Literacy and Mathematics

TOPICS IN EDUCATION

Touching the Future

Building Inclusive Assessments with Tactile Graphics and Integrated Technology

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by i-Ready

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Summary

This whitepaper examines how advances in tactile graphics and assistive technology are improving accessibility in Grades K–12 assessments for students who are blind or low vision (BLV). Developed by Curriculum Associates and the American Printing House for the Blind (APH), it addresses the challenge of maintaining rigorous assessment practices while making visual-dependent items in computer-adaptive assessments accessible.

The paper describes a scalable tactile solution aligned to thousands of assessment items, designed to work across platforms for embossers and emerging tactile display technologies.

Key insights for district leaders include moving beyond compliance-based accessibility, investing in scalable solutions, and preparing for emerging technologies. Ultimately, it argues that inclusive design improves both fairness and the quality of assessment data for learners with disabilities.

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Expanding Access without Compromise: The Future of Inclusive Assessment

Digital and adaptive assessments have transformed how educators understand student learning. While innovative, these assessments pose accessibility challenges for students who are blind or low vision (BLV) when test items depend on visual representations such as graphs, diagrams, and geometric figures.

Historically, accessibility workarounds for students who are BLV have included removing visual-dependent items entirely or providing alternate testing formats, most notably print versions, that lack adaptivity. While these approaches reduce friction for students and administrators during test administration, they may limit opportunities for BLV students to fully demonstrate what they know. Additionally, these stopgap measures may reduce the overall depth and breadth of assessment results for these students, diluting the data educators use to inform instruction, as well as negatively impacting an educator's ability to evaluate peer-to-peer normative comparisons.

A collaboration between the American Printing House for the Blind and Curriculum Associates demonstrates a different approach: integrating tactile graphics directly into the adaptive assessment experience while building a system to support emerging tactile display technologies.

Through this joint venture, the organizations developed a scalable library of tactile graphics aligned to assessment items and designed to work across a wide variety of assistive technologies, including a range of braille embossers and tactile printers.

The work illustrates an advancement within the assessment field: a shift from accessibility efforts centered primarily on compliance requirements to an approach grounded in inclusive design practices that preserve rigor while expanding usability and opportunity.

For district leaders and educators, the implications are significant. When accessibility is built into assessment design as a core value and not an afterthought, schools can ensure that students who are BLV have fair opportunities to demonstrate what they know while maintaining high academic expectations.

The Accessibility Challenge in Modern Assessment

Visual information plays a central role in learning and assessment, especially for mathematical representations of data and relationships. Graphs, diagrams, charts, and geometric figures allow educators to measure complex reasoning and conceptual understanding.

For students who are BLV, however, reliance on these visual representations can create barriers to critical academic constructs, particularly in digital assessment environments.

Although screen readers and refreshable braille displays have significantly improved access to text-based digital content, some visual information requires tactile representations to be fully understood and to maintain the construct being measured (Rosenblum & Herzberg, 2015).

While alternative text provided via screen-reader technology can sufficiently describe many images, describing complex mathematical concepts with alternative text alone is often not possible without adding significant cognitive load and or changing the construct of measurement.

We work with teachers of students with visual impairments (TVIs) who frequently report that students can navigate assessments with assistive technologies but still require or benefit from tactile graphics, such as raised-line diagrams, to meaningfully access visual content.

These challenges are amplified in computer-adaptive testing environments in which students receive different assessment items based on their responses. Because the queue of test items cannot be predicted, tactile materials must be made available on demand.

As discussed earlier, simply removing visual-dependent items from accessible test versions or defaulting to fixed-form tests can reduce the richness of assessment content and dilute the accuracy of assessment data, potentially depriving both BLV students and TVIs of the benefits and insights of adaptive assessments.

The challenge facing the field is clear:

How can complex visual information be made accessible so that standards of measurement are not lowered, and as a result, instructional expectations and educational outcomes are not diminished for some students?

The Opportunity

Tactile solutions are a critical need across US schools. According to the American Printing House for the Blind Annual Census, approximately 55,382 children and youth in educational programs are registered as legally blind and eligible to receive specialized educational materials and services (American Printing House for the Blind, 2024).

This group represents the core population for whom tactile graphics and braille-based materials are essential. However, the broader population that could benefit from tactile access to visual information is much larger.

The CDC Vision and Eye Health Surveillance System estimates that more than 600,000 children in the United States experience measurable vision loss, including conditions that cannot be fully corrected with glasses (Prevent Blindness, 2024).

Prior to COVID, an estimated 70 percent of blind children were found to be at least one grade level behind in mathematics, and of those, 20 percent were significantly behind, reaching five or more grade levels behind (Gulley et al., 2017). More recent research similarly indicates that mathematics achievement for students who are BLV tends to lag behind that of their sighted peers but seeks to identify why. Hayes and Proulx (2024) and Shoaib et al. (2023) found that these differences were largely attributable to continual and systemic barriers in access to visual information and instructional supports rather than an inherent limitation of understanding or an underlying deficit in mathematics performance.

Taken together, these estimates suggest:

- Tens of thousands of students rely heavily on tactile materials for learning and assessment
- Hundreds of thousands more may benefit from multimodal representations of visual information

Improving accessibility to visual content represents an important opportunity for advancing fairness and improving educational measurement.

Case Study: Building a Tactile Graphics Library at Scale

After interviewing many TVIs and students using its adaptive assessment, Curriculum Associates recognized the need for a scalable accessibility solution and collaborated with the American Printing House for the Blind to develop a new approach to tactile graphics in digital assessments, one that would support access to grade-level content and the precision of computer-adaptive testing.

Over an 18-month collaboration, teams from both organizations worked together to create a library of tactile graphics aligned to thousands of *i-Ready Inform*™* assessment items, ranging in complexity from basic two-dimensional shapes for early grades to four-quadrant coordinate planes with varying scales for middle school items.

The project brought together:

- Product and accessibility leaders
- Tactile graphic artists and designers
- Editorial and standards experts
- User experience researchers
- Teachers and students

"Accessibility should not mean removing rigor. Our goal is to ensure that all students, including those who are blind or low vision, can demonstrate their knowledge and skills to inform instruction."

—Allison Johnson, Associate Vice President, Accessibility, Authenticity, and Belonging, Curriculum Associates

Through this collaboration, the teams created tactile graphics for more than 4,000 assessment images, with multiple versions designed to support:

- Different braille codes (e.g., UEB, Nemeth) and contraction approaches
- Multiple languages (e.g., Spanish, English)
- Physical embossing formats
- Emerging digital tactile displays

Quality assurance included user experience research with students and educators using both embossed tactile graphics and digital tactile technologies. In addition, cross-functional experts from both organizations, including tactile artists, accessibility experts, assistive technology users, and editorial leads, performed rigorous quality control checks.

The result is a growing tactile infrastructure capable of supporting digital and computer-adaptive assessments.

**i-Ready Inform*™ is the new name for the adaptive assessment previously named "*i-Ready Diagnostic*."

Technology Is Expanding Possibilities

New assistive technologies are expanding what is possible for accessible learning and assessment.

One example is the Monarch tactile display, developed by the American Printing House for the Blind in collaboration with HumanWare and the National Federation of the Blind.

Unlike traditional braille displays that present only braille on a single line, the Monarch display can render both braille and tactile graphics simultaneously on a 10-line by 32-cell refreshable surface.

This allows students to explore graphs, geometric figures, spatial diagrams, and data visualizations in real time.

The device supports a digital file format that integrates braille text and tactile graphics into a single navigable document. This integration represents a major advancement in how students who are BLV can interact with visual information.

While Curriculum Associates is launching the initial version of its tactile graphics library for use with embossable printers in 2026, the organization intentionally built the underlying system with a future vision to support Monarch and is currently working on developing the Monarch app for deployment in schools in the future.

Why a Scalable Tactile Approach Matters

Producing tactile graphics for thousands of assessment items requires more than artistic expertise. It requires a sustainable infrastructure.

Key considerations include:

- Standards Alignment: Tactile representations must accurately reflect the academic constructs being assessed so students are able to demonstrate their knowledge to inform instruction.
- Usability for Educators: Teachers need clear guidance about when tactile materials are required and how they should be delivered during assessments.
- Device and Braille Code Compatibility: Schools use many types of assistive technology, including embossers, braille displays, and emerging tactile displays, as well as different braille codes or contraction styles. Accessible materials must support multiple formats.

A robust tactile system allows schools and assessment providers to deliver accessible materials reliably and at scale.

What Is the Monarch Tactile Display?

Monarch is a next-generation tactile display designed to make digital graphics accessible to people who are BLV. Key features include:

- Refreshable tactile graphics surface
- Integrated braille display
- Multiline braille support
- Dynamic rendering of diagrams and charts
- Compatibility with emerging digital tactile formats

For education, this technology opens the possibility of fully interactive tactile learning experiences, allowing students to explore visual information dynamically rather than relying solely on static embossed materials.

Implications for District and School Leaders

For district leaders responsible for instruction, assessment, and accessibility compliance, a scalable tactile system offers important benefits.

- **Ensuring Equity in Assessment:** Accessible assessments help ensure that students who are BLV can demonstrate their academic knowledge and skills, not their ability to access test information.
- **Supporting Teachers and Specialists:** TVIs often spend significant time adapting materials manually. Scalable tactile libraries can reduce this burden while improving consistency and the reliability of testing data.
- **Preparing for Emerging Assistive Technologies:** As devices such as tactile displays become more common, districts will increasingly encounter technologies that integrate with digital learning platforms. Planning for these technologies today will help schools support accessible learning environments tomorrow.

The Tactile Accessibility Framework

Building a tactile graphic solution involves a continuous, interconnected process that ensures all learners can access and engage with educational content.

1. It begins with the intentional design of accessible assessments that consider the needs of students who rely on tactile and nonvisual supports.
2. These assessments are supported by a robust library of tactile graphics, which provides learners with access to alternatives to visual information through raised, touchable formats. This library serves as a foundational resource for creating meaningful and equivalent learning experiences.
3. To bring these materials to life, assistive technologies, such as braille embossers, refreshable braille displays, and emerging tactile display devices, are integrated into the learning environment. These tools enable students to independently access and interact with content in ways that meet their needs.
4. Equally important is the role of educators, who implement these resources effectively through informed instruction and guidance. Teachers ensure that materials and technologies are used purposefully to support student understanding and participation.

Together, these elements form an ongoing cycle of design, resource development, technology integration, and instructional practice, continuously improving accessibility and learning outcomes for all students.

The Future of Accessible Assessment

The collaboration between the American Printing House for the Blind and Curriculum Associates reflects a broader transformation in how accessibility is approached across education.

Emerging technologies, from tactile displays to integrated braille-graphic file formats, are expanding possibilities for accessible digital learning. As these technologies mature, they have the potential to transform classroom opportunities for students who are BLV. This transformation will only happen if the educational community, including publishers and edtech providers, incorporates considerations for available technologies into product design and implementation processes.

Moving the Field Forward

Accessible assessment is not simply about meeting regulatory requirements. It is about ensuring that every student has the opportunity to demonstrate knowledge, participate fully in learning, and reach their potential.

"When accessibility is built into assessment design from the start and approached as a continuous improvement process, we move closer to a system where every student has the opportunity to show what they know."

—Andrea Dodson, Senior Product Manager, Accessibility, Curriculum Associates

By investing in scalable tactile solutions and continuing to explore emerging technologies, the education community can ensure that accessibility plays a vital role in strengthening, not limiting, the future of assessment.

"Having instant access to tactile content is truly a game changer when it comes to having an equitable assessment experience for our blind and low-vision students."

—Greg Stilson, Head of Global Innovation, American Printing House for the Blind

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