and Lexile Guidance

One of the most important outcomes has been the company's commitment to ensuring that children engage with texts that are appropriate for their developmental stage. Many books aimed at young readers are intended to be read aloud by adults, and contain vocabulary and sentence structures that are beyond the child's reading ability. As such, E-Line plans to integrate reading-level guidance into its independent reading mode. By aligning text selection with readability frameworks, RiSi will support fluency, comprehension, and confidence, particularly for emerging readers who benefit most from level-appropriate materials.

Building a Literacy Logic Model

Equally transformative, the company embraced the need for a logic model to structure its literacy features. This decision reflects a desire to build a coherent framework grounded in literacy science. By developing this roadmap, the company has shown its commitment to making research-informed design decisions and to communicating the educational value of RiSi to schools, families, and partners.

A Platform Positioned for Impact

Together, these changes signal a shift in how the company approaches literacy. By being mindful of when and how children engage with texts independently and by committing to a logic model for literacy development, RiSi is positioned not only as an engaging reading companion but also as a tool to support comprehension. These steps demonstrate the company's dedication to ensuring that every child's reading experience is purposeful, level-appropriate, and rooted in evidence-based practice.

> *"The time the Sandbox team took to really understand our product and our needs was so valuable. It meant the time we spent together wasn't just children's literacy education in broad strokes—it was a refined approach to the topic through the lens of our goals and our product.*
>
> JASON EVERETT, VP PRODUCTION, E-LINE MEDIA

IMAGE 7: Co-designers working together to create supports for children reading with E-Line's RiSi.

Sago Mini

Integrating Phonics Research into Product Design
Sago Mini is a studio that creates imaginative, engaging educational games for young readers. Initially the studio developed a phonics learning app called Superfonik that selected and sequenced words based on word frequency and level of difficulty. The design reflected an early commitment to data-informed content but did not fully align with established principles from the science of reading, which emphasize the importance of explicit and systematic phonics instruction (National Reading Panel, 2000; Ehri, 2020).

Turning Play Into Instruction
Through consultation with our literacy team, Sago Mini explored ways to increase the instructional precision of its design. We provided research-based guidance on how young readers acquire decoding skills through structured phonics progressions that move from simple to complex letter-sound correspondences. Drawing from frameworks such as Scarborough's Reading Rope (2001), we emphasized the value of cumulative review, controlled word sets, and opportunities for transfer of the skills learned in the game to connected text.

Towards a Phonics Pathways
Based on these recommendations, Sago Mini redesigned the core algorithm to follow a phonics-aligned curriculum. Rather than ordering words in the game by frequency and level of difficulty, the new system sequences content according to an evidence-based phonics scope and sequence. Each instructional unit introduces new grapheme-phoneme correspondences explicitly, provides targeted practice opportunities, and integrates previously taught skills for reinforcement.

Greater Coherence Across Levels
The updated game demonstrates stronger alignment with research-based literacy instruction. The structured progression supports a decoding development framework, improves coherence across game levels, and provides greater instructional transparency for educators and parents.

IMAGE 8: Testing Sago Mini's Superfonik app in order to give "likes, dislikes, and "design ideas" feedback during a co-design session.

Playful Design Meets Rigor

This case illustrates how integrating literacy science into product design can strengthen the pedagogical foundation of educational technology. Sago Mini's redesign exemplifies how cross-sector collaboration between researchers and developers can ensure that playful learning experiences remain both engaging and instructionally rigorous.

> *I've learned so much about the science of reading and phonics education from the literacy consultations. I came in with a lot more background on creating engaging experience for kids, but not specifically in the literacy space, so having the expertise on making sure we were introducing words and skills properly, and having an eye on how product features reflect this has been so valuable.*
>
> YOUNGNA PARK, PRODUCT LEAD, SUPERFONIK, SAGO MINI

IMAGE 9: Testing Sago Mini's Superfonik app in order to give "likes, dislikes, and "design ideas" feedback during a co-design session.

Lirvana Labs

Aligning AI Writing Support with Self-Regulated Strategy Development (SRSD)

Lirvana Labs develops AI-powered learning tools for children, with a focus on early literacy. Its Sandbox engagement focused on the development of a new writing tool aimed at upper elementary and middle school students. When the company first entered the Sandbox, its AI writing agent was being designed around a model that emphasized writing output. Early consultations identified potential barriers to classroom adoption, especially around student motivation, cognitive load, and concerns that the AI focused too heavily on the student's writing product over their skill development.

Research Alignment: SRSD as the Backbone

We recommended the adoption of the SRSD model (Graham, 2006), supported by a Model–Practice–Reflect (MPR) cycle. This research-backed approach emphasizes explicit strategy instruction, scaffolding, and self-regulation, enabling students to plan, draft, and revise effectively. Feedback integration was also highlighted, drawing on Hattie and Timperley's (2007) framework of feed-up, feed-back, and feed-forward* to expand the types of reflection the product supported.

Action Taken

The company made a structured pivot in their product development with:

+ Revised product framework to adopt SRSD as the guiding instructional model
+ Integrated scaffolds such as sentence combining/expanding, sentence starters, and prompts for idea generation
+ Embedded feedback loops to promote student goal-setting, reflections, and iterative improvement

What Changed for Students (and Teachers)

Through this shift in structure, the AI writing agent shifted from being a feedback generator focused on the final product to serving as a strategic writing coach that guides students through the writing by supporting self-regulation. By scaffolding writing processes and embedding evidence-based feedback, the product now supports motivation, builds transferable skills, and empowers teachers with flexible implementation.

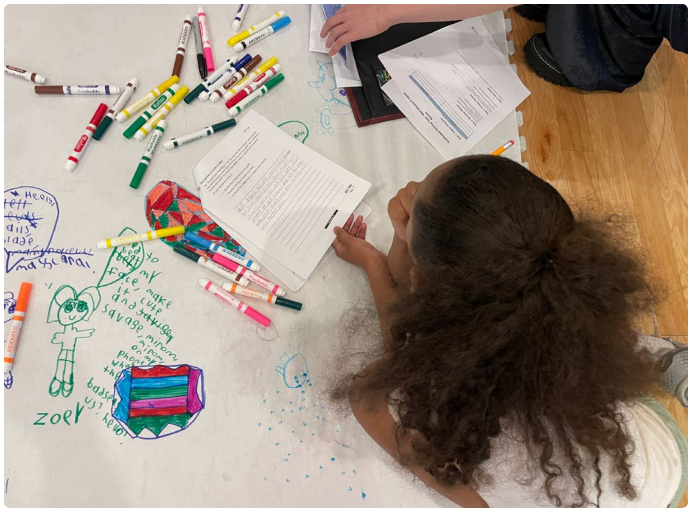


IMAGE 10: A co-designer completes a writing exercise before getting feedback from Lirvana Labs's AI-powered writing companion.

* Feed-up - "Where am I going?": Helps learners understand what they are aiming for and why it matters. Feed-back - "How am I doing?": traditional information about the learner's current performance relative to the goal. Feed-forward - "Where to Next?": provides guidance for future improvement.

Why it Matters

This case illustrates how research-based consultation can drive innovation. By adopting SRSD and feedback principles, the company positioned its product to meaningfully impact student writing development and align with classroom needs.

> *The literacy consultation provided a strong, research-backed foundation for our team to build upon. We're using the SRSD and MPR cycles as the groundwork for our writing and language reasoning tool, which guided our design of a non-linear user flow. We want to mindfully support students in developing the ability to assess for themselves what stage of the writing process they need to address, building a tool that balances guidance with ownership.*
>
> SARAH SUNG, SENIOR DESIGNER, LIRVANA LABS

IMAGE 11: A co-designer listens to writing feedback from Lirvana Labs's AI-powered writing companion.

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Lonigan, C. J., Schatschneider, C., & Westberg, L. (2008). Identification of children's skills and abilities linked to later outcomes in reading. In J. Torgesen & B. Foorman (Eds.), *Reading research handbook* (pp. 179–199). Routledge.

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Mancilla-Martinez, J., Hwang, J. K., & Oh, M. H. (2021). Assessment selection for multilingual learners' reading development. *The Reading Teacher, 75*(3), 351-362. https://doi.org/10.1002/trtr.2053

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Many of the resources below were developed as practice guides for educators or as academic research studies, rather than as materials written specifically for digital product design. As a result, some recommendations will require thoughtful translation into an edtech context. For this reason, we strongly recommend consulting with a literacy expert to support the interpretation and application of these research-based practices into developmentally appropriate digital design. We include these sources because they represent the strongest available research on literacy development and instruction.

Grades K-5

Instructional approaches that support executive function aspects, self-regulation, feedback, choice/agency, and engagement

Lane, K. L., Baldy, T., Becker, T., Bradshaw, C., Dolan, V., Dymnicki, A., Freeman, B., Holian, L., Lemire, S., McIntosh, K., Moulton, S., Nese, R., Payno-Simmons, R., Porowski, A., & Sutherland, K. (2024). *Teacher-delivered behavioral interventions in grades K–5* (WWC 2025001). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. https://whatworks.ed.gov

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., and Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ncer.ed.gov

Grades K-3

Foundational skills, academic language, segmentation, phonological Awareness, decoding, blending, fluency and comprehension

Foorman, B., Beyler, N., Borradaile, K., Coyne, M., Denton, C. A., Dimino, J., Furgeson, J., Hayes, L., Henke, J., Justice, L., Keating, B., Lewis, W., Sattar, S., Streke, A., Wagner, R., & Wissel, S. (2016). *Foundational skills to support reading for understanding in kindergarten through 3rd grade* (NCEE 2016-4008). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. http://whatworks.ed.gov.

Grades K-8

ESL scaffolds, screening, content-area knowledge, vocabulary, academic language, writing development

Baker, S., Lesaux, N., Jayanthi, M., Dimino, J., Proctor, C. P., Morris, J., Gersten, R., Haymond, K., Kieffer, M. J., Linan-Thompson, S., & Newman-Gonchar, R. (2014). *Teaching academic content and literacy to English learners in elementary and middle schoo*l (NCEE 2014-4012). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/wwc/publications_reviews.aspx

Gersten, R., Baker, S.K., Shanahan, T., Linan-Thompson, S., Collins, P., & Scarcella, R. (2007). *Effective literacy and English language instruction for English learners in the elementary grades: A practice guide* (NCEE 2007-4011). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/wwc/publications/practiceguides

Grades K-5

Writing development, writing model, writing process, self-regulation, scaffolds, techniques, spelling, sentence structure, choice and agency

Graham, S., Bollinger, A., Booth Olson, C., D'Aoust, C., MacArthur, C., McCutchen, D., & Olinghouse, N. (2012). *Teaching elementary school students to be effective writers: A practice guide* (NCEE 2012-4058). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/wwc/publications_reviews.aspx#pubsearch

Grades K-3

Comprehension strategies, text organization and structure, motivation and engagement

Shanahan, T., Callison, K., Carriere, C., Duke, N. K., Pearson, P. D., Schatschneider, C., & Torgesen, J. (2010). *Improving reading comprehension in kindergarten through 3rd grade: A practice guide* (NCEE 2010-4038). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. whatworks.ed.gov/publications/practiceguides

Grades K-2

Response to Intervention, foundational reading skills, progress monitoring, target areas for early screening, differentiated reading instruction

Gersten, R., Compton, D., Connor, C.M., Dimino, J., Santoro, L., Linan-Thompson, S., and Tilly, W.D. (2008). *Assisting students struggling with reading: Response to intervention and multi-tier intervention for reading in the primary grades. A practice guide.* (NCEE 2009-4045). Washington, DC: National Center for Edu-cation Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/wwc/publications/practiceguides.

Grades 4-9

Decoding multisyllabic words, building fluency, comprehension, background knowledge, self-monitoring

Vaughn, S., Gersten, R., Dimino, J., Taylor, M. J., Newman-Gonchar, R., Krowka, S., Kieffer, M. J., McKeown, M., Reed, D., Sanchez, M., St. Martin, K., Wexler, J., Morgan, S., Yañez, A., & Jayanthi, M. (2022). *Providing reading interventions for students in grades 4–9* (WWC 2022007). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. https://whatworks.ed.gov/

All grades

Interactive features and instruction that foster learning and/or comprehension

Bus, A., Kucirkova, N., Ten Braak, D., & Ciesielska, M. (2025). Which interactive features in children's digital picture books promote reading comprehension? A meta-analysis. *Early Education and Development*, 1-20. https://doi.org/10.1080/10409289.2025.2571978

Dahl-Leonard, K., Hall, C., & Peacott, D. (2024). A meta-analysis of technology-delivered literacy instruction for elementary students. *Educational Technology Research and Development*, 72(3), 1507-1538. https://link.springer.com/article/10.1007/s11423-024-10354-0

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National Commission on Writing (2004). *Writing: A ticket to work... or a ticket out. A survey of business leaders*. College Entrance Examination Board.

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SESAME WORKSHOP

Joan Ganz Cooney Center

The Joan Ganz Cooney Center is an independent research and innovation lab within Sesame Workshop that advances positive futures for kids in the digital world. We conduct research on emerging technologies and collaborate with technologists, digital media producers, and educators to put this research into action to support children's learning and well-being. We facilitate an international network of researchers and partner with young people themselves, elevating their voices in our research and engaging them in co-designing digital media experiences. We also work directly with policy makers and investors to drive national conversations and decisions that help children thrive within our digital world.

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FOUNDATION

The Walton Family Foundation is at its core, a family-led foundation. Three generations of the descendants of our founders, Sam and Helen Walton, and their spouses, work together to lead the foundation and create access to opportunity for people and communities. We work in three areas: improving education, protecting rivers and oceans and the communities they support, and investing in our home region of Northwest Arkansas and the Arkansas- Mississippi Delta. To learn more, visit waltonfamilyfoundation.org.

SESAME WORKSHOP

Joan Ganz Cooney Center

1900 Broadway
New York, NY 10023

cooney.center@sesame.org
joanganzcooneycenter.org