**American**

**Printing House**

**for the Blind**

**Department of Research**

**Annual Report of**

**Research and Development Activities**

**Fiscal Year 2022**

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# MISSION STATEMENT

Empowering people who are blind or visually impaired by providing accessible and innovative products, materials and services for lifelong success.

We believe the future belongs to everyone.

# ADVISORY COMMITTEES

APH especially wishes to acknowledge the superb leadership and guidance from the Ex Officio Trustees serving as members of the Educational Products Advisory Committee (EPAC) and the Educational Services Advisory Committee (ESAC).

**EPAC—FY 2022**

*Chair*— Scott McCallum (WA)

Leslie Bechtel Van Orman (WY)

Heidi Munschy (RI)

Pam Parker (WA)

Kay Ratzlaff (FL)

Dawn Soto (WI)

Armando Venegas (PR)

**ESAC—FY 2022**

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Tanya Armstrong (NE)

Brian Darcy (ID)

Jared Leslie (AZ)

Beth Pieters (IA)

Donna Cox (VA)

*Alternate****—***Robert Hair (MD)

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Moschowsky, Daria, BA Accessible Test Editor

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Taylor, Justine, MA Low Vision Product Manager

Welch, Sarah, MS Product Specialist

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Zierer, Laura, MA Independent Living and O&M Product Manager

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Maddox, Tyler, MA Technical Innovations Product Manager

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Stewart, Matthew, BS Associate Software Engineer

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**Technical and Manufacturing Research**

Abadie, Jason Administrative Coordinator

Dakin, Andrew, BFA Model Maker/Pattern Maker

Dixon, Rod, MFA Manager of Technical and Manufacturing Research

Moulton, Andrew, BS, ME Director of Technical and Manufacturing Research

Rogers, Bryan, AAS Manufacturing Specialist

Taylor, Ben Model Maker/Pattern Maker

Wegner, Joe, BS, EE Electronic Product Design/Manufacturing Specialist

White, Patrick, MFA Manufacturing Specialist

Williams, Jeff, AA Manufacturing Specialist

# ACCESSIBLE TESTS AND TEXTBOOKS

Jane Thompson, Director

## Accessible Tests Department

#### Purpose

To provide accessible, high-stakes assessments to students who are blind or visually impaired

#### Project Staff

Thompson, Jane, Director, Accessible Tests and Textbook Department

Knapp, Louise Accessible Test Editor

Knight, Priscilla, Accessible Test Editor

Moschowsky, Daria, Accessible Test Editor

Padgett, Katherine, Accessible Test Editor

Scott, Kristopher, Accessible Test Editor

#### Background

In FY 2000, the Test Central initiative—prepared by Debbie Willis while director of The American Printing House for the Blind’s Educational Product Research Department—received federal funding. In FY 2002, Test Central became APH’s new Accessible Tests Department. The primary focus of the department was, and continues to be, the review and editing of high-stakes test materials to be produced in accessible media, delivered in a timely manner, and administered to individuals who are blind or visually impaired.

#### Work Completed During FY 2022

The number of unique tests that the Accessible Tests Department has provided in accessible media continues to indicate strong demand for such materials. In FY 2022, Accessible Tests successfully adapted approximately 1,056 unique tests, which led to the production of roughly 20,235 total tests.

#### Work Planned for FY 2023

The continued editing of high-stakes assessments for students who are blind or visually impaired will remain the primary focus of the Accessible Tests Department in FY 2023.

Moreover, work continues on tasks dealing with online assessments, such as the preliminary review for visual bias of items and the construction of text-based descriptions of graphical information that supplement tactile graphics with speech output.

# EDUCATIONAL PRODUCT INNOVATION

Mark Renfrow, Director

# CORE CURRICULUM

## Fine and Performing Arts

### Music Braille Wheel

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzierer@aph.org](mailto:lzierer@aph.org).

#### Purpose

To provide a portable reference tool that can assist in the teaching and learning of the music braille code

#### Project Staff

Laura Zierer, Independent Living and O&M Product Manager

Anna Tellis-Ackley, Consultant

Jeff Williams, Manufacturing Specialist

Laura Greenwell, Graphic Designer

Ben Taylor, Model Maker/Pattern Maker

Sarah Welch, Product Specialist

#### Background

Laura Zierer identified a lack of materials for teaching the music braille code while working on the development of a music-braille curriculum. In January 2018, Zierer created a needs survey to garner feedback from the field on this topic. A link was published in the *APH News*, as well as on various social media group pages. Twenty-five professionals responded to the survey in January and February 2018. The main takeaway from the survey results was the lack of resources for teachers in this area.

In FY 2020, Feel the Beat and Music Braille Flash Cards were released. These products reinvigorated the discussion around the music braille code and the development of innovative tools to assist in the teaching process. Anna Tellis-Ackley, a teacher of students with visual impairments, created a tool for herself, which has been designed into the Music Braille Wheel.

#### Work Completed During FY 2022

Prototypes for field-testing are currently being created for the product manager’s approval. The graphic-design process was completed in January of FY 2022. Final print files were sent to the Technical and Manufacturing Research team, which began prototype development in March. Progress continued throughout the fiscal year, nearing completion at the time of this report.

#### Work Planned for FY 2023

Field-testing will begin once the prototypes have been approved and testers have been recruited and selected. The feedback from testers will be reviewed, changes will be made as necessary, and the product will move through the in-house production process.

### Paint-By-Number Safari™ (Series)

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).



#### Purpose

To provide an art product that gives a fun and educational glimpse into how subjects in the world look, live, eat, and function

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Emily Grimany, Product Specialist

Joyce Lopez, PlayAbility Toys™ Consultant

Debi Harrison, Artist

Melissa Escobar, Artist

#### Description/Background

Paint-by-Number Safari™ is a series of paint-by-number books that represent five environmental locations: tropical rainforest, under the sea, backyard creatures, desert creatures, and endangered species. Each print tactile drawing has information relating to core subjects (e.g., size–math, habitat–social studies, etc.). The product includes color-mixing instructions to create real-world colors. The target market is K–12 students who have visual impairment and blindness. The American Printing House for the Blind (APH) develops the Paint-By-Number Series in partnership with PlayAbility Toys™. The series is produced in Unified English Braille.

APH has a long history of working collaboratively with PlayAbility Toys. This is an ongoing series; therefore, to review the original field-testing of the product, please see the 2017 Annual Research Report. The first book in the series, *Paint-by-Number Safari: Tropical Rainforest,* launched August 22, 2017. APH launched the second book in this series, *Paint-by-Number Safari: Under the Sea,* on January 4, 2019. *Paint-by-Number Safari: Backyard Creatures* launched on January 8, 2020. *Paint-by-Number Safari: Desert Creatures* launched on January 12, 2021.

#### Work Completed During FY 2022

The team completed documentation, approved print and embossed proofs, and launched the fifth and final book, *Endangered Species* on April 21, 2022.

### Paint Pot Palette UEB (Modification)

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To update the original Paint Pot Palette so that it follows Unified English Braille (UEB) guidelines

#### Project Staff

Rachel Bishop, Braille Product Manager

Emily Grimany, Product Specialist

Joyce Lopez, Product Developer

Matthew Poppe, Graphic Designer

Anthony D. Jones, Director of Creative Services

Andrew Moulton, Director of Technical and Manufacturing Research

Frank Hayden, Director of Technical and Manufacturing Research

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

#### Background

Paint Pot Palette is a set of drawings and paints that teach children with visual impairments how to color and paint. PlayAbility Toys manufactures Paint Pot Palette in partnership with The American Printing House for the Blind (APH) and has decided to use a new vendor. Because of this change, the company needed to create new tooling. They reached out to APH about making new changes during this time. Emily Grimany, the product specialist, was asked to review the braille in the product. She determined that there were no braille changes needed in the nine drawings and none in the plastic tiles used to identify the color of paint in a pot. The 8-page product guide would require approximately a 10% UEB-translation change. This would be a “pass-through” product, so there would be no manufacturing on the part of APH.

In April of 2020, the product manager submitted a Product Modification form for Paint Pot Palette to the Product Ideation Committee (PIC). The product was approved and assigned a grant number.

In November of 2020, the project was assigned to Rachel Bishop, the Braille Product Manager. She contacted the Director of Technical and Manufacturing Research to set up a “pass-through” meeting and contacted the vendor to discuss what changes would be needed.

#### Work Completed During FY 2022

Production was completed on the project in October 2021, and 504 units were received into stock. A UEB logo sticker was sent to the vendor and was included on the brochure and inner box. Brochure and box art files were updated and sent to the vendor. The old Paint Pot Palette (English Braille American Edition) was obsoleted. A Gate 6: Product Launch/Lessons Learned meeting was held at the end of October.

The product was released for sale on November 15, 2021.

#### Work Planned for FY 2023

This project is completed. No work is planned for FY 2023.

## Math

### Flip-Over Concept Books: TELLING TIME

(Completed)

Analog Clock and Digital Clock Panels Set to 8:30 on the TELLING TIME Flip-Over Book

For information about product development of Flip-Over Concept Books: TELLING TIME from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org)

#### Purpose

To provide young children with an interactive tactile book series that encourages the development and understanding of basic concepts and tactile skills related to shape, texture, spatial concepts, telling time, and so forth

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Andrew Dakin, Model Maker/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Matthew Poppe, Graphic Designer

Anthony Jones, Director of Creative Services

Rachel Bishop, Braille Product Manager

Bobby Fulwiler, Product Specialist

James Williams, Braille Transcriber

#### Background

In April 2006, the product manager submitted a formal proposal to develop a series of interactive tactile/print books to encourage young children's development and understanding of basic concepts related to shape, texture, spatial concepts, counting, and so forth. This product incorporates an interactive feature whereby the child independently flips pages or adjacent print/tactile panels that can be matched or sequenced. The panels turn so that, for instance, the child can find all the panels that have a rough texture, continue a line path, complete a sequence, build an image, and so forth.

Flip-Over Concept Books: TELLING TIME will function similarly to previously introduced Flip-Over Concept Books (i.e., LINE PATHS, TEXTURES, PARTS OF A WHOLE, and FRACTIONS) from The American Printing House for the Blind (APH). Specifically, it will feature freely rotating panels that are threaded onto a ProClick® binding, allowing the removal and repositioning of panels, if desired. However, rather than three panels wide, the book will feature HOUR and MINUTE stacks that are positioned next to an analog clock model with movable HOUR and MINUTE hands.

#### Work Completed During FY 2022

The project staff closely monitored the pilot run and initial production run of TELLING TIME (Nemeth and UEB versions). On March 22, 2022, a Gate 6: Product Launch/Lessons Learned meeting was conducted on the Nemeth version of the book. The Gate 6 form was circulated after the completion of the pilot run of the UEB version. All required gate signatures and approvals were secured on June 22, 2022. The product manager worked on content for the Creative Kick-off form with the Marketing team.

As of August 9, 2022, the first production runs of both versions of TELLING TIME were completed and stocked—269 units of the Nemeth version and 263 units of the UEB version. Results from production time studies were submitted to the Cost Department for final determination of the final selling price. Both versions of TELLING TIME were concurrently launched in September 2022.

#### Work Planned for FY 2023

The product manager will participate in post-product launch activities, such as showcasing the product at virtual webinars, conferences, and workshops; and writing blogs. The development of additional Flip-Over Concept Books will be guided by requests from the field. The product manager will also explore the possible production and provision of blank flip-over books to accommodate the construction of custom-made tactile books created by students, parents, and teachers.

## Physical Education and Health

### Physical Education and Health Special Projects and Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to tpierce@aph.org.

#### Purpose

To research, identify, and develop products that promote physical activities, good health practices, social interactions, and self-advocacy

#### Project Staff

Tristan Pierce, Physical Education Product Manager

Emily Grimany, Product Specialist

#### Background

The American Printing House for the Blind (APH) recognized the need and began to develop products and fund university research in physical activity in relation to students and adults who have visual impairment, blindness, and deafblindness. The positive feedback from the field prompted a new designation in the budget for Health and Physical Education.

#### Work Completed During FY 2022

Five obsoleted publications are now available in various formats online at one of APH’s two download pages. A collaboration with the Connect Center resulted in a series of webinars. The team spent time and research locating resources for kit items that have become obsolete by the global supply-chain issues. The product Manager presented sales, issues, and future concepts on four physical education products. She continued her duties as secretary for the Association for Education and Rehabilitation of the Blind and Visually Impaired (AER) Division 19, which includes meetings and writing the D-19 newsletter.

#### Work Planned for FY 2023

The team will present replacement items and design concepts to meet the ongoing revisions and new development. Pierce will continue to review new product submissions from the field and continue to represent APH and serve on the board of AER Division 19.

### Physical Education, Recreation, and Health Website

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).

#### Purpose

To provide individuals with visual impairments and blindness, parents, and teachers with resources that promote health, physical education, and recreation

#### Project Staff

Tristan Pierce, Physical Education Product Manager

Emily Grimany, Product Specialist

Lydia Smith, Digital Content Product Specialist

#### Background

The American Printing House for the Blind (APH) funded a three-year study on parent-child physical activity intervention among families of children with visual impairments. The investigators who conducted the study were Moira Stuart, Ph.D., Northern Illinois University; Lauren Lieberman, The College at Brockport; and Nicole Riscica, The College at Brockport. During year three of the study, APH produced a resource manual for the participating families. Upon completion of the study, APH decided to make the information available on its website. Staff updated the original resource manual and launched it on the APH website. At the time of launch, viewers could navigate between PE programs, nutrition, organizations, articles, books, equipment, events, magazines, mailing lists, national services, regional and state services, sport camps, toys and games, videos, and websites. Later, an advocacy page and a page for stories was added. APH moved this [resource website](https://sites.aph.org/physical-education/videos/) to a legacy location when APH launched its current website. APH no longer updates this website.

#### Work Completed During FY 2022

APH considered a platform to relaunch selected portions of content-specific websites from the former website. The team reviewed the former PE website to evaluate its past offerings and submitted the outline to the Senior Director of Engagement and Experience. This is still under consideration. The team formed a collaboration with APH’s Connect Center and introduced them to the Institute for Movement Studies for Individuals with Visual Impairments to present a series of 10 webinars.

#### Work Planned for FY 2023

Future work on this project is to be determined.

### SPORTS COURTS

Formerly SPORTS COURTS: Touch and Play

(Continued)



For information about product development of SPORTS COURTS from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org)

#### Purpose

To provide a variety of interactive sports courts and fields (e.g., basketball, tennis, football, bowling) with interactive pieces to demonstrate player positions and game rules, along with instructional reference booklets

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Rachel Bishop, Braille Product Manager

Lauren Lieberman, Contributing Author

Justin A. Haegele, Contributing Author

Monica Lepore, Contributing Author

Maria Lepore-Stevens, Contributing Author

Jenna Sticken, Contributing Author

Andrew Dakin, Model Maker/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Anthony D. Jones, Director of Creative Services

Matthew Poppe, Graphic Designer

Joon Lee, Director of Information Governance and Privacy Compliance

Bobby Fulwiler, Product Specialist

#### Background

The prospect of developing an interactive set of tactile sports courts and fields was originally explored by the Tactile Graphics Brainstorming Committee in August 2002. The product idea gained some careful consideration after repeated product submissions were received from teachers in the field, especially from those who routinely teach physical education to students with visual impairments and blindness.

Feedback regarding the need for SPORTS COURTS was most directly indicated by 32 respondents to a product-specific survey conducted by the product manager in February 2012.

On May 8, 2013, Karen Poppe, product manager, submitted a formal product submission form describing and recommending the development and production of SPORT COURTS. The product idea was approved by the Product Evaluation Team on May 29, 2013, and by the Product Advisory and Review Committee on June 13, 2013. The difficulty of product-development and production were rated as “high.”

Components proposed by Karen Poppe for inclusion in the kit include the following:

* various multi-color screen-printed/vacuum-form sports courts that can be mounted to a metal surface,
* moveable players (e.g., perhaps using Tactile Town’s pedestrian pieces with two colors and two textures) to differentiate between teams or individual players and to demonstrate player positions and movement on the field/court,
* accompanying guidebook highlighting the background/history, adaptations/modifications, and basic rules of various sports (to be written and prepared by experts in the field, some of whom submitted similar product submissions to APH in recent years), and
* a housing binder for 3D players and other game pieces.

In early January 2014, a team of consultants, some of whom had previously submitted similar product submissions for tactile court and field layouts, joined the project.

Field-test prototypes were built and available for field-testing by mid-June 2015.

**Figure 1**

Students at the Kentucky School for the Blind Exploring the Tennis Tactile Court Layout



Progress on SPORTS COURTS continued at a steady pace over many years but was frequently derailed due to concurrent Research products assigned higher priority, as well as the introduction of new staff. Specific yearly accomplishments are noted in previous Annual Research Reports. Time-intensive efforts on this complex product during the post-field test stage involved conversion of scanned silkscreen art to digitized files, construction of vacuum-form masters, updating and editing of the related sports chapters, final design of the injection-molded 3D pieces, and much more.

#### Work Completed During FY 2022

Significant strides on SPORTS COURTS were curtailed due to other competing APH products of higher priority that demanded attention from in-house resources, especially the talents and expertise of Technology Manufacturing Research staff. Nevertheless, some project milestones and notable tasks were accomplished throughout FY 2022, including the following:

* TMR staff devised the best way to manufacture the “X” and “O” magnetic pieces.
* Andrew Moulton gave attention to the construction of the specifications document.
* Karen Poppe provided monthly updates at the New Products Meetings to keep the product on the radar as it moved closer to Gate 5. She also reviewed samples of 3D-parts and 2D manipulatives as they were furnished to her by TMR for review and approval.

#### Work Planned for FY 2023

Project staff will continue to usher the project through the remaining goals of tooling construction and specifications for eventual production. A Gate 5: Specifications meeting will be conducted. Barring any unexpected complications with vendor parts or in-house production, the final product availability of SPORTS COURTS is expected to occur by the end of FY 2023.

## Reading and Language Arts

### Early Braille Trade Books

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose­

To provide emergent and beginning braille readers with a wide selection of small books that provide practice and reinforcement of early reading skills and aid in the development of reading fluency

#### Project Staff

Rachel Bishop, Braille Product Manager

Jeanette Wicker, Core Curriculum Project Leader

Frank Hayden, Director of Technical and Manufacturing Research

Andrew Moulton, Director of Technical and Manufacturing Research

Laura Greenwell, Graphic Designer

Anthony D. Jones, Director of Creative Services

Michael McDonald, Senior Software Engineer

Emily Grimany, Product Specialist

Sara Lee, Product Specialist

#### Background

The need for Early Braille Trade Books (EBT) was identified by the Early Literacy Focus Group, conducted by Suzette Wright in the summer of 2005. These small books for emergent readers are used in classrooms to support the reading curriculum and are available from several publishers. In the winter of 2006, The American Printing House for the Blind (APH) conducted a reading survey to determine the types and series of leveled reading materials used by teachers of the blind and visually impaired.

Using information gained from the 2005 Early Literacy Focus Group and the customer surveys, the Wright Group Books were chosen for the first project. Cay Holbrook, associate professor at the University of British Columbia, agreed to serve as the consultant for this project. In July 2007, Holbrook, along with five of the original members from the Early Literacy Focus Group of 2005, met in Louisville, KY, to review and select books to be included in the kits.

In 2011, the committee selected Rigby® Publishing for the next two sets of books. The committee met in June and reviewed books; they selected 15 fiction books and 14 nonfiction books to add to the EBT collection. Books were analyzed for contraction type and count. Titles were added to the website and the books prepared for braille translation.

In FY 2021, the product manager continued to monitor the production and sale of the second set of fiction books (four kits) and the second set of nonfiction books (three kits). The files for the second set of nonfiction books were approved and placed on the server. A Gate 5: Specifications meeting was held in September 2021.

#### Work Completed During FY 2022

The pilot production run of Rigby Kits 4-5 (contracted and uncontracted) was completed in February 2022. The product manager received the proofs and approved them in the same month.

The product was released for sale on June 6, 2022. A Gate 6: Product Launch/Lessons Learned meeting was held on June 17, 2022 in which the product engagement plan was discussed.

#### Work Planned for FY 2023

The most recent Rigby kits have been released. Nonfiction books 4-5 (contracted and uncontracted) will be added to the EBT Website.

### Wilson Reading System®

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzierer@aph.org](mailto:lzierer@aph.org).

#### Purpose

To provide a remedial reading program for students who are blind or low vision

#### Project Staff

Laura Zierer, Independent Living and O&M Product Manager

Carolyn Williams, Consultant

Emily Grimany, Product Specialist

Mary Kelly, Graphic Designer

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

The Wilson Reading Program, with its well-developed multi-sensory approach, is one of the most respected programs used to teach reading in the United States. This program has been used to teach reading to students with visual impairments who experience reading difficulties, but the program is not available for sale in large print or braille.

Wilson Reading System®, 4th Edition, has been released by the publisher. Carolyn Williams and Laura Zierer were chosen to co-lead this project in FY 2021, adapting the materials in both large print and braille.

#### Work Completed During FY 2022

Most large print materials have been designed and approved. Approved PDFs and clean text files are being submitted to the Braille Preproduction Department for translation, as available. The teacher manual has been written, edited, and sent to the graphic designer.

#### Work Planned for FY 2023

Prototype file-creation will continue, an expert review of materials will be conducted, and feedback from the field will be reviewed.

## Science

### Adapted Biology Lab Manual

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To provide high school and college instructors with 12 introductory biology laboratory protocols adapted for students with vision impairment including blindness

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Andrew Moulton, Director of Technical and Manufacturing Research

Erica Martin, Consultant

Whitney Davidson, Consultant

Lara Kirwan, Senior Product Specialist

Sarah Welch, Product Specialist

#### Background

The lead consultant, Erika Martin, adapted twelve introductory biology laboratory modules for her students with visual impairment. Understanding that this could help other instructors and their students with vision impairment, she submitted the Adapted Biology Lab Manual (ABLM) as a new product idea to APH in August 2016. ABLM was reviewed by Rosanne Hoffmann in September 2016, presented to the Product Evaluation Team in January 2017, and to the Product Advisory and Review Committee in February 2017. The Product Development Committee met at the end of January 2017 to discuss the product elements. ABLM entered the formal product development pipeline in March 2017 after the consultant contracts for Martin and her co-consultant, Whitney Davidson, were finalized.

Martin and Davidson completed the formal write up of all twelve modules by May 2018. Due to the new product development procedure in the Educational Product Innovation department at APH and Hoffmann’s workload at the time, development of ABLM was placed on hold during FY 2019 and FY 2020. Hoffmann’s work resumed in November of fiscal year 2021 which involved reviewing, editing, and formatting the modules for accessibility. Lara Kirwan and Sarah Welch assisted in the formatting work. The first four prototype modules were completed by the end of fiscal year 2021 (Microscopic Investigation, Scientific Method, Data Presentation, and Cells).

#### Work completed during FY 2022

The remaining eight prototype modules were reviewed, edited, and formatted for accessibility (Diffusion and Osmosis, Mitosis, Genetics, Hardy Weinberg, Photosynthesis, Animal Behavior, Biodiversity and Classification, and Aquatic Ecology). Hoffmann made the decision to present this collection of biology laboratory modules as digital documents in the form of individual accessible PDFs. Diagrams and illustrations associated with the modules that are needed by students with visual impairment will be included in the form of downloadable PDF graphics. Instructors can print the files on capsule paper to produce tactile graphics with a PIAF machine (Pictures in a flash tactile graphic maker) or make them tactile by other appropriate means (e.g., Puffy® Paint, glue, etc.). Hoffmann compiled all the diagrams and illustrations for all twelve modules by the end of fiscal year 2022.

#### Work planned for FY 2023

Hoffmann will submit the diagrams and illustrations for all twelve modules to an in-house graphic designer who will modify and prepare them as needed for their eventual use as tactile graphics. When the text and graphics for all twelve modules are ready, the product manager will select a geographically diverse set of expert reviewers and prepare evaluation instruments to collect demographic information and prototype evaluations. The expert review will take place either in the spring or fall of 2023.

### Life Science Tactile Graphics (Modification)

(New/Hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To update the keys and labels of the 56 tactile graphics in the Life Science Tactile Graphics collection from English Braille: American Edition (EBAE) to Unified English Braille (UEB)

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Lara Kirwan, Senior Product Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Andrew Dakin, Model Maker/Pattern Maker

#### Background

The Life Science Tactile Graphics (LSTG) collection of 56 full color tactile graphics with print and braille keys and labels was released in 2010. At that time, EBAE was the standard form of published braille in the United States. However, in January 2016, the US adopted UEB as its official braille code. Thereafter, Teachers of the Visually Impaired (TVIs) in training learned UEB rather than EBAE, and many are now unfamiliar with the latter code. This makes using LSTG challenging for TVIs trained more recently than those trained in the years before 2016. In addition, the BRF of the LSTG Teacher’s Guide, available for free download as an accessible document, was also presented in EBAE. These features of the original product were brought to the attention of Rosanne Hoffmann during a meeting of Ex Officio Trustees at APH in the spring of 2021.

#### Work during FY 2022

Hoffmann submitted a Product Modification form on December 2, 2021, detailing the changes needed in the product. These include modifying the braille comprising the labels and keys on the resin patterns used to make the vacuum-formed tactile graphics from EBAE to UEB and changing the corresponding braille in the art files to ensure correct registration between the vacuum-formed and printed plastic.

A Gate 1 meeting took place in February 2022 during which a matrix score of 73 was tabulated. Although the LSTG Modification is officially in the product development pipeline, work will not begin until the start of fiscal year 2023 due to the budget and time constraints of the product manager.

The braille version of the LSTG Teacher’s Guide, originally presented in EBAE, was re-transcribed into UEB in the spring of 2022. The UEB version of the LSTG Teacher’s Guide was posted to the Manuals section of the web page for LSTG on the shop site in June 2022.

#### Work planned for FY 2023

Andrew Dakin will make the appropriate changes in the resin patterns for all 56 tactile graphics in the LSTG collection, a process that is estimated to take two months. He will also make corresponding changes in the art files for each pattern. All subsequent production runs of LSTG will use the amended resin patterns and updated art files, which will make this product current with regard to braille.

### Tactile Chemical Bonding Kit

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To provide middle and high school students with a large print and tactile model system that makes the concept of chemical ionic bonding accessible to students with visual impairment and blindness

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Adam Stockhausen, Consultant

Lara Kirwan, Senior Product Specialist

Andrew Dakin, Model Maker/Pattern Maker, Model/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

The Tactile Chemical Bonding Kit is a model that demonstrates bonding of two oppositely charged ions, such as sodium (Na+) and chloride (Cl-), in an accessible way for students with vision impairment. Positive and negative ions are represented by manipulatives die-cut from flat foam that interlock like puzzle pieces. Each braille- and large print-labeled foam piece will have either a connector tab (or tabs) or a connector slot (or slots) on one side representing the number of valence electrons available to give away (tabs) or that it still needs (slots) to reach a stable electron configuration, demonstrating the octet rule. Teachers can attach a material or symbol to the specific element/ion it represents (e.g., aluminum foil to represent an aluminum ion). A teacher’s guide will be included with this product.

Adam Stockhausen submitted a Product Submission form for this product idea in March 2018; it was reviewed by APH staff in the fall of 2018. The product manager met with Stockhausen in the fall of 2018 to discuss product design details. At that point, due to the new product development process adopted by the APH Educational Product Innovation department, and subsequently the Covid-19 pandemic, this project was placed on hold for FY 2019, FY 2020, and FY 2021.

#### Work during FY 2022

In the fall of 2021 and winter 2022, the product manager met with Stockhausen and Andrew Dakin several times to discuss the subunit materials and design. Subunits will be made of 1/4-inch-thick foam onto which plastic laminate will be adhered. Prior to lamination, the plastic will be printed with the element name, atomic number, and atomic symbol. All print will be rendered in braille as well via the vacuum form process. Finally, the pieces will be die-cut from the laminated foam. An example of two element subunits is shown in Figure 1 below.

**Figure 1**

*Design of Two Tactile Chemical Bonding Kit Element Subunits*

Top element: Fluorine represented in lavender with element name in large print and braille on left side; atomic number (9) and atomic symbol (F) boxed on right. Bottom element: Hydrogen in yellow with element name in large print and braille on the left; atomic number (1) and atomic symbol (H) boxed on the right


After design details were established, the specific elements to include and their quantity in the kit were determined. In all, twenty different elements will be represented with varying numbers of duplicates of each, for a total of 50 subunits in the kit.

A Gate 2 meeting took place in April 2022 during which the design details were discussed; a matrix score of 61 was obtained.

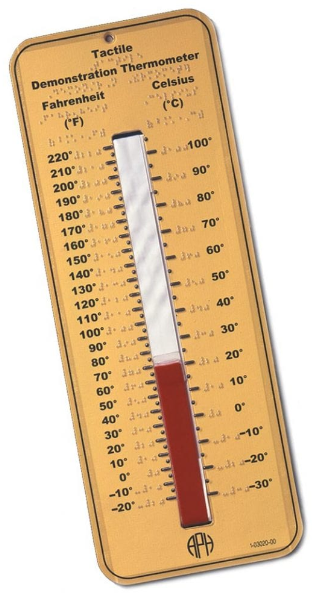
To decrease cost, it was decided to limit the number of element subunits to prepare for field testing. In the summer of 2022, Dakin prepared ten sets of six different element subunits (Sodium, Magnesium, Aluminum, Phosphorus, Oxygen, and Chlorine) for field testing. The product manager and Stockhausen wrote a prototype guidebook for the field test process.

#### Work planned for FY 2023

When the prototype kit elements and guidebook are prepared, the product manager will solicit ten field testers from a geographically diverse area of the U.S. Field testing will take place in late 2022 or early 2023. The product manager will compile evaluation results and make recommendations for the final presentation of the kit.

### Tactile Demonstration Thermometer (Modernization)

(New)



For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org)

#### Purpose

To modernize an original APH product intended to provide an accessible educational tool for students with visual impairments and blindness to use to review basic concepts related to temperature comparisons (Celsius versus Fahrenheit) and the workings of a thermometer

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

Emily Grimany, Product Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

Bryan Rogers, Manufacturing Specialist

Ben Taylor, Model Maker/Pattern Maker

#### Background

The Tactile Demonstration Thermometer (1-03020-00) was originally designed by the product manager and Tom Poppe (retired APH Model Maker/Pattern Maker) and introduced into The American Printing House for the Blind’s product line in March 2000. Prior to its official launch as a Quota-eligible product, the Tactile Demonstration Thermometer had been formally field-tested by ten teachers of the visually impaired with nearly 50 students with varying eye conditions, visual acuity levels, and multiple disabilities. The unique features that made the product especially useful to students with vision loss included the following: a two-textured, two-colored adjustable “mercury column” with an easy-grip tactile indicator; comparable Fahrenheit and Celsius scales presented in both large print and braille on a high-contrast background; and distinct visual and tactile markings every five and ten degrees. Notable accolades from the field-test audience highlighted the product’s ease-of-use, appropriateness for the target audience, and universal appeal for all students.

The product manager recognized the need to modernize the Tactile Demonstration Thermometer because of its 20-plus years of availability in the current style. On August 21, 2021, the product manager submitted a formal Product Modernization form that outlined expected design improvements, most notably the introduction of two versions—Nemeth and UEB. This dual-option offering is consistent with APH’s goal to provide many of our math products in both braille versions. Otherwise, the high-contrast colors, contrasting textures on the slidable mercury column, and combined print/braille degree markings are expected to be mimicked in the next iteration of the product. Although sales have waned since 2000, recent year-to-year sales of the product have been very predictable and steady. Reintroduction of the modernized version is expected to spark renewed interest in the product.

#### Work Completed During FY 2022

On December 27, 2021, the product manager’s Product Modernization form for the Tactile Demonstration Thermometer was reviewed and scored by the Product Ideation Committee at the Gate 1 meeting. The modernization proposal received a rating of 65. The grant number 779 was assigned to the project, and the product moved into an on-hold status while other active products were addressed and completed.

During the third quarter of the fiscal year, Production staff experienced new assembly challenges while attempting to ensure perfect alignment between the printed thermometer and the clear tactile overlay. It became apparent that during the recent transition from the use of screen printing to flat-bed printing, the new digital print file did not accurately register and align with the tactile counterpart as did the original print artwork. This assembly difficulty, paired with an approaching stock depletion of the current version, accelerated the urgency for obsolescence of the current product and introduction of an updated version.

On May 20, 2022, the product manager conducted a meeting with representatives from the Model Shop and Technical Manufacturing Research, Operations Engineering, Quality Control, Purchasing, Production (Educational Aids area), and Educational Product Innovation. All attendees unanimously agreed that this was an opportune time to obsolete the current catalog item for the following reasons: 1) inventory was currently at zero and all backorders had been addressed; 2) recalibration of the existing cutting dies and vacuum-form patterns to ensure ideal registration would, at this time, impose effort and a cost increase that are avoidable, given the planned modernization; and 3) the current version is not UEB-compliant because of the use of retired braille contractions. On May 31, 2022, the existing product was officially double-slashed and retired; notification of its discontinuation was conveyed on the APH website’s shopping page: <https://www.aph.org/product/tactile-demonstration-thermometer/>

Immediate consequences of the product’s obsolescence involved the following:

* scrapping remaining quantities of the braille and print documentation, as well as related parts lists;
* retaining related raw materials (e.g., red velvet ribbon, white satin ribbon, yellow matt posterboard) that might be incorporated into the modernized design of the Tactile Demonstration Thermometer;
* storing all existing vacuum-form patterns in the Model Shop for later reference during the construction of the new production tooling; and
* removing references to the product in all new marketing publications and blogs.

As a peripheral task, the product manager explored online interactive thermometers for students and shared a possible app idea with product managers Li Zhou and William Freeman, who manage math and tactile technology products, respectively.

#### Work Planned for FY 2023

The product will transition from on-hold status to active status. In early FY 2023, the product manager will host a Gate 2: Product Design meeting to initiate the work needed for the eventual reintroduction of the Tactile Demonstration Thermometer in two versions—UEB and Nemeth. The project staff will explore new production avenues and methods that could potentially streamline the production of the product and make it less costly.

### Tactile Greek Alphabet

Formerly Accessible Greek Alphabet

(New/On hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To provide a tactile rendering of the Greek alphabet including upper- and lower-case letters with the corresponding English transliterations in print and braille (e.g., alpha, beta)

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Ken Perry, Senior Software Engineer

Cary Supalo, Consultant

Lara Kirwan, Senior Product Specialist

Andrew Dakin, Model Maker/Pattern Maker, Model/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

Rosanne Hoffmann submitted a Product Submission form for this product idea in May 2021, responding to a request by Cary Supalo, a chemist who is blind. The Greek letters are basic symbols used in many aspects of math and science education. As such, they are integral to many of the standards described in the Common Core State Standards (for math) and the Next Generation Science Standards.

The idea for this product would be to create a collection of tactile graphics, devoting one page for each of the 24 Greek letters. Each page would include a large graphic of the upper case and lower-case Greek letter along with a large print, braille (UEB and Nemeth) transliteration of that Greek letter (e.g., alpha, beta, etc.). The pages would be rendered in vacuum formed plastic (to be held in a binder) and/or individual PDF, BRF and PRN file formats to be posted on APH’s Tactile Graphic Image Library. Supalo stated that a product like this would have helped him during his scientific education.

#### Work during FY 2022

The APH Product Ideation Committee met in January 2022 to discuss this product idea. A matrix score of 56 was obtained and the product officially entered the development pipeline; it was placed on hold until the beginning of FY 2023.

#### Work planned for FY 2023

Hoffmann will meet with Andrew Dakin to discuss product materials and design in the fall of 2022. When preliminary design of the Greek letters for each page is complete, Dakin will prepare prototype images to show and discuss with Supalo and Ken Perry.

## STEM Technology

### Code Jumper®

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kbest@aph.org](mailto:kbest@aph.org)

#### Purpose

To give young students with blindness or low vision a fun and accessible tool to create computer programs and learn basic programming concepts

#### Project Staff

Katrina Best, Accessible Coding Product Manager

Leslie Farr Knox, Senior Director, Engagement and Experience

Larry Skutchan, Director of Technology Product Research

Dorinda Rife, Vice President of Educational Services and Product Development

Frank Hayden, Director of Technical and Manufacturing Research

Michael McDonald, Senior Software Engineer

Robin Lowell, Educational Consultant

Heather Kennedy-MacKenzie, Director of Technology Product Research

Greg Stilson, Head of Global Innovation

Li Zhou, Math Product Manager

Lara Kirwan, Senior Product Specialist

Lydia Smith, Digital Content Product Specialist

John Hedges, Programmer

William Freeman, Tactile Technology Product Manager

Joseph Hodge, Technical Innovations Product Manager

Matthew Poppe, Tactile Graphics Designer

Anthony Jones, Director of Creative Services

Ricky Irvine, Website and Video Designer

Michelle Cundiff, Education and Outreach Specialist

Dave Wilkinson, Director of Sales

Lisa Echsner, Director of Grants

Cecilia Peredo, Director of Grants

Stephanie Lancaster, Graphic Designer

Lawrence Lovelace, Advanced Software Engineer

#### Background

Substantial effort has gone into creating tools to teach young students to program. However, most existing tools are highly visual in nature, both in how code is manipulated (such as dragging and dropping coding blocks) and in how the code behaves (such as showing animations). As a result, they are not accessible for use by students who are blind or have low vision. Although these students are equally interested in and capable of learning about programming, lack of accessible tools puts them at a disadvantage.

To help address this barrier for students with visual impairments, Microsoft® designed an educational tool named Code Jumper. Rather than asking students to write code in text, Code Jumper enables them to create programs by physically connecting Command pods and setting parameter values. All programming products are auditory in nature, such as musical notes, songs, and voiced stories. A Code Jumper app is used together with the physical parts. The app is accessible to students with blindness who need to use screen-reading software and to students with low vision who have unique vision needs.

Code Jumper is designed for students ages 7–11 who have never learned coding before. Its purpose is to generate interest in programming and introduce them to basic programming concepts and computational thinking. Understanding these concepts—including computer systems, programs, algorithms, threads, sequences, repetition, selection, parameters, constants, variables, network topology, protocol, binary, decomposition, and debugging—provides students with a solid basis for further study of programming.

#### Work Completed During FY 2022

Hardware/Software Updates

A project to add a piece of hardware to connect Code Jumper® to iOS® devices was investigated, but ultimately The American Printing House for the Blind (APH) has decided to move in another direction. Due to difficulties acquiring the parts needed as well as technical complexities of the project, APH has decided to focus on expanding the learning opportunities for Code Jumper on Windows® and Android®.

*Lessons/Assessments*

We developed a series of eight Code Jumper puzzle activities. The puzzles were designed as student-facing activities that could be done by a student, by themselves, or in a small group with minimal teacher or parent instruction. The motivation behind the puzzle development was to make Code Jumper more accessible to students when working remotely or when they had some one-on-one time with Code Jumper, but there are many applications for these shorter coding exercises. The puzzles will be launched in Fall 2022.

*Localization*

Translations are completed for the following languages:

* French Canadian
* European French
* European Spanish
* Latin American Spanish
* Brazilian Portuguese
* German

At this point, we do not have any plans to begin new translations. Due to lagging sales and the fact that our 2021 rollouts are being delayed due to the continued effects of the COVID-19 pandemic, we will hold off on other translations for the foreseeable future. Should an international partner be interested in using Code Jumper, we have developed a translation guide for them to create their own localized version of Code Jumper.

*Community Support*

Throughout the pandemic, we have partnered with organizations interested in STEM and coding, introducing them to Code Jumper and its educational benefits. Below are some examples of the outreach that has occurred in FY 2022.

* British Computing Society (BCS): In conjunction with Cecily Morrison of Microsoft®, APH has engaged the BCS to examine the impact of physical programming on students learning computer coding and to introduce several local education agencies to Code Jumper.
* Organización Nacional de Ciegos Españoles (ONCE): APH has partnered with ONCE to test Code Jumper kits with students and teachers as part of their computer programming and coding offerings and to develop Spanish language sound sets.

*Conferences*

Code Jumper was demonstrated at two virtual-exclusive settings in FY 2022: On October 8, 2022, *Learning to Code: Engaging Students Across Multiple*

*Settings with Code Jumper* was presented at APH’s 153rd Annual Meeting in Louisville, KY. In April 2022, *Code Jumper*®*: An Inclusive Coding Tool from APH* was presented at the Promoting Achievement through Technology and INstruction for all Students (PATINS) Tech Expo in Carmel, IN.

January 2022 saw some in-person activities return, allowing us to again demonstrate Code Jumper at conferences and in exhibit halls. While some activities remain virtual, we are excited about the beginning of a return to normalcy and the ability to allow teachers, ex officio trustees, parents, and others to be hands-on with Code Jumper®. APH hosted three webinars featuring Code Jumper in FY 2022 and participated in 12 conferences. Jeff Schwartz, APH Regional Outreach Specialist for nine states in the southeast United States, has conducted five Code Jumper trainings since October 2021.

The Center for Assistive Technology Training (CATT) Project is a collaboration between The American Printing House for the Blind (APH) and the Alabama Institute for Deaf and Blind (AIDB). Its mission is to provide assistive technology training to teachers of the visually impaired, utilizing a "train the trainer" model while also providing training for students and families. Since October 2021, CATT has provided four Code Jumper-centered training sessions for 77 participants.

#### Work Planned for FY 2023

A new module will be added to Code Jumper® to give students the ability to take the next step in learning coding. The new module will allow students to take programs they have created with the Code Jumper hardware kit and transform them into written programs. Several languages are being evaluated such as C#, Python, and JavaScript. This will allow students to create programs using the Code Jumper hardware and then explore how they could also be written in code. Once these programs are written in code, the students can modify and update the programs to expand on what they have already learned.

Code Jumper will continue to be presented through various venues such as conferences. APH Hive is working on a curriculum related to Code Jumper. Its three courses (Getting Started with Code Jumper, Primary Lessons to Code Jumper, and Advanced Lessons to Code Jumper) are scheduled to be released in early 2023.

### Cosmic Number Lines

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzhou@aph.org](mailto:lzhou@aph.org).

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to lzhou@aph.org.

#### Purpose

To provide early elementary students who are visually impaired with an accessible app that allows them to learn a variety of number line concepts and skills through gameplay

#### Project Staff

Li Zhou, Math Product Manager

Lawrence Lovelace, Advanced Software Engineer

Mark Rohret, Technology Quality Assurance Analyst

Lara Kirwan, Senior Product Specialist

Emily Grimany, Product Specialist

Heather Kennedy-MacKenzie, Director of Technology Product Research

#### Background

The number line is one of the most fundamental concepts in K–12 math; its study starts as early as 2nd grade. Among many tools to teach this concept in general education classrooms are number-line apps. However, as far as the product manager (PM) reviewed in August 2020, none of the existing mainstream apps were accessible for students who relied on a screen reader.

Cosmic Number Lines is designed to be a fully accessible iOS® game app. The game can be a fun and motivating tool to practice and reinforce a variety of number-line skills, such as locating points on a number line, comparing numbers using a number line, and solving addition and subtraction problems using a number line. Playing this game also gives visually impaired students more exposure to accessible technologies, which benefits them in the long run.

The idea of Cosmic Number Lines was submitted to APH in June 2020. Two PMs reviewed the product idea; in October 2020, the Product Ideation Committee accepted the idea, and it was assigned a grant number. The project was put on hold until May 2022 as project staff worked on other projects.

#### Work Completed During FY 2022

Development of this app started in May 2022. The team redesigned the eight levels of training activities and tasks and decided to add a few other features, including using a ranking system to motivate players. Coding started, based on the new design. A Gate 2: Product Design meeting was held in August 2022.

#### Work Planned for FY 2023

A prototype of Cosmic Number Lines will be built for use in a field-test. The field test will be conducted. Revisions will be made based on testers' feedback. The app will be released.

### Dots123

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to lzhou@aph.org.

#### Purpose

To enable students who are blind to create and edit print math equations using either Nemeth code or UEB code

#### Project Staff

Li Zhou, Math Product Manager

Michael McDonald, Senior Software Engineer

Rob Meredith, Senior Software Engineer

Matthew Stewart, Associate Software Engineer

Ken Perry, Senior Software Engineer

Heather Kennedy-MacKenzie, Director of Technology Product Research

Lara Kirwan, Senior Product Specialist

Emily Grimany, Product Specialist

#### Background

Math students who are blind often encounter difficulties when they need to present mathematical material to sighted instructors and classmates. One barrier exists as they attempt to translate electronic math from braille to print. Because blind students learn to write math in either Nemeth or Unified English Braille (UEB) code, it is natural to think of a software application like Dots123, with which students can write math in either code and their results can be translated into print math.

As for now, to get around this barrier, some blind students learn to use LaTeX, a document-preparation system commonly used by scientists, engineers, mathematicians, programmers, and other professionals. It is widely used in academia for the communication and publication of scientific documents. Because LaTeX is text-based and non-graphical in nature, blind students can use it.

Simply speaking, LaTeX is just another set of codes that can be used to represent math materials, just as Nemeth code is used by braille users. For example, the LaTeX code for the fraction 1/2 is written as $\frac{1}{2}$. There are software applications (e.g., MathType™ for Microsoft® Word) that allow students to write math in LaTeX and then translate it into print math through MathML (a mathematical markup language).

However, except for some high-performing students, especially those who are willing to pursue a postsecondary degree in science, technology, engineering, and math fields, asking blind students to learn an extra math code in addition to Nemeth or UEB braille code seems to be too much. The technical nature of LaTeX also makes it difficult for some teachers of the visually impaired to learn it.

Dots123 could be a better solution. With Dots123, students can create print-math materials using Nemeth or UEB codes. They do not have to learn a separate set of code like LaTeX, unless that is needed for postsecondary study.

Some braille notetakers, such as products from Humanware® and Human Information Management Service, have special math support. Users of those products can type in Nemeth or UEB code to create math materials in print. However, that is tied to their specific notetakers. A stand-alone software application like Dots123 will give students more freedom and flexibility.

#### Work Completed During FY 2022

The development team has been building the application. With the use of Xamarin®, Dots123 targets multiple platforms, including Windows®, Android®, and iOS®.

#### Work Planned for FY 2023

The prototype to use for field-testing will be created, the field test will be conducted, and the app will be revised according to testers’ feedback. Once Federal Quota approval is obtained, the app will be released.

### Keys to Code

Formerly Let’s Start Coding™

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To create an electronic coding kit designed for high school students who are blind or visually impaired

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Katrina Best, Accessible Coding Product Manager

Lara Kirwan, Senior Product Specialist

Heather Kennedy-MacKenzie, Director of Technology Product Research

Ken Perry, Senior Software Engineer

Mark Klarer, Advanced Software Engineer

Matthew Stewart, Associate Software Engineer

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

APH staff has followed the development of Let’s Start Coding™ kits since 2017 (www.letsstartcoding.com/). The kits are easy to build and appropriate for students just learning about programming, coding, and electronics, including those with low vision and blindness. These low-cost devices and easy-to-understand projects provide all students with the ability to dive into learning programming at a young age, while also making a powerful learning tool for students who start at older ages.

APH field-tested several Let’s Start Coding kits in June 2019 and solicited evaluations from students and teachers. APH also gathered information from programming experts at the Assistive Technology Industry Association, CSUN, Principals of Schools for the Blind, SciAccess, and ISLAND conferences. It was suggested in order to improve the accessibility of the instructions and hardware to include earphones, a standard Arduino® board, and a breadboard in the kit; and develop projects with fewer LEDs and more motors, servos, sound, and speech output.

In June 2020, APH staff began development of an access-neutral Arduino kit with at least 20 projects designed for students with low vision and blindness. A Gate 2: Product Design meeting took place in August 2020. Following this, Perry selected 20 projects for initial development to include in the kit. By the end of FY 2021, Perry had identified the needed parts for the various projects (after constructing them himself) to ensure their accessibility to students with visual impairments and drafted online documentation to accompany the product. It was also decided to change the product name to “Keys to Code.”

#### Work completed during FY 2022

Software engineers Mark Klarer and Matthew Stewart joined the development team to assist Perry, along with Product Manager Katrina Best. Four sets of materials (to build 16 projects each) ordered from SparkFun Electronics® were received in April 2022; delivery was delayed due to supply chain issues. While the team was waiting for the kits, Klarer and Stewart worked on the breadboard design, tested code with a simulator, and updated the user guide originally written by Perry. When the kits arrived, work on the 16 projects was divided between Stewart (projects 1-8) and Klarer (projects 9-16). After several months of work, it was noted that certain parts were best ordered from vendors other than SparkFun (due to price and availability differences).

The first eight projects include Beep and blink, Melody, Potentiometer tuner, Push button, Light sensor, Servo, Motor, and Speed control motor. Projects nine through 16 will include a Continuity tester, Ohm meter, Talking Voltmeter, Perkins keyboard, Talking Thermometer Hygrometer, Remote Control, Motion Detector, and Ultrasonic Sensor.

Stewart and Klarer designed tactile graphics of the schematics for each project including print, braille, and black line drawings. The tactile graphics will be vacuum formed on plastic after being printed on the Roland® flatbed printer, as they must be sturdy and waterproof. The same schematics will be rendered in large print and included in the final product.

Best constructed and reviewed projects 1 through 8 to evaluate the directions provided by Stewart in the user guide. Rod Dixon provided samples of the schematic tactile graphics and large print versions so size requirements could be evaluated.

#### Work planned for FY 2023

The software engineers (Perry, Stewart, and Klarer) will complete the list of needed parts and select the appropriate vendors to purchase the parts needed to assemble at least ten prototype kits. A corresponding number of sets of prototype tactile and large print schematics will be prepared for field testing. Rosanne Hoffmann, Perry, and Best will identify a group of geographically diverse field testers in the US, prepare online evaluation instruments, and edit the user guide to accompany the prototype kits. Prototype field testing will take place in the fall or winter of 2022/2023, followed by analysis of evaluative comments. The product managers will make appropriate changes to the final product elements (hardware, schematics, and user guide) responding to field tester suggestions.

### Linux Introductory Coding Box

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tmaddox@aph.org](mailto:tmaddox@aph.org).

#### Purpose

To create a Linux-based coding education platform that is accessible on boot and bundled with an introductory coding curriculum

#### Project Staff

Tyler Maddox, Technical Innovations Product Manager

Ken Perry, Senior Software Developer

Katrina Best, Accessible Coding Product Manager

Joe Hodge, Technical Innovations Product Manager

#### Background

Because of the open-source nature of Linux platform development, there is no centralized entity responsible for maintaining accessibility standards; therefore, Linux *distros* (Linux kernel-based operating systems [OS] and their accompanying software and files) are not built with accessibility standards in mind. As Raspberry Pi computers become more prevalent in schools, blind students are at a distinct disadvantage when learning to code, managing systems, and generally exploring computing.

To address this chasm, The American Printing House for the Blind (APH) is configuring a Linux OS image that is more accessible and ensuring that the screen reader can read the OS image out-of-the-box. The Linux Introductory Coding Box, which will be bundled with a coding curriculum and user support and reference materials on an all-in-one Raspberry Pi 400 (RP400) computer-keyboard combo, will give computer-science learners a jumping-off point to explore text-based coding concepts.

The key objectives for the Linux Introductory Coding Box are:

1. offer a multi-faceted solution for computer-science education in a Unix ecosystem that is built to be accessible and highly usable out-of-the-box;
2. develop and host a coding curriculum with appropriate outcomes and scaffolding for a wide range of beginner-to-intermediate learners;
3. release a Linux image that will support the access of blind and visually impaired programmers who want to work in a Linux environment; and
4. support APH’s overall “Road to Code” ecosystem roadmap and goals by developing a sustainable and extensible platform for future products and projects.

#### Work Completed During FY 2022

Using the existing Ubuntu-MATE Linux distro, APH staff have focused on configuring a new GNOME 2 (pronounced gah-NOHM) graphical user interface (GUI) Linux image that is more accessible out-of-the-box. This involves ensuring the Orca screen reader can focus on and read all aspects of the GUI on a RP400 computer.

Also underway are efforts to house commonly used software features and hotkeys in a central repository for users to navigate and utilize the OS.

Representatives from APH have also tested Spel Technology’s online integrated development (IDE) environment curriculum as a potential platform for the bundled Python coding curriculum.

#### Work Planned for FY 2023

* Develop the Python curriculum, which entails:
* deciding on the platform,
* building the lesson map, and
* creating content for individual lessons.
* Decide which IDE interface to use and how to configure it.
* Build a user support tool that includes:
* a wiki for software information and
* hotkey resources for all bundled software.
* Stress test the RP400 for anticipated use cases.
* Continue scripting hotkeys and software to provide a more accessible experience.
* Make final decisions on which bundled software to include with the OS.
* Begin formulating a plan for outreach and advocacy in the open-source community for more accessible base-Linux repositories.
* Field-test the OS image with computer-science teachers so that they are involved in its design and configuration. (The Introductory Coding Box curriculum will be field-tested at a later date.)

After release, APH will continue to monitor the state of open-sourced Linux development. If new solutions and innovations surface that prove better able to meet the goals of this product, a new software iteration or product redesign will be submitted to the Product Ideation Committee.

### Math Flash™ Android®

Formerly Math Flash™ Online (Modernization)

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

#### Purpose

To provide an Android® application of Math Flash™, The American Printing House for the Blind’s (APH) accessible, interactive math-drills-and-practice flash-card software

#### Project Staff

Li Zhou, Math Product Manager

Heather Kennedy-MacKenzie, Director of Technology Product Research

Rob Meredith, Senior Software Engineer

Leyvis Valdes, Software Engineer

Mark Rohret, Technology Quality Assurance Analyst

Joseph Hodge, Technical Innovations Product Manager

Emily Grimany, Product Specialist

#### Background

Math Flash™ Android® is a standards-compliant application for Android devices building on APH’s four previous Math Flash programs: Math Flash for Windows® (released version 1.0.0.2 in FY 2000), Math Robot iOS®, Math Flash for Amazon® voice-assistant devices, and Math Flash for Google® voice-assistant devices. Math Flash for Windows is a tremendously successful program that includes professionally narrated digitized speech, presents math problems in a flash-card format, and responds with fun positive and negative feedback. Feedback from the field and the Educational Products Advisory Committee indicated demand for an updated online version of this program that could work on other platforms, especially Android and Chromebooks.

#### Work Completed During FY 2022

A prototype of the app was built for a beta test, and the beta test was conducted in December 2021, with ten participants signing up. Two issues were found during the test. One tester could not enter answers when using the app on a specific notetaker, and another one could not set the number of problems in a drill and drill time. Both issues were addressed after the team received the feedback.

Development of this app was completed. The app was released in February 2022.

#### Work Planned for FY 2023

Product development is complete. No work is planned for FY 2023.

### Practice2Master Abacus

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzhou@aph.org](mailto:lzhou@aph.org).

#### Purpose

To provide students who are visually impaired with an accessible and interactive abacus learning app

#### Project Staff

Li Zhou, Math Product Manager

Lawrence Lovelace, Advanced Software Engineer

John Karr, Software Engineer

Mark Rohret, Technology Quality Assurance Analyst

Joseph Hodge, Technical Innovations Product Manager

Heather Kennedy-MacKenzie, Director of Technology Product Research

Lydia Smith, Digital Content Product Specialist

Michael Jones, Product Specialist

Matt Poppe, Graphic Designer

#### Background

The abacus is widely accepted in the field of education of the visually impaired as an important calculation-learning tool for students who are blind. However, the learning curve is daunting—not only for some students but also for many teachers of the visually impaired (TVIs). Further, factors such as high caseload of itinerant TVIs limit the amount of time teachers and students can spend on abacus learning.

In a session at the 2017 Annual Meeting of The American Printing House for the Blind (APH), participating TVIs suggested creating a new abacus-learning tool. Different from existing tutorial books and demonstration videos, this tool is expected to combine instruction, practice, and drill into one systematic and interactive curriculum and to enable self-learners to customize and monitor their study. The tool can be used not only by students but also by TVIs as a reference guide.

Based on that suggestion, the product manager submitted a new product proposal in October 2017 to create an abacus-learning app called Practice2Master Abacus. The app is designed to be compatible with both iOS® and Android® platforms. It includes systematic instructions based on the logical approach of abacus calculation and covers all four arithmetic operations. Students can use either app-generated problems or problems created by their teachers for practice and drill.

#### Work Completed During FY 2022

The development team built a prototype of Practice2Master Abacus for use in a field test. The field test started October 13 and ended November 30, 2021. Twelve testers submitted completed evaluation forms by the end of the field test. They were from Alabama, Massachusetts, Missouri, New Mexico (2), New York, Pennsylvania (3), Tennessee, and Texas. All testers were TVIs and worked in itinerant positions (information about one tester was missing).

On average, testers had 14 years of experience teaching students with visual impairments, and 11 years of experience teaching the abacus. They tested this app with 12 students during the field test. Below is a breakdown of students' demographics:

* Five (5) students (42%) were female, and 5 students (42%) were male. Genders of 2 students were unknown.
* Students’ ages ranged from 8 to over 18, with the median being 11 and the mode (most frequently reported ages) being 9 (3 students).
* Academic levels ranged from 3rd grade through 12th grade, with the mode being 3 (4 students).
* Seven (7) students (58%) had low vision, and 5 students (42%) had blindness.
* For primary reading medium, 6 students (50%) used braille, 4 students (33%) used large print, 1 student (8%) reported electronic, and 1 student (8%) reported both braille and large print.
* Five (5) students (42%) had disabilities in addition to their visual impairments. Their conditions included Autism, ADHD, deafblindness, and others.

After testing the app with their students, testers were asked to rate the app for students’ abacus study. Nine (9) of the 12 testers responded. On a scale from 1 (not at all useful) to 5 (very useful), 1 tester gave 3, 7 gave 4, and 1 gave 5. The average was 4.

Testers listed the followings strengths of Practice2Master Abacus (direct quotes):

* “It is a way for students to practice abacus skills when the teacher is not present.”
* “This is the only abacus apps that I can find for students VI. It has a potential to provide them a great opportunity to enjoy their abacus math activities on the screen.”
* “Students enjoy using technology - can be easier to get them to use the abacus.”
* “It makes learning the abacus ‘cooler’ with the tech piece and allows for the entire spectrum of learning the abacus.”

The following were weaknesses identified by testers (direct quotes):

* “It only allows for one method in the lesson section.”
* “It does not have a basic approach for very beginner abacus users with VI. It would be nice to simple words explanations for these students.”
* “The clunkyness in navigation with Voice Over and a braille display.”

Below is a summary of testers’ suggestions:

* Lower the reading level of instructions for young students.
* Add a level for young students that would include basic skills, such as setting and recognizing numbers and one-digit number addition and subtraction.
* Enlarge font sizes and adjust colors for low-vision students.
* Improve the digital abacus to make it more user friendly.
* Allow students to control the pace when reading lesson instructions.

The development team discussed field-test results and decided to make the following revisions:

* Revise instructions to lower their reading levels.
* Add pre-developed problem lists on one-digit number addition and subtraction.
* Add settings to allow users to change colors and font sizes.
* Improve the digital abacus to make it easier to see and navigate.
* Adjust the order of accessibility elements on lesson slides to make it easier for students to find the Next button.
* Explore ways to break lesson instruction shown on each slide into chunks to make it easier for screen reader users to read.
* Update the guidebook to include recent changes.

All these revisions have been made. The app launched on September 23, 2022.

### Snap Circuits® Jr. (Modernization)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org).

#### Purpose

To update the Snap Circuits® Jr. introductory electronics kit to the current version produced by Elenco®

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Lydia Smith, Digital Content Product Specialist

Heather Kennedy-MacKenzie, Director of Technology Product Research

Ken Perry, Senior Software Engineer

Mark Rohret, Technology Quality Assurance Analyst

Connor MacKenzie, Consultant

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

APH released the Snap Circuits® Jr. Access Kit in April 2018. This kit teaches children 8 and older about circuits, current, resistance, switches, motors, and other basic electronics concepts. Made by Elenco® and sold in retail stores, Snap Circuits Jr. is widely used in classrooms because the parts are durable, colorful, and easy to assemble into projects that light up, make sounds, and move elements like fan blades. The kit sold by APH includes the commercial product and is made accessible to blind and visually impaired users by providing parts labeled in braille, along with written project instructions in braille and large print.

In 2021, Elenco changed the content of the Snap Circuits Jr. kit as well as the manual and packaging. Some of the original components were removed, new parts were added, several of the 101 original projects were changed, and 29 projects were added (the kit now has 130 projects). The manual is also divided into two parts, both of which are available online, and the print manual for projects 1-71 is included in the box.

The original APH adapted kit sold well, and English and Spanish versions have been incorporated into a summer camp activity sponsored by APH outreach services. To continue to provide introductory electronics activities accessible to students with vision impairment, APH staff got the go ahead to make the necessary adaptations to the new version of this Elenco product to reintroduce it to the vision impairment community.

#### Work during FY 2022

Rosanne Hoffmann submitted a Product Modification form in January 2022 stating the need to adapt the new version of Snap Circuits Jr. for students with vision impairment.

A Gate 1 meeting took place in February 2022 during which the changes needed for the new kit were discussed; the project achieved a matrix score of 72.

In February 2022, Heather MacKenzie identified the differences between the old and new kits with regard to the braille labels needed to make various parts accessible; the placement of some labels will be changed, and some labels will be eliminated in the new kit. The team determined that several projects that involve lamps need additional parts to make them accessible. The user guide will provide instructions on how to substitute a horn and/or a motor and fan assembly for lamps in these cases. MacKenzie and Rod Dixon confirmed that the additional parts (to be ordered separately from Elenco) will fit in the new Snap Circuits Jr. box.

A Gate 2 Product Design meeting took place in March 2022. Details about the revised kit were discussed: the prototype will not be field tested, retooling is needed for the braille stickers, and accessible versions of the user guide (PDF and BRF) will be made available online only. The project achieved a matrix score of 72.

From February through August 2022, Connor MacKenzie and Mark Rohret built all 130 projects and added project descriptions to an updated user guide.

#### Work planned for FY 2023

Dixon will complete writing the specifications for the product and design the labels for the additional parts to be added to each Snap Circuits® Jr. box. After Hoffmann reviews the updated user guide, it will be converted to an accessible PDF and transcribed to braille (BRF). The user guide will also be translated into Spanish. The Snap Circuits Jr. Modification is expected to be released for sale before the end of calendar year 2022.

### Submersible Audio Light Sensor

Formerly Submersible Audible Light Sensor

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org)

#### Purpose

To provide a device that allows K-12 students who are visually impaired to participate more fully in science experiments and promote their interest in fields of research related to science, technology, engineering, and mathematics (STEM)

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Andrew Moulton, Director of Technical and Manufacturing Research

Lawrence Lovelace, Advanced Software Engineer

Ken Perry, Senior Software Engineer

Mark Klarer, Advanced Software Engineer

James Robinson, Manufacturing Specialist

Joe Wegner, Electronic Product Design/Manufacturing Specialist

Joseph Hodge, Technical Innovations Product Manager

Cary Supalo, President; Independence Science, LLC

Mark Swain, Electrical Engineer; Precision Circuit, LLC

Ron Supalo, Project Manager; Independence Science, LLC

Greg Williams, Director of Products and Training; Independence Science, LLC

Ashley Neybert, Lead Curriculum Specialist; Independence Science, LLC

Emily Grimany, Product Specialist

Lara Kirwan, Senior Product Specialist

#### Background

The Submersible Audio Light Sensor (SALS) device detects changes in light in air (e.g., placement over dark or light objects) or in aqueous solution (e.g., chemical reactions that form precipitates) and converts this signal to comparable changes in audible sound or tone. This instantaneous feedback allows students who are visually impaired to observe the same information as students with typical vision in real time. SALS is unique in that the probe detects light while immersed in liquids in addition to detecting light in air.

Originally developed by Cary Supalo in 2005, the first SALS device consisted of a light-detecting probe (photocell contained within a glass and plastic wand) connected to a standalone output or control box (see Figure 1).

**Figure 1**

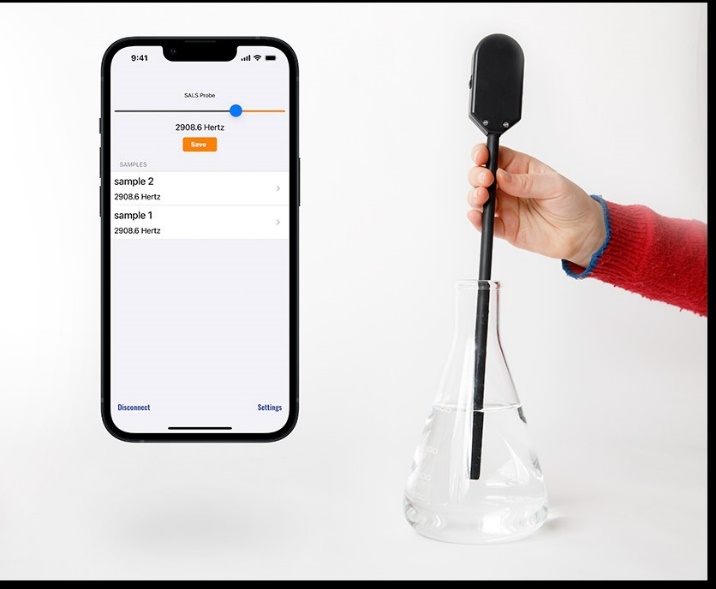
Child Using the SALS Probe With the Stand-Alone Conversion Box



APH came on board in 2011 to redesign the device and conducted a prototype field test in 2015. Field test results revealed that SALS improved the participation of students with vision impairment in the science classroom, particularly students with total blindness. However, by 2016 the product manager recognized the increased popularity and acceptance of smart devices in schools and approved the development of a SALS app that would connect wirelessly to the light-detecting probe via Bluetooth®. Following successful feasibility tests, iOS® and Android® versions of the SALS app were developed along with a wireless light-detecting probe (see Figure 2).

**Figure 2**

SALS Probe in use with app on smart device



Hardware, firmware, and software development of the SALS app and probe were completed in 2019. Source International was selected to produce the SALS probes in 2020 and a full production run of 250 units was ordered in July 2021. Boxed probes from Source International include a print and braille insert that directs users to accessible PDF and BRF versions of the SALS User Guide. The SALS webpage on the APH shop site will include a link to accessible PDF and BRF versions of 10 activities appropriate for the SALS probe and app in addition to the SALS User Guide.

#### Work during FY 2022

The 250-unit order of SALS probes arrived at APH in June 2022. (The delay was due to supply chain issues and the Chinese New Year.) In July 2022 the SALS units were inspected for quality assurance. In August 2022 the product manager completed a SALS User Guide which was then transcribed to braille and converted to an accessible PDF document. The SALS probe and the iOS and Android apps were released for sale in September 2022.

#### Work planned for FY 2023

The iOS™ and Android™ apps will be updated as needed and any issues that arise from customers and users will be addressed. The product manager will make appropriate changes to the SALS User Guide and ensure PDF and BRF versions are up to date. Marketing efforts will continue in the form of blogs, webinars, and conference presentations.

## Early Childhood

### Alphabet Scramble (Modification)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To update the popular read-aloud story book into Unified English Braille (UEB)

#### Project Staff

Rachel Bishop, Braille Product Manager

#### Background

*Alphabet Scramble* is a read-aloud story book designed to introduce young children to braille and large print. The current version of *Alphabet Scramble* is written in the outdated English Braille: American Edition (EBAE) code and needs to be updated into UEB. The book is popular with Teachers of the Visually Impaired, who regularly request these updates.

In December 2021, the Braille Product Manager submitted a Modification form to the Product Ideation Committee (PIC) requesting permission to modify the product to comply with UEB guidelines. Updates would include the front cover (catalog number, APH logo, UEB logo), as well as updates to the copyright page, inner pages, back cover, and user booklet.

#### Work Completed During FY 2022

A Gate 1: Product Ideation Committee (PIC) meeting was held, and the product was approved to go into development in February 2022.

#### Work Planned for FY 2023

In FY 2023, a Gate 2: Product Design meeting will be scheduled for the project, and work will begin on the braille and layout.

### Animal Recipes Farm Set

Formerly Animal Recipes

(Completed)



For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To teach and reinforce a young child’s understanding of the salient features of animals with animal “recipes” and key “ingredients” that make each animal unique

#### Project Staff

Susan Sullivan, CVI Project Leader

Dawn Wilkinson, Early Childhood Project Leader

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Kelly Kennedy Mimms, Research Assistant

Leasha Twyman, Research Assistant

Frank Hayden, Director of Technical and Manufacturing Research

Andrew Moulton, Manager of Technical and Manufacturing Research

Adam Clark, Manufacturing Specialist

Anthony D. Jones, Art Production/Design Manager

Matt Poppe, Graphic Designer

Katherine Corcoran, Model Maker/Pattern Maker

INgrid Design, Graphic Design

Ricky Irvine, Graphic Designer

#### Description

The Animal Recipe farm set will include seven animals: horse, cow, goat, pig, sheep, rooster, and goose. One of the main objectives of this kit is to allow young children to make the connection between the 3D manipulatives and the visual/tactile representations. In order to accomplish this concrete-to-abstract thinking, the foundational components of the kit begin with seven 3D jumbo farm animal figures. Each animal in the set will have a colored LED Mini-Lite Box print underlay representing the animal’s side profile with a corresponding LED Mini-Lite Box clear overlay of a tactile side profile that can be associated with the animal figure. A set of clear puzzle pieces (eyes, ears, nose/snout) can then be used to create the image displayed on the colored LED Mini-Lite Box underlay and matching clear tactile overlay depicting the animal’s face.

Providing children with the “ingredients” for each animal, paired with the “recipe” for building that animal, will foster a multi-sensory understanding. Three-dimensional models will promote the transfer of understanding to tactile representations of the animals.

#### Work Completed During FY 2022

In Fall 2021, the manufacturing specialist reported that the part number for the braille sheets had been received, a spec meeting was held, and Operations Engineering finalized the details of the product in Syspro.

The first set of the Animal Recipes, the Farm set, launched November 3, 2021.

### Early Childhood Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, related to this category of projects, send email to drogers@aph.org.

#### Purpose

To research and develop educational materials that address the diverse needs of children birth to six years with visual impairments in order to meet the needs of early interventionists, teachers, and parents

#### Project Staff

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Rosemary Sims, Research Assistant

Sarah Welch, Product Specialist

#### Background

Product development in the area of early childhood has continually been a focus of the Educational Product Innovation department. Various product managers (PMs) have sought input from the field to develop products that meet the needs of early childhood across the curriculum. Donna McClure-Rogers began work as the early childhood PM in August 2019.

#### Work Completed During FY 2022

The PM continued to manage the early childhood projects currently under development and review new product submissions, conduct needs and feedback surveys, write product blogs, conduct webinars, participate in podcasts, and monitor early-childhood product sales for those products already in circulation. The PM continued to represent The American Printing House for the Blind (APH) at multiple events and network with Ex Officio Trustees, teachers, early interventionists, and parents.

The PM attended various virtual conferences and webinars throughout the year, including: California Transcribers and Educators for the Blind and Visually Impaired (April 2022), Perkins School for the Blind’s CVI: Collaboration for Change (June 2022), and National Federation of the Blind National Convention (July 2022). These conferences provided opportunities for networking with professionals in the field of early childhood education and visual impairments and a chance to learn about current research in the field.

Tasked with serving as the “evangelist” for APH’s early childhood products, the PM continued her ongoing training in product management throughout 2021.

#### Work Planned for FY 2023

Investigation and development of new products for early childhood will continue, along with modernization of existing products. Training APH staff on new and existing products in the area of early childhood will continue, as needed. Monitoring parent needs and concerns will continue via the use of social media, requests through the APH Connect Center, and questions from teachers of the visually impaired. The PM will collaborate with experts in the field, conduct literature reviews, and present at and attend conferences in order to determine appropriate educational products and materials to address best practices in the area of early childhood and visual impairment.

### Emergent Numeracy Kit for Preschool

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To determine major needs areas in emergent numeracy for young children with visual impairments and to develop a kit to be used by early interventionists and preschool teachers

#### Project Staff

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Sarah Welch, Product Specialist

Dawn Wilkinson, Early Childhood Project Leader

Jeanette Wicker, Core Curriculum Consultant

Adam Clark, Manufacturing Specialist

Rod Dixon, Manager of Technical and Manufacturing Research

Jeff Williams, Manufacturing Specialist

Joe Wegner, Electronic Product Design/Manufacturing Specialist

Ben Taylor, Model Maker/Pattern Maker

Matt Poppe, Graphic Designer

#### Background

Many journal publications have focused on teaching emergent numeracy concepts to very young children. There is evidence that combining math and literacy through the use of picture books in a meaningful situation can increase a young child’s understanding of numbers in the real world setting. Since a great deal of research has focused on storybooks that are picture based and use math manipulatives that are color dependent, it is in the best interest of young children with visual impairments that these materials be adapted accordingly. The development of an early childhood numeracy product was subsequently ranked as a very high priority by the early childhood focus group held at APH in 2012.

Work During FY 2022

*Five Speckled Frogs*

Fast forward to FY 2022, work is underway again on *Five Speckled Frogs.* In July 2022, a dragonfly sample was created in-house with the 3D printer; the sample was approved. In early 2022, the vendor informed the team that they will no longer sell the brown vinyl/polyblend that is used for the log. Alternate plans were discussed. In February 2022, the team decided to move forward with using green vinyl printed with brown ink; however, at a Gate 5: Specifications meeting, the team learned that the green shelf liner to cover the frogs is available again. Also at the Gate 5 meeting, it was determined that a manipulative dragonfly will be made in-house with the 3D printer. *Five Speckled Frogs* is scheduled to launch in December 2022.

*My Very First Book of Shapes*

The prototype was field-tested November 2021 through January 2022. Reviewers suggested changes to the product, some of which the team decided to implement. Table 1 paraphrases the reviewer comments and the decisions and comments made by the development team. Currently, *My Very First Book of Shapes* is on hold.

**Table 1**

*Reviewer Comments About and Team Response to* My Very First Book of Shapes *Prototype*

| Reviewer Comment | Team Response |
| --- | --- |
| Add a user guide. | Large print and braille versions of a user guide will be included. The product specialist will begin work on this guide. |
| Make the pages larger. | Using a larger book would make it difficult for young hands to carry it around. It also would mean that the book would need to be changed to a square shape. Because so few reviewers commented on this, this suggested change was rejected. |
| Rotate the diamond. | Rotating the diamond would not allow the shape to fit on the page as it is currently sized. |
| The book does not lay flat when opened. | The PM requested larger binder rings. Manufacturing Specialist Jeff Williams is investigating this. |
| The cover is flimsy. | The stabilizing that were placed inside the covers are not functioning properly. Williams will try to locate a thicker clear stabilizer. |

*The Doorbell Rang*

The manufacturing specialists created a pattern for the cookies. A die cut was ordered but has still not arrived. The vendor no longer sells the sound chips, which are used in many APH products. Affected PMs discussed options; samples of those options are forthcoming. The likely change in the design of the chip may prolong prototype development. The electronic product design/manufacturing specialist may need to create this sound chip in-house. The sound page, intended to be used on the back page for the sound of a doorbell throughout the book, was discontinued. While in search of a replacement, the project was put on hold.

Work Planned for FY 2023

*Five Speckled Frogs* is scheduled to launch in December 2022. *My Very First Book of Shapes* and *The Doorbell Rang* will remain on hold.

### Fingers That Dream (Les Doigts Qui Rêvent)

Formerly Tactile Books/International Collection

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [swright@aph.org](mailto:swright@aph.org) or [drogers@aph.org](mailto:drogers@aph.org)

#### Purpose

To collaborate in order to provide high-quality tactile illustrated books with print/braille text to support the emergent literacy skills of young children with visual impairments and to join the efforts of Les Doigts Qui Rêvent (LDQR) and other organizations in sharing information leading to improved quality and production of tactile books

#### Project Staff

Suzette Wright, Emergent Literacy Product Manager

Donna McClure-Rogers, Early Childhood and CVI Product Manager

#### Background

The Les Doigts Qui Rêvent (LDQR) workshop, located in Dijon, France, has specialized in the production of collage-style tactile illustrated books since its establishment in 1994, producing more than 50,000 books in multiple languages. LDQR award-winning books have been featured in *Outstanding Books for Young People with Disabilities*, a catalog and exhibit organized by the International Board on Books for Young People (IBBY).

LDQR’s books include hand labor and often involve sewn parts and special methods of attachment, enabling moving parts, as well as fabric textures. Richly textured books, such as those produced by LDQR, meet a need identified by the Early Books Focus Groups (2004, 2007) and Meeting of the Minds (2011) for a greater variety of books for young tactual learners— “something besides raised line drawings and thermoforms.” Available research supports the central role of texture in interpreting tactile illustrations (Theurel, et al., 2013; Gentaz & Hatwell, 2003).

#### Work Completed During FY 2022

To preserve the goal of offering variety to consumers while giving them a wider window in which to order new titles before they are discontinued, the product managers (PMs) consulted with LDQR and completed development of a new order and delivery plan. The plan seeks to maximize LDQR’s production capabilities and provides APH with two back-to-back production runs of new titles. At least one new title will be produced each year. The *Six Little Dots* book title and Six Dots Game of Cards will continue to be regularly stocked. The PMs presented the plan to a large group of in-house staff; it was approved in May 2022.

By February 2021, all copies of *Let’s Eat!* had been ordered; an order of a second run of 500 copies was approved, the books were delivered, and they became available in March 2022.

500 copies of the first run of *How to Recognize a Monster* were delivered to APH in February 2022.

A “pass-through” form, serving as a Gate 5: Specifications meeting form, for the first run of another new book, *A Tail for Baby Lizard*, was approved and resulted in a request for a quote. A purchase order was subsequently sent, and PMs worked with LDQR staff to translate, modify illustrations, and proof the print and the UEB braille layout of the new book. In September 2022, 500 copies are expected to be ready.

#### Work Planned for FY 2023

The new book, *A Tail for Baby Lizard*, will be stocked and launched.

*Six Little Dots* (book) and the Six Dots Game of Cards will continue to be regularly stocked; however, the card game is currently out of stock. It has been reordered and is due to be delivered in December of 2022.

A second run of *How to Recognize a Monster* will be ordered as stock is depleted, and another new book will be ordered and is slotted into the new order and delivery plan to become available in calendar year 2023.

**References**

Gentaz, E., & Hatwell, Y. (2003). Haptic processing of spatial and material object

properties. In Y. Hatwell, A. Streri, & E. Gentaz (Eds.), *Touching for knowing* (pp. 123–159). Amsterdam, The Netherlands: Benjamins.

Theurel, A., Witt, A., Claudet, P., Hatwell, Y., & Gentaz, E. (2013). Tactile picture

recognition by early blind children: The effect of illustration technique. *Journal of Experimental Psychology-Applied,* 19(3), 233-240. doi:10.1037/a0034255

### FirstTouch Books

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org) or [swright@aph.org](mailto:swright@aph.org).

#### Purpose

To develop read-aloud, tactile illustrated books with interactive features that support the development of emergent literacy skills for students ages birth to three years

#### Project Staff

Suzette Wright, Emergent Literacy Product Manager

Monica Vaught-Compton, Product Specialist

Frank Hayden, Director of Technical and Manufacturing Research

Andrew Moulton, Director of Technical and Manufacturing

Bryan Rogers, Manufacturing Specialist

#### Background

Children take their first steps toward learning to read and write early in life. Reading aloud to a child, from infancy onward, has been cited as a key contributor to later success in learning to read. Young children who will read braille, however, face a limited selection of books in braille, particularly print/braille books that enable a typically sighted adult to read aloud to the child. Even fewer books contain tactile illustrations capable of adding both meaning and interest to the words of a story. The The American Printing House for the Blind (APH) continues to make strong efforts to poll the field to determine and seek help in prioritizing current needs. In an online survey, 140 of 156 respondents ranked very simple, early books for birth to three years as a high need, a need also noted by subsequent focus groups. APH shared the survey results with two consultants with experience in teaching and in research regarding emergent literacy for children with visual impairments, and they recommended that APH develop adaptations of high-quality, commercially available books with tactile components added by APH and that APH create books with simple texts written to support meaningful tactile, interactive components. *Holy Moly* is, the first book developed for the series; it was priced and made available for purchase in spring 2018. t

APH selected the second book for this series, *Tickly Prickly*, and copyright permission was obtained..

#### Work Completed During FY 2022

*Tickly Prickly* continued to be on hold as the PM focused on projects already underway as well as department-wide efforts including: training in product management, sales analysis and forecasting, and obsoletion of products.

#### Work Planned for FY 2023

The previous PM will be available to serve as a consultant, and a new PM will be assigned, making it possible for development of *Tickly Prickly* or another book to begin. As first steps, the tactile illustrations and layout will be completed and submitted at a Gate 2: Product Design meeting. If approved to move forward, the manufacturing specialist and model maker will join with the PM to gather materials and refine designs leading to prototype production.

**Reference:**

Theurel, A., Witt, A., Claudet, P., Hatwell, Y., & Gentaz, E. (2013). Tactile picture

recognition by early blind children: The effect of illustration technique. *Journal of Experimental Psychology-Applied,* 19(3), 233-240. doi:10.1037/a0034255

### Moving Ahead: Tactile Graphic Storybooks

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org) or [swright@aph.org](mailto:swright@aph.org).

#### Purpose

To provide print/braille storybooks for upper preschool, kindergarten, and first grade students featuring tactile graphics designed to encourage tactual exploration; refine tactual discrimination; and introduce tactile symbols, simple keys, and maps in the context of a story

#### Project Staff

Suzette Wright, Emergent Literacy Product Manager/Author

Monica Vaught-Compton, Product Specialist

Lois Harrell, Consultant/Author

Mila Truan, Consultant

Josephine Stratton, Consultant

#### Background

Symbolic visual displays, such as maps and diagrams, play an increasingly important role in textbooks and computer displays for students with typical vision. They present a special challenge for students with significant vision loss, who are often expected to use a tactile equivalent in the course of their studies and in test-taking. Observers have suggested that difficulty interpreting tactile displays may be due, in part, to lack of early exposure. The four storybooks for the series developed thus far are designed to give young students opportunities to explore and interpret tactile illustrations featuring raised line symbols, lines, and areal patterns.

Of equal importance, the storybooks offer exposure to braille and foster key emergent literacy skills. The print/braille text of the books is intended to be read aloud by an adult reader. Embedded text (in large print and the user’s choice of either contracted or uncontracted braille) offers opportunities for the student to explore and read single words and short phrases, just as they might read labels included in a tactile diagram. Storyboards with detachable raised line symbols depicting the storybook’s characters are available for three of the books, supporting the child’s retelling of the story as well as providing tactile displays assembled by the child. Each book is accompanied by a Reader’s Guide with information about how to introduce the child to the book’s tactile graphics and with a brief discussion about emergent literacy skills and development of tactual learning skills. Following field evaluation of the four storybooks and approval for sale on the Federal Quota, it was decided that each of the four books be produced separately to assist flow through the pre-production/tooling and production phases. *Goin’ On a Bear Hunt* was produced first, followed by *Splish the Fish*, and *The Boy and the Wolf*; the last book to be produced, *Turtle and Rabbit*, became available for purchase in FY 2012.

The product manager (PM) has proposed tactile adaptations of additional books for the series; however, difficulties in obtaining copyright permission and work on higher priority projects prevented further development. (Permission is necessary because the print text is retained, interlined with the braille text, and tactile illustrations replace original print illustrations.)

#### Work Completed During FY 2022

The project continued to be on hold as the PM focused on projects already underway and requests for copyright permission remained unanswered.

#### Work Planned for FY 2023

A new PM will take over, and the previous PM will serve as a consultant. A last attempt to obtain permission to adapt *Dans le Cour de l’ Ècole* (*In the Schoolyard*) may be made, or permission to use the book *Louella Mae, She’s Run Away!* or another book may be pursued.

### On the Way to Literacy Storybooks (Modernization)

Formerly Art Digitizing/Modernizing of On the Way to Literacy Storybooks

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org) or [swright@aph.org](mailto:swright@aph.org).

#### Purpose

To update the storybooks by replacing deteriorating film art with digital art, reducing page sizes to enable in-house printing of the books, updating tactile and visual illustrations, converting and producing them in Unified English Braille (UEB), and providing more book-like binding

#### Project Staff

Suzette Wright, Emergent Literacy Product Manager

Anthony D. Jones, Director of Creative Services

Frank Hayden, Director of Technical and Manufacturing Research (retired)

Andrew Moulton, Director of Technical and Manufacturing Research

Bryan Rogers, Manufacturing Specialist

Katherine Corcoran, Model Maker

Andrew Dakin, Pattern Maker/Model Maker

Ben Taylor, Model Maker/Pattern Maker

#### Background

The 18 storybooks in the On the Way to Literacy series were first produced in the early 1990s using film art, then the standard in the printing industry. Because the original film art for the books was deteriorating and digital files are now standard in the industry, Production asked that the print tooling for the books be recreated in digital file formats. In addition, Production staff recommended redesigning the books for digital production, making it possible to produce smaller runs in-house.

As an additional modification, consumers and focus-group members repeatedly noted the importance of providing read-aloud books to interest sighted peers; therefore, print illustrations were redesigned to make the illustrations more visually attractive for sighted audiences without disadvantaging the tactual reader. The product manager (PM) worked with the in-house graphic designer and outside graphic designers to complete the modernization of six books (*Something Special*, *That’s Not My Bear*, *Giggly Wiggly*, *The Littlest Pumpkin*, *Jennifer’s Messes, Geraldine’s Blanket*). The PM conducted an initial examination of all books to assess the impact of conversion to UEB on each book’s layout of text and graphics. The last book to receive print art modifications, *Geraldine’s Blanket*, was updated to UEB.

The PM had long advocated for a more extensive update of tactile illustrations in some books, providing collage style illustrations featuring a wider variety of textures. Research confirms the effectiveness of this type of illustration (Theurel et al., 2013). *The Caterpillar*, written by Josephine Stratton (1991), was rewritten and re-illustrated using a variety textures, interactive elements, and a more book-like binding and cover. It was updated to UEB. A workshop approach to modernization of *The Caterpillar* was used involving a small group of graphic designers, artists, TVIs, and other in-house staff. The book was prototyped, and field test results indicated teachers and parents were very positive with the book as redesigned. Comments centered around the developmentally appropriate nature of the book, its tactile appeal, and interactive qualities.

Given highly positive feedback for the changes made to *The Caterpillar*, the book *Jellybean Jungle* was selected for similar extensive modernization utilizing input from workshop participants. It was updated to UEB. Field-testing was equally successful. A Gate 4: Modifications meeting was held in July 2021.

#### Work Completed During FY 2022

Production of *The Caterpillar* was completed. The PM completed a Creative Kickoff form (description of product, product purpose, field test results) and submitted this for the product launch. She approved written texts for the product brochure, product shopping page, and social media posts. The product was priced and launched in February, and a Gate 6: Product Launch/Lessons Learned meeting was held in March. Initial orders for the book have been very good. Orders for first run have almost depleted stock and a second run is underway.

Regarding *Jellybean Jungle*, the PM supported the work of the manufacturing specialist as he worked on tooling and written specifications. A meeting was held in July to overview the specifications.

UEB files for *The Blue Balloon* with modernized print art and font were completed; they will be placed on the server along with the updated print art to be used for this book’s next production run.

Five books in the series were selected for obsoletion: *Book About Me*, *That Terrible Awful Day*, *Thingamajig*, *Gobs of Gum*, *The Gumdrop Tree*. Remaining inventory of these titles will continue to be sold until stock is fully depleted.

A sharp increase in the price of the ring binders used for On the Way to Literacy titles prompted Purchasing and Production staff to request that the PM explore other means of binding the books. Costs and design options were analyzed in detail; the least expensive and difficult option was sampled, but the height of the front cover’s embossed tactile symbol (in clear label material applied over print art) was inadequate.

#### Work Planned for FY 2023

Once written specifications and tooling for *Jellybean Jungle* are completed, a Gate 5: Specifications meeting will be called by the manufacturing specialist to initiate production of the book. The PM and manufacturing specialist will follow progress of the product through the production phase. The PM will submit a Creative Kickoff form with information to be used in preparing product launch materials.

A new PM will take over, and the previous PM will serve as a consultant. Movement of remaining books in the series to UEB will be resumed, as will exploration of moving some titles to generic binders or to a more book-like binding if not cost-prohibitive and if staff time permits.

**References**

Theurel, A., Witt, A., Claudet, P., Hatwell, Y., & Gentaz, E. (2013). Tactile picture

recognition by early blind children: The effect of illustration technique. *Journal of*

*Experimental Psychology-Applied,* 19(3), 233-240. doi:10.1037/a0034255

### Moving Ahead: Tactile Graphic Storybooks

(Continued)

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For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org) or [swright@aph.org](mailto:swright@aph.org).

#### Purpose

To provide print/braille storybooks for upper preschool, kindergarten, and first grade students featuring tactile graphics designed to encourage tactual exploration; refine tactual discrimination; and introduce tactile symbols, simple keys, and maps in the context of a story

#### Project Staff

Suzette Wright, Emergent Literacy Product Manager

Monica Vaught-Compton, Product Specialist

Lois Harrell, Consultant/Author

Mila Truan, Consultant

Josephine Stratton, Consultant

#### Background

Symbolic visual displays, such as maps and diagrams, play an increasingly important role in textbooks and computer displays for students with typical vision. They present a special challenge for students with significant vision loss, who are often expected to use a tactile equivalent in the course of their studies and in test-taking. Observers have suggested that difficulty interpreting tactile displays may be due, in part, to lack of early exposure. The four storybooks for the series developed thus far are designed to give young students opportunities to explore and interpret tactile illustrations featuring raised line symbols, lines, and areal patterns.

Of equal importance, the storybooks offer exposure to braille and foster key emergent literacy skills. The print/braille text of the books is intended to be read aloud by an adult reader. Embedded text (in large print and the user’s choice of either contracted or uncontracted braille) offers opportunities for the student to explore and read single words and short phrases, just as they might read labels included in a tactile diagram. Storyboards with detachable raised line symbols depicting the storybook’s characters are available for three of the books, supporting the child’s retelling of the story as well as providing tactile displays assembled by the child. Each book is accompanied by a Reader’s Guide with information about how to introduce the child to the book’s tactile graphics and with a brief discussion about emergent literacy skills and development of tactual learning skills. Following field evaluation of the four storybooks and approval for sale on the Federal Quota, it was decided that each of the four books be produced separately to assist flow through the pre-production/tooling and production phases. *Goin’ On a Bear Hunt* was produced first, followed by *Splish the Fish*, and *The Boy and the Wolf*; the last book to be produced, *Turtle and Rabbit*, became available for purchase in FY 2012.

The product manager (PM) has proposed tactile adaptations of additional books for the series; however, difficulties in obtaining copyright permission and work on higher priority projects prevented further development. (Permission is necessary because the print text is retained, interlined with the braille text, and tactile illustrations replace original print illustrations.)

#### Work Completed During FY 2022

The project continued to be on hold as the PM focused on projects already underway and requests for copyright permission remained unanswered.

#### Work Planned for FY 2023

A new PM will take over, and the previous PM will serve as a consultant. A last attempt to obtain permission to adapt *Dans le Cour de l’ Ècole* (*In the Schoolyard*) may be made, or permission to use the book *Louella Mae, She’s Run Away!* or another book may be pursued.

## Early Childhood Technology

### Astro Adventure Balls: Swirl, Twirl, & Whirl (Modernization)

Formerly Revolution Sports Ball

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).



#### Purpose

Purpose 1: To bring back a discontinued ball that is in high demand by teachers, parents, and children

Purpose 2: To provide animated cartoons in an app that will help students develop visual complexity skills

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Susan Sullivan, CVI Consultant

Emily Grimany, Product Specialist

Rod Dixon, Manager of Technical and Manufacturing Research

Andrew Moulton, Director of Technical and Manufacturing Research

Rob Meredith, Senior Software Engineer

Mark Klarer, Advanced Software Engineer

Matt Poppe, Graphic Designer and Illustrator

#### Description/Background

Each Astro Adventure ball will have its own name—Swirl, Twirl, or Whirl. The multiple disabilities product manager and the CVI consultant wrote the script for the first cartoon (Whirl) for the development of the app. The graphic designer and the two developers met with the product managers, as needed, to assess needs and progress.

The team commenced the development of the app in late 2021. The ball development remained on temporary hold, in accordance with the Educational Product Innovation Department’s New Product Development process.

#### Work Completed During FY 2022

The team tested the app through TestFlight® and then had three professional reviewers test it, each completing a questionnaire. Development commenced on the ball, but locally made prototypes still could not produce the required sound for 20 seconds. APH decided to send a request for proposals to see if an outside manufacturer could successfully produce the results we need.

#### Work Planned for FY 2023

The team will continue to seek a manufacturer who can replicate the ball we need. If successful prototypes are made, the team will field-test them with the app.

### BrailleBuzz™ App (Modernization)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To provide access to the BrailleBuzz app content in additional languages and meet the needs of our English Language Learners (ELL)

#### Project Staff

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Bobby Fulwiler, Product Specialist

John Karr, Software Engineer

#### Description

This project is a cross-platform (iOS®, Android™) digitization of the Phonics and Letter modes of the popular BrailleBuzz hardware. This modernization will create a version of the app in Spanish for our ELL customers and their families.

#### Work Completed During FY 2022

Work began on this project in January 2022. Technology Products Research designed an app template that could be used for additional language options in the future. Multiple members of APH staff contributed to identifying appropriate phonics correlations for each letter of the Spanish alphabet to maintain relevance for our users with visual impairments. Sounds were then identified for each of the phonics words. The original script for the English version of the app was modified to fit the Spanish alphabet version. In August 2022, the product specialist began the pursuit of a voice artist who would meet the needs of native Spanish speakers and appeal to our youngest audience.

#### Work Planned for FY 2023

The following tasks will be completed:

* Voice artist will be identified.
* Recording of the script will be completed.
* Audio will be applied to the app.
* App will be reviewed by both the PS and the product manager.
* App will launch.

### Novel Effect – The Caterpillar (Modernization)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To create an additional level for active reading with the modernized version of *The Caterpillar* through Novel Effect’s game-changing app, which listens to the reader’s voice and adds sound effects, enhancing the storytelling experience

#### Project Staff

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Lydia Smith, Digital Content Product Specialist

#### Description

Working in collaboration with the app Novel Effect, a soundscape will be created to accompany the modernized version of the On the Way to Literacy (OTWL) book *The Caterpillar*. The soundscape will assist children with visual impairments to understand the context within the story, much like the visual images do for sighted children. The book will be read aloud while the app is open, and the app will react to specific words within the text by producing a sound that fits with specific content within the story.

#### Work Completed During FY 2022

The app was reviewed by The American Printing House for the Blind staff and was determined to have accessibility barriers. A Gate 2: Product Design meeting was held on May 31, 2022 (and then reconvened to perform a matrix score on the product on July 19, 2022). App usage with *The Littlest Pumpkin* file/book (the first book produced with the Novel Effect soundscape) was evaluated to determine if previous activity warranted creating another soundscape for an OTWL title. The committee determined this product could move forward.

#### Work Planned for FY 2023

Ensure accessibility with Novel Effect and develop a prototype by Fall 2023.

### Polly®

Formerly Annie™

(Continued)



For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To create an interactive electronic braille device for young children that will serve as a step between the Braille Buzz alphabet-introduction tool and a typical refreshable braille display, to provide reinforcement of braille lesson concepts taught by teachers of the visually impaired (TVIs), and to supplement independent practice in the classroom or at home

#### Project Staff

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Sarah Welch, Product Specialist

Matthew Pope, Graphic Designer

Chris Argabright, Graphic Designer

Anthony Jones, Director of Creative Services

Jessica Wortham, Voice Artist

Lydia Smith, Digital Content Product Specialist

Lara Kirwan, Senior Product Specialist

Emily Grimany, Product Specialist

Thinkerbell Labs Pvt. Ltd., Consultant

#### Description

This electronic device has multiple interaction methods, including brailler-style keys, a speaker for instruction and feedback, an innovative electronic braille slate, a six-cell braille display, two jumbo braille cells, and an online learning portal that allows remote access for educators and parents. The device also has volume control, a headphone jack, two USB ports, an Ethernet port, Wi-Fi access, and a Repeat button. Included in the box will be a power cord, guidebook, and saddle stylus to use with the electronic braille slate. The device measures 9 in. by 9.5 in. by 2 in. (22.86 cm by 24.13 cm by 5.08 cm) and has a white face with dark purple accents.

Presenting information through auditory feedback, a jumbo braille display, and a standard braille display enables the device to meet individual learning needs. The electronic slate and brailler-style keys allow students to develop writing skills that will promote independence in multiple environments, while eliminating the frustration of dealing with mistakes that often discourage beginners when writing braille on paper.

Featuring step-by-step uncontracted braille lessons selected by a TVI on an online learning portal, Polly® will provide students with an interactive educational experience. Students will read and write braille and apply their reading skills in multiple ways. Included stories focus on development of vocabulary, phonics, and spelling. This allows students to apply their newly acquired knowledge of braille alphabet letters while gaining a sense of how to transfer these skills to everyday activities. The fun interactive games create a way to increase reading speed and promote healthy competition between peers.

#### Background

Polly® has been created in partnership with Thinkerbell Labs Pvt. Ltd., a company based in Bengaluru, India. Polly is modeled after Thinkerbell Labs Pvt. Ltd.’s Annie™ device. The product submission for Annie was presented to American Printing House for the Blind’s (APH) Product Ideation Committee in July of 2020. Annie is currently being used throughout India, the UK, and the UAE. It has been evaluated by the National Institute for the Empowerment of Persons with Visual Disabilities, which is an institute affiliated with the government of India. This evaluation found Annie to be very effective with braille learners.

Interactive learning, as explored by a lecture at Harvard (Mazur, 2014), encourages versatility in teaching and learning and promotes autonomy. Polly will provide a gamified educational experience for braille learners. According to Kiryakova et al, learning through games helps optimize the brain’s processing of new information, improves motivation and engagement, modifies the brain’s reward-and-pleasure center, encourages learning, provides the necessary encouragement for a student’s growth, and aids in cognitive development. Utilizing Polly in the classroom, students will be able to engage in interactive learning during independent app- and tablet-use time periods which benefits the learning process.

#### Work Completed During FY 2022

Throughout fiscal year 2022, three batches of prototypes for Polly were provided to APH (see Figure 1) in an attempt to remedy hardware issues. Issues encountered include the large braille display function, board incompatibility with the US electrical grid, the ethernet port on one unit, etc. Software content drafts were submitted for review throughout the year. The Thinkerbell team tested the software concurrently with APH staff. The last section of contracted braille content was submitted for review in July of 2022; this content was submitted only one day before the pilot testing began, thus it was not reviewed by APH prior to pilot testing.

Once hardware issues were thought to be remedied with the third set of prototypes, Wi-Fi connection issues were found when attempting to connect in a school environment due to the required credential verification. The portal hosted by the vendor also needed a timing adjustment to allow users additional time to enter information. A whitelist instructions sheet was created and added to the box, shopping page, and customer service files to assist IT departments when teachers attempted to connect the Polly within school environments.

Pilot-testing began in August of 2022, following software and hardware corrections up to the last content addition, which occurred one day before testing began. Hardware-testing was completed first, and issues previously found in prototypes were still seen in a number of units. For example, problems existed with the function of the large display, and inconsistency in dot function were found on the standard display. Three of the 50 units had problems with slate function; this problem was not seen in earlier prototypes). These issues were repaired by the vendor onsite, and software-testing began. Within the first day, 15 units were tested. Inconsistencies occurred between the units, as follows:

* Four units did not receive homework assignments from Helios without rebooting multiple times.
* Three units had problems with the large display not accepting answer submissions.
* One unit not contain the entire audio for lesson titles within the menu.
* One unit continued to show information from the previous lesson on the large display after the user had moved on.
* Three units showed issues with standard cells being either stuck or not at the same height as the rest.

The same content was tested by both APH and Thinkerbell staff, except one area: The segment of testing involving the homework feature was randomly assigned. The vendor ensured APH that all pilot units had received the hardware replacements deemed necessary by the prototype repairs. The pilot was marked as a failure, and the vendor plans to repair braille cells on all units as well as address software issues by having the entire content tested by a group in India. APH also will test the entire content on four staging units to ensure all software issues are identified. Pilot testing will begin again once these issues are remedied.

#### Work Planned for FY 2023

Pilot-testing will resume in early 2023. Upon successful pilot, launch is planned for sometime in FY 2023.

**References**

Kiryakova, G., Angelova, N., & Yordanova, L. (2014, October). Gamification in education [Conference paper]. 9th International Balkan Education and Science Conference, Edirne, Turkey. <https://www.researchgate.net/publication/320233774> GAMIFICATION\_IN\_EDUCATION

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# EXPANDED CORE CURRICULUM

## Assistive Technology

### Chameleon™ 20

Formerly 20-Cell Braille Display with Audio Support

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports.](https://www.aph.org/rd/research-resources/)

For more detailed information about field tests and expert reviews, send email to [wfreeman@aph.org](mailto:wfreeman@aph.org).

#### Purpose

To reinforce braille-literacy skills with text-to-speech audio and a traditional Perkins-style keyboard

#### Project Staff

William Freeman, Tactile Technology Product Manager

Greg Stilson, Head of Global Innovation

Mark Rohret, Technology Quality Assurance Analyst

Lara Kirwan, Senior Product Specialist

Emily Grimany, Product Specialist

Joseph Hodge, Technical Innovations Product Manager

Denise Snow, User Experience Content Strategist

Andrew Flatres, Consultant

Maryse Legault, Consultant

#### Background

Development of the Chameleon 20 began after a FY 2019 survey established what needs were not being met by currently available braille displays. The survey results guided the needs outlined in a Request for Proposal for a new 20-cell refreshable braille display. Later that year, a vendor was selected, and a prototype was reviewed and approved.

An expert review was conducted from March to June of FY 2020. Reviewers offered their feedback throughout the duration of the testing period via a mailing list and then a survey at review completion.

In July of FY 2020, the Chameleon 20 was released. As shown in Figure 1, the Chameleon has 20 braille cells with router keys roughly in the middle of the device. Below the braille are two space bars. Above the braille are eight traditional Perkins-style keys. Along the front edge are the Home button and thumb keys. Demand for the display has been strong, and feedback has been very positive.



#### Work during FY 2022

Much of the development work resulted from communication with users via both the public mailing list and the private, invitation-only beta-team mailing list, as well as customer feedback via Customer Service.

Text-to-Speech was officially released in FY 2022. It includes a hotkey to read everything from the cursor onward, options to read text after pan, read text after type or delete, and read word under cursor. Reading text after typing has a few options; one is to read letters, words, or both as they are typed. This allows users to get the kind of granularity that they require. Read word under cursor is a useful feature since a user could turn off all other text-to-speech and then use this feature to read words they are not familiar with and thus use the text-to-speech feature to help them learn braille. Users can also disable text to speech at any time with a hotkey combination, helping them avoid any embarrassing outbursts of sound from the device. Finally, the user can switch between three voices, two of them being English-speaking and one being Spanish-speaking with more voices planned for a future update.

The Chameleon also has the ability to play unprotected DAISY audio files. The functionality here includes increasing and decreasing playback speed, fast forwarding and rewinding, and various forms of navigation throughout the book.

This year also saw the release of the Braille Editor. This app functions much like the Editor except it only edits braille files. The Braille Editor opens BRF and BRL files and saves any edited file as a BRF. This feature was much requested on the mailing list because of its usefulness for students and people like braillists, transcribers, and proofreaders who regularly work with braille.

Another much requested feature was the ability to switch quickly from one device to another while in terminal mode. This feature uses a couple of hotkeys to move either forward or backward through the list of connected devices without ever leaving terminal mode for local mode.

Additional updates were added based on user feedback, including an easier method to enter Bluetoothpairing mode, the option to disable the keyboard while in terminal mode, and various other smaller features and fixes.

#### Work planned for FY 2023

Need for the following features has been established through both the survey and other communications with users:

* Visual Display App: This app will assist teachers, parents, and non-braille readers working with the device by displaying in print the currently highlighted braille line on the Chameleon. The app will be fully accessible. It will also have the option of displaying the current line in braille.
* The ability to change the voices available on the device from the three available by default. This includes bilingual voices and all other English-speaking voices throughout the world.
* Improvements to the Braille Editor, including options to set cells per line and lines per page, automatic page numbering, and other enhancements.

Other goals for FY 2023 include:

* exploring ways to increase the maximum allowed file size for the Library and Editor,
* refining connectivity and local functionality based on user feedback,
* continuing to update device behavior to maximize battery life when the device is in use and at rest, and
* exploring potential enhancements, such as more online libraries and support for additional file types in the Editor and Library.

### DC Supplement Adapter

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org)



#### Purpose

To provide a way to operate battery-powered, switched-adapted devices using a battery-powered environmental control unit, such as the APH Select Switch. This allows the user to operate in four modes: direct, latch, timed seconds, and timed minutes.

#### Project Staff

Tristan Pierce, Product Manager

Emily Grimany, Product Specialist

Joe Wegner, Electronic Product Design/Manufacturing Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

#### Description/Background

This battery-powered (DC) adapter provides electrical current between the DC-powered Select Switch and the DC-powered SLK Caframo fan (former purchase item), the Sensory Learning Kit (SLK) Honeywell Turbo On-the-Go portable folding fan (purchase item), and the SLK vibrating pad (make item). Initially, the team recommended “C” cell-type alkaline batteries because they have lots of run time and are physically smaller than “D” cells. They are off-the-shelf batteries that are available at many stores. Later, a discussion about using rechargeable batteries opened and eventually became the preferred recommendation (2019) so that teachers will not have to use personal funds on battery replacements. The product received a catalog number. The team agreed it best to link it (in the catalog and on the shopping site) to the Select Switch, because the sole purpose of the product is to use it as a support product with two SLK items and the Select Switch. For this reason, the New Products Meeting members chose to exempt it from field-testing, and it received automatic Federal Quota eligibility as a supplement to the Select Switch. The product will have a quality protocol. The product manager completed the documentation. During the pandemic, the team agreed to keep the product in Gate 4 of the New Product Development process for the remainder of the 2020 calendar year. The team decided that the entire product (and bid package) will include the following: DC Supplement Adapter, off-the-shelf (pre-labeled) recharger, four lithium-ion batteries (3.7 volts each), a shipping box, and large-print instructions. The The American Printing House for the Blind (APH) will send a Word® file to the vendor, which will print and insert it into the product box. The APH catalog and shopping site will notate that the instructions are available as a free download (for accessibility). There are no replacement parts. The bid package went out, and APH awarded it to Source International.

#### Work Completed During FY 2022

The arrival of the first shipment was delayed by pandemic-related issues and did not arrive at APH until July 2022 (6 months late). After a clean quality inspection, it was released for sale on July 21. It was posted to the shopping site and an instructional/promotional video is in development.

### Dynamic Tactile Device

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [gstilson@aph.org](mailto:gstilson@aph.org).

#### Purpose

To create a next-generation braille and tactile device capable of displaying standard multi-line braille and tactile graphics, ensuring students have more immediate access to textbooks, worksheets, and impromptu graphical content

#### Project Staff

Greg Stilson, Head of Global Innovation

Joe Hodge, Technical Innovations Product Manager

William Freeman, Tactile Technology Product Manager

Ken Perry, Senior Software Engineer

Rob Meredith, Senior Software Engineer

Karen J. Poppe, Tactile Literacy Product Manager

Heather Kennedy-MacKenzie, Director of Technology Product Research

Andrew Flatres, Humanware® Braille Product Manager

Alain Belanger, Humanware® Software Engineering Director

Maryse Legault, Humanware® Product Subject Matter Expert (SME)

Peter Tucic, Humanware® Product SME

Additional Humanware® hardware/software partners

#### Background

The Dynamic Tactile Device (DTD), is a collaborative project between The American Printing House for the Blind (APH) and Humanware® to create a device capable of displaying multiple lines of standard braille and tactile graphics on the same tactile surface. It will ultimately provide students and other users with the ability to read a tactile textbook or document and to access impromptu content via one powerful tool.

Today, it can take over a year and tens of thousands of dollars to produce tactile textbooks, often resulting in students receiving the books later than their sighted classmates and putting them at an educational disadvantage. The DTD aims to reduce the production cost of textbooks, along with reducing the time it takes to ship volume after volume of braille. APH recognizes that electronic braille textbooks will not completely replace physical textbooks; however, they can be a truly efficient alternative for students who have learned the foundational skills of braille.

In addition to its primary goal of serving as a tactile textbook reader, the APH and HumanWare product-management team created a roadmap of software they plan to develop for the DTD. Some of these apps include a multi-line word processor, graphing calculator, tactile-graphics viewer, and tactile monitor to be used in conjunction with other mainstream tools. APH and HumanWare hope to make this product available in FY 2024.

#### Work Completed During FY 2022

During fiscal year 2022 many significant accomplishments were achieved. These are organized in three categories:

* hardware/software
* user testing and validation
* eBRF progress

*Hardware/Software Progress:*

Based upon the original software roadmap set forth in 2021, APH and HumanWare have made significant progress on the development of the foundational software that will drive the DTD. Some apps include a multi-line braille book reader, a multi-line braille editor, and a tactile-graphics viewer.

During this fiscal year, the team has used technology prototype devices consisting of 300 braille cells connected to an emulator to simulate the experience that will be felt on the final device. This combination of tools has been used to perform much of APH’s user-experience testing throughout the year.

The team created a 3D model and the first non-functional prototype. This prototype simulated the controls, size, and weight outlined in the specifications for the actual device, and it was instrumental in gathering critical feedback that allowed the team to expand upon the original design based on that feedback.

*User-Experience Testing:*

Thanks to many of APH’s great partners, including the National Federation of the Blind (NFB), APH gathered feedback on both the hardware and software . During the 2022 NFB convention, APH and HumanWare accumulated over 18 hours of direct user feedback from more than 25 participants on both the hardware and software. This included multi-line braille-reading effectiveness, texture recognition, and dynamic graphic manipulation. Some learnings identified from these sessions:

* With a device consisting of 10 lines of braille, quick identification of an editing cursor was quite challenging.
* Identification of a user’s location in a zoomed-in graphic was challenging; APH will work to provide indicators to assist a user in understanding their positioning.
* Multiple spacing and cursor types are preferred, as users’ capabilities and skills varied greatly.
* The weight and form factors of the device was acceptable to all participants.

*eBRF Progress:*

During fiscal year 2021, it was quickly identified that for this project to be successful, the current braille and tactile standards needed to be updated to 21st-century requirements. Prior standards were not designed to handle the dynamic use cases that the DTD would present. To update the existing braille standards, APH would need to partner with organizations for the blind around the world, and in fiscal year 2022, that is precisely what it did. APH built an initial draft of a new electronic braille standard, called the eBRF, or electronic braille ready file, and began circulating it among braille authorities and various organizations for the blind.

After meeting with several organizations on this topic, it became clear that many global organizations were attempting to do something similar but saw the problem as too large to take on themselves. Virtually every organization that met with APH on this topic was happy to partner on such a project.

In March 2022, APH held the first eBRF Summit at the California State University Northridge (CSUN) assistive-technology conference in Anaheim, CA. The number of organizations whose representatives attended in person and expressed their support clearly and significantly demonstrated the need for the eBRF. Some of the partners identified at CSUN included Humanware®, Duxbury, the National Library Service, Royal National Institute of Blind People, Vision Australia, Benetech, International Council on English Braille, and many more.

Several revisions to the original draft took place after the eBRF Summit, and today APH is collaborating with the DAISY Consortium to make this dream of an electronic braille standard a reality.

#### Work Planned for FY 2023

* continue software development on original software roadmap for the DTD,
* produce first functional alpha hardware,
* produce first beta hardware,
* using alpha and beta units, gather user feedback on both hardware and software features,
* design first APH-created apps using the DTD software development kit,
* continue work with DAISY and other global partners to finalize the eBRF standard and introduce it into existing workflows for transcribers, teachers, and technology vendors, and
* build eBRF into APH’s textbook-prep pipeline.

### Freedom Scientific Education Edition

Formerly Fusion Student Edition

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [wfreeman@aph.org](mailto:wfreeman@aph.org).

#### Purpose

To help students utilize assistive technology including magnification and/or speech in a single package that can be easily managed by teachers and administrators

#### Project Staff

William Freeman, Tactile Technology Product Manager

Emily Grimany, Product Specialist

Mark Rohret, Technology Quality Assurance Analyst

Andrew Lueken, E-Commerce Administrator

Lance Swan, Consultant

Mike Wood, Consultant

Ryan Jones, Consultant

Alan Fors, Consultant

#### Background

Currently APH offers three different ways to get Freedom Scientific software. Each method has its advantages and disadvantages but none of the current delivery systems are perfect. To help improve the way this product is delivered, interviews were conducted between the product manager and EOTs and their assistants. These interviews revealed two main facts about how the current systems worked: first, EOTs did not have enough information about whether a license was being used and when it would expire, and second, they wanted Fusion to be made available using an easier to manage system than what was available via the Freedom Scientific Software Suite. They also wanted other changes, such as multiple installs, the ability to order through the website, and more helpful automated information from the portal license management system.

#### Work Completed During FY 2022

During FY 2022, the groundwork was laid for future development by enabling sales of Freedom Scientific software products through the APH website. Previously, customers would have to contact APH Customer Service and interface with a human to purchase these software products. Now they can just place an order the same as they would for any other APH product.

Additionally, the documentation available both on the shopping page and in the automated communication was improved to help mitigate any opportunity for customer confusion.

While the work done in FY 2022 was done for the JAWS and ZoomText Student Editions, it was done in preparation of the move toward the Freedom Scientific Education Edition.

#### Work Planned for FY 2023

During FY 2023, we will continue to work with Freedom Scientific to improve the customer experience while using the software distribution portal. We'll also start testing the deployment of the new kind of license that will be involved in this product. Once those pieces are in place and have been thoroughly tested, field testing will begin. Changes will then be made in response to field testing and then the product will be released.

### HabitAware® Bracelet

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jhodge@aph.org](mailto:jhodge@aph.org).

#### Purpose

To make individuals aware of when and how frequently they eye-press, thereby enabling them to decide whether or not to continue the habit

#### Project Staff

Greg Stilson, Head of Global Innovation

Joe Hodge, Technical Innovations Product Manager

Laura Zierer, Independent Living and O&M Product Manager

Bobby Fulwiler, Product Specialist

Sameer Kumar, HabitAware® CEO

Ellen Crupi, HabitAware® Director of Awareness

#### Background

In 2019 The American Printing House for the Blind (APH) started receiving calls from the field asking if we sold or knew of other companies that sold products that could detect eye-pressing. In their preliminary research about eye-pressing products, the product specialist and the independent living and O&M product manager determined that a product of this nature was not available on the commercial market. In 2020, APH surveyed 350 people; 94% of respondents were looking for something to assist with eye-pressing.

After looking into this further, APH learned that health effects from eye-pressing can range from eye infections to the need for a prosthetic. Teachers who responded to the survey said that when eye-pressing, students often became disengaged and stopped paying attention. One teacher reported that during an orientation and mobility lesson, one of their students was just standing still on the sidewalk—not moving other than pressing on their eye. Often a person is not even aware they are eye-pressing until someone tells them.

APH partnered with HabitAware®, which produced a bracelet that can detect other repetitive body gestures, such as trichotillomania (hair-pulling). When the bracelet detects a user performing the repetitive behavior, the device vibrates. The wearer can then decide to stop or continue the behavior.

#### Work Completed During FY 2022

APH and HabitAware signed their partnership contract, and the work on the eye-pressing bracelet began. At the 2021 APH Annual Meeting, Hodge shared the survey results with professionals in the field of blindness and visual impairments. Currently, HabitAware and APH are creating an algorithm to detect eye-pressing and gathering video and other data on precisely how people eye-press, so false-positive results can be eliminated.

#### Work Planned for FY 2023

* continue building the algorithm for the bracelet,
* test the algorithm in small groups,
* develop an app for iOS® and Android™ that indicates when eye-pressing occurs,
* test the app for accessibility, and
* field-test the prototype.

### Joy Player Cartridge Holder

Formerly Joy Player Digital Cartridge

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org)

#### Purpose

To provide an assistive device that allows individuals with challenging fine motor skills to independently, to their best ability, insert a digital talking book (DTB) cartridge into APH’s Joy Player.

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Emily Grimany, Product Specialist

Andrew Dakin, Model Maker/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

#### Background

This product started as a fresh style of DTB cartridge. The team decided to include the completion of American Printing House’s (APH) computer-assisted designs (CAD) in the request for proposal. As the bid package was prepared, a new DTB cartridge from a vendor other than National Library Service (NLS) became available on the market. It is identical to the NLS cartridge except for color. APH Production & Logistics stopped the bid package on the Joy Player Cartridge and said they would purchase the new cartridge from the new vendor and dedicate resources to other products. Because the field-test report outlined the need for an adapted cartridge, the product manager met with the Director of Technology Manufacturing Research Andrew Moulton; he exchanged drawings of a potential assistive device. The design mimicked the prototype Joy Player Cartridge, in that it would attach through the DTB cartridge hole, and one could produce it using a 3D Printer.

#### Work Completed During FY 2022

The team conducted field-testing on the new holder in the fall of 2021. The purpose of the field test was to determine if a design would print consistently on different 3D printer brands and models. Model Maker/Pattern Maker Andrew Dakin designed the two versions. We provided the four participating 3D printer operators with an STL file and a 3MF file. Three operators downloaded and used the STL file and one downloaded and used the 3MF. Dakin used both. The field-test results include Dakin’s data, for a total of five operators. The operators live in Kentucky, Massachusetts, Michigan, Oregon, and Texas. The operators submitted samples made from five different printers (brand/model): Ultimaker/S3, Ultimaker/S5, Monoprice/MP Select Mini, Makerbot/Replicator+, and Creality/Ender 3 Pro. Two operators said they find the screw-closure version to be more operational, with one adding that the slide-closure works well if the user takes time to tweak and maintain the fit. The other three operators said there was no difference in operational use. All operators stated that offering a free downloadable file for school- or home-printing is a viable option to address the low incidence need to insert and remove a DTB cartridge when using a Joy Player. APH’s recommended layer height and infill were provided to tighten our control-group results. APH placed both design versions on the [Tactile Graphics Image Library](https://imagelibrary.aph.org/portals/aphb/#category/115) for consumers to download and explore what works best for their printer and situation.

### Mantis™ Q40

Formerly 40-Cell Braille Display with a QWERTY Keyboard

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports.](https://www.aph.org/rd/research-resources/)

For more detailed information about field tests and expert reviews, send email to [wfreeman@aph.org](mailto:wfreeman@aph.org).

#### Purpose

To help older students learn traditional QWERTY keyboarding skills while maintaining a focus on braille literacy

#### Project Staff

William Freeman, Tactile Technology Product Manager

Greg Stilson, Head of Global Innovation

Mark Rohret, Technology Quality Assurance Analyst

Lara Kirwan, Product Specialist

Emily Grimany, Product Specialist

Joseph Hodge, Technical Innovations Product Manager

Denise Snow, User Experience Content Strategist

Keith Creasy, Consultant

Andrew Flatres, Consultant

Maryse Legault, Consultant

#### Background

The Mantis™ Q40 began development in FY 2016. The goal was to develop a 40-cell braille display with a QWERTY keyboard that was inexpensive and had simple reading and editing capabilities. It would also use the new Braille HID standard so it could be treated as a keyboard and braille display when connected to most devices, rather than as a monitor like a traditional braille display.

The project stalled in FY 2017 and wouldn’t restart in earnest until FY 2019 when many keyboards were tested by people with various levels of vision. It wouldn’t be until FY 2020 when, after approval, 40 prototypes were acquired and distributed. These units were distributed to individuals at Apple, the National Federation of the Blind, and Educational Testing Service, among others.

In June of FY 2020, the Mantis was released. As shown in Figure 1, it has 40 braille cells with router keys along the bottom of the face of the device and a laptop-style QWERTY keyboard above that.



#### Work during FY 2022

Much of the development work resulted from communication with users via both the public mailing list and the private, invite-only beta-team mailing list.

One majorly requested feature from users that was released this year was the Braille Editor. This app functions much like the Editor except it only edits braille files. The Braille Editor opens BRF and BRL files and saves any edited file as a BRF. This feature was much requested because of its usefulness for students and people like braillists, transcribers, and proofreaders who regularly work with braille.

Another much requested feature was the ability to switch quickly from one device to another while in terminal mode. This feature uses a couple of hotkeys to move either forward or backward through the list of connected devices without ever leaving terminal mode for local mode.

Additional updates were added based on user feedback including:

* an easier method to enter Bluetoothpairing mode,
* a recently saved menu item in the Editor to make it quicker to get back into recent documents,
* the ability to toggle text indicators to help minimize clutter on the braille line, and
* various other smaller features and fixes.

#### Work planned for FY 2023

The need has been established through both the survey and other communications with users for the features that follow:

* Sticky Keys that allow the device to be used one-handed: As on a keyboard connected to Windows®, Sticky Keys allow users to use key combinations involving Ctrl, Alt, Function, or Shift by pressing only one key at a time.
* Visual Display App: This app will assist teachers, parents, and non-braille readers working with the device by displaying in print the currently highlighted braille line on the Mantis. The app will be fully accessible. It will also have the option of displaying the current line in braille.
* Adding support for Bluetoothheadphones so Text-to-Speech support can be added. Key here will be ensuring that switching from headphones to an external device via the Terminal app is seamless and easy.

Other goals for FY 2023 include:

* exploring ways to increase the maximum allowed file size for the Library and Editor,
* refining connectivity and local functionality based on user feedback,
* continuing to update device behavior to maximize battery life when the device is in use and at rest, and
* exploring potential enhancements, such as more online libraries and support for additional file types in the Editor and Library.

### Visual Display App

(Hold)

#### Purpose

To help teachers and parents know what is being viewed on the student's braille display, so they can instruct the student in both braille and the braille display's use

#### Project Staff

William Freeman, Tactile Technology Product Manager

John Karr, Software Engineer

Ken Perry, Senior Software Engineer

Emily Grimany, Product Specialist

Mark Rohret, Technology Quality Assurance Analyst

Andrew Flatres, Consultant

#### Background

The Visual Display App is a companion app for the Mantis™ Q40 and Chameleon 20. It will be available on Windows®, Android™, and iOS® devices. The purpose of the app is to display the contents of the connected braille display as either print or braille.

#### Work Completed During FY 2022

During FY 2022, the use cases and user stories for the Visual Display App were prepared and shared with the development team. Mockups of the graphical user interface were created and discussed.

Work on this app is on hold until HumanWare can provide APH with the necessary protocols to communicate with the displays in this way.

#### Work Planned for FY 2023

During FY 2023, Humanware® will provide APH with the necessary protocols to communicate with the displays via the app. We will also unlock different options within the displays, such as accepting a connection to the app, requiring a password for connecting in this way, and the ability to automatically refuse any connection to the app. These options will be in place for the many users of the displays who will have no need for the app and may be concerned about security.

A beta of the app will be prepared and shared with interested parties. Once the beta is stable and feature complete, we will begin field testing. The app will be refined based on the results of field testing and then be released. The app will be free to download upon release.

# COMPENSATORY AND ACCESS SKILLS

## Braille

### Braille Literacy Website

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To provide teacher resources on braille literacy, including APH product information and links to other resources

#### Project Staff

Rachel Bishop, Braille Product Manager

Cathy Senft-Graves, Product Specialist (Building on Patterns)

Ricky Irvine, Graphic Designer

Anthony D. Jones, Director of Creative Services

Robert Conaghan, WordPress Front-End Developer

Sara Lee, Product Specialist

INgrid Design, Graphic Design and Web Design

#### Background

In 2016, the product manager began working with INgrid Design on the format of a Building on Patterns (BOP) component for the Braille Literacy Website. The product manager decided that the BOP Web pages would initially contain information and resources related to the existing Kindergarten, First Grade, and Second Grade levels of BOP. INgrid Design was provided with content and images to include about the three levels.

In FY 2017, INgrid Design created downloadable scope-and-sequence charts for each existing level of BOP. Braille versions of these charts were also created. Pages with links to the APH shopping site for each component of the three levels of BOP were created. After changes were made to improve accessibility, the pages were reviewed again. Following some additional edits, INgrid Design turned over the website files to APH. Communications staff converted the site to WordPress® and reviewed it for accessibility again. Sara Lee and the product manager also reviewed the site again. Additional edits were made, and the BOP Website was made public.

In FY 2021, information about the order of introduction of the letters of the alphabet was added to the Frequently Asked Questions page of the BOP Pre-K Website.

#### Work Completed During FY 2022

The project staff made changes to the BOP Website formatting and navigation. For more specifics about website changes, please see the BOP Pre-K report.

#### Work Planned for FY 2023

The registration for the domain for the BOP Website will be renewed. The BOP Website will be maintained, and additional materials will be added as they are available. Additional braille literacy components for the website will be considered.

### Quick Check: Index of Literary Braille Signs (Modification)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To update the print and braille files for *Quick Check: Index of Literary Braille Signs* to comply with Unified English Braille (UEB) standards and Braille Authority of North America (BANA) guidelines

#### Project Staff

Rachel Bishop, Braille Product Manager

Emily Grimany, Product Specialist

Sara Lee, Product Specialist

Anthony D. Jones, Director of Creative Services

Laura Greenwell, Graphic Designer

Andrew Moulton, Director of Technical and Manufacturing Research

#### Background

The old version of *Quick Check: Index of Literary Braille Signs*, written in English Braille: American Edition (EBAE), was outdated but provided a valuable reference guide to the braille literary code and other commonly used braille symbols. The product had been recently obsoleted, but if updated into UEB, would be useful for adult braille learners, transcribers, parents, and teachers who are learning braille or who are familiar with it but may need to look up a symbol for reference. Quick Check could also be paired with the Illinois Braille Series for instances when a student is working through a lesson and needs to look up a symbol or contraction.

In November 2022, the Braille Product Manager submitted a Modification form to the Product Ideation Committee (PIC) requesting approval to update *Quick Check: Index of Literary Braille Signs* into UEB. Suggested changes included updating the braille and print booklets to reflect updated UEB guidelines and BANA revisions, as well as updating the introduction and categorical list of contractions. The product manager pointed out the high demand for the product, siting the many teachers’ requests that the product be updated.

#### Work Completed During FY 2022

In December 2021, a Gate 1: Product Ideation Committee (PIC) meeting was held, and the product was approved for active development.

In February 2022, the product manager held a Gate 2: Design meeting. In the meeting, the project team discussed needed changes to the product, including UEB updates to the symbols listed, organization changes to symbol categories, updating the APH logo, and changing the binding from saddle stitch to spiral for more flexibility and ease of use. Target markets would include general education, adults, TVIs, students with visual impairments, parents, and new transcribers. The group agreed to an estimated yearly volume and cost.

Throughout February and March of 2022, the product manager and product specialist made edits to the Quick Check PDF files. In April, the product manager submitted the updated Portable Document Format (PDF) to Graphic Design for layout. The project was assigned to graphic designer, Laura Greenwell.

The product manager, graphic designer, and product specialist, collaborated on the layout to make updates to the print booklet, including adding an APH logo to the cover and updating all UEB symbols.

In August 2022, a combined Gate 3: Prototype Evaluation and Gate 4: Modifications meeting was held to go over the proof, estimate a date for tooling completion, and make any needed changes to the proof. At the meeting, the group discussed changes made to the product and suggested additional changes to the proof copy, including updates to the cover art and colors, updates to the braille, and final edits to the print.

#### Work Planned for FY 2023

The product manager, product specialist, and graphic designer will update the Braille Ready File (BRF) and complete edits to the PDF. The graphic designer will update the cover and make color changes, and the product specialist will complete the braille updates. A catalog number will be generated and added to the booklet. Tooling will be completed, and a Gate 5: Specifications meeting will be held.

### Rules of Unified English Braille (Modification)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To provide *Rules of Unified English Braille* and *Guidelines for Technical Materials* in large print and braille hard copy

#### Project Staff

Rachel Bishop, Braille Product Manager

Cathy Senft-Graves, Product Specialist (Building on Patterns)

Sara Lee, Product Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Matthew Poppe, Graphic Designer

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

*Rules of Unified English Braille* (RUEB) officially replaced the previous braille code *English Braille: American Edition* (EBAE). APH used to provide EBAE in print and braille hard copy. The Braille Authority of North America (BANA) has requested that we consider providing RUEB in braille and print hard copy. The PDF and BRF for RUEB are housed on the ICEB (International Council on English Braille) website. BANA also requested that RUEB be packaged with the *Guidelines for Technical Materials* (GTM), also housed on the ICEB website. There is a high demand for this product; Hadley gets five to 10 requests per year for a braille hard copy of this document, and many university students pay to print a copy. The product would be used by transcribers and people who are learning UEB.

In 2021, Cathy Senft-Graves, the product manager, met with Andrew Moulton, the Director of Technical and Manufacturing Research, and Rod Dixon, Manager of Technical and Manufacturing Research, to discuss what needed to be done on the project and how long it would take. Following the meeting, the product manager consulted with Dr. Frances Mary D’Andrea, the secretary of ICEB, who made recommendations for binding (spiral bound or 3-ring binder) and also recommended that RUEBbe packaged with GTM*.*

In October 2021, the product manager submitted a Product Modification form to the Product Ideation Committee (PIC) requesting the updates.

#### Work Completed During FY 2022

In December 2021, a Gate 1: Product Ideation Committee (PIC) meeting was held, and the project was accepted for active development.

In April 2022, Rachel Bishop, the Braille Product Manager, was assigned the RUEB project. After meeting with Senft-Graves and the product specialist, Sara Lee, the product manager scheduled a Gate 2: Product Design meeting. The meeting was held in May 2022. At this meeting, the project team determined target markets, date for proof completion, estimated selling price, and yearly volume. Suggested changes included providing materials in braille and print hard copy and packaging RUEBwith GTM. The product manager sited high demand from teachers of the visually impaired (TVIs) for hard copies. The product would be used by transcribers, TVIs, and students learning UEB.

During the meeting, it was determined that APH would need to include a binder and binder inserts along with the printed pages for the print hard copy of RUEB. There was also the option to use spiral binding for print, but then the booklet would have to be in more than one volume. For the braille version, APH would need to produce print copies of the title pages along with embossing and spiral binding the braille. The braille booklet would also include front and back plastic protectors.

Following the meeting, the product manager consulted with Joon Lee, APH Director of Information Governance and Privacy Compliance, about selling the product internationally. Lee agreed that the product could be sold internationally if approved by ICEB. The product manager then checked with ICEB and got approval to sell internationally.

In June 2022, the product manager consulted with D’Andrea and Senft-Graves to determine the binding method for the print volumes. It was agreed that a binder would be best for holding materials and allowing pages to be added in cases where rules were changed. This was then confirmed with the Director of Technical and Manufacturing Research. The product manager and product specialist began editing the RUEB and GTM documents. When edits were completed, the product manager sent a ticket to Graphic Design to begin the process of editing and layout for the project. Throughout the months of July and August 2022, the graphic designer, Matthew Poppe, combined the GTM and RUEB documents and created a cover encompassing both documents. The graphic designer also added the APH logo to the cover. When major edits and layout were completed, the product manager scheduled a combined Gate 3: Prototype Evaluation and Gate 4: Modifications meeting to discuss the proof and needed changes. The meeting will be held at the end of August 2022.

#### Work Planned for FY 2023

The product specialist and product manager will complete changes to the Portable Document Format (PDF) and Braille Ready File (BRF), and then a Gate 5: Specifications meeting will be held.

### Word Associations Print/Braille Labels (Modification)

(Hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To update the existing Word Associations guidebook and labels from English Braille: American Edition (EBAE) to Unified English Braille (UEB)

#### Project Staff

Rachel Bishop, Braille Product Manager

Anthony D. Jones, Director of Creative Services

Emily Grimany, Product Specialist

#### Background

This product was originally released in 2000 and included a braille and print guidebook and 12 sheets of self-adhesive braille labels. The braille labels are meant to be placed on common objects, such as a chair or table, to help the young reader associate the word with the object. The guidebook contains information on creating braille awareness and a guide for activities that can be performed with the labels. In 2018, it was decided that because the guidebook and labels are written in EBAE, the product would need to be updated into UEB. In 2019, Rachel Bishop was assigned product manager for the product and began searching for a consultant. In August, Jodi Floyd agreed to be a consultant on the project. A Gate 2: Product Design meeting was scheduled in September 2019.

In FY 2020, the product manager met with the consultant in October 2019 to discuss the design and scope of the project. There were UEB changes, as well as outdated terms, activities, and materials to update. They agreed to speak again in December. The consultant and product manager continued to work on the project throughout FY 2020; but due to unforeseen circumstances, the consultant was unable to provide the necessary changes and the project was placed on hold.

#### Work Completed During FY 2022

This project was placed on hold during FY 2022.

#### Work Planned for FY 2023

This project is currently on hold. No work is planned for FY 2023.

## Braille Technology

### Braille Brain

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [wfreeman@aph.org](mailto:wfreeman@aph.org).

#### Purpose

To help people that can read print learn how to read and write braille or refresh already existing braille skills

#### Project Staff

William Freeman, Tactile Technology Product Manager

John Karr, Software Engineer

Michael McDonald, Senior Software Engineer

Emily Grimany, Product Specialist

Mark Rohret, Technology Quality Assurance Analyst

Cheryl Kamei-Hannan, Consultant

Gina Michell, Consultant

Kim Blackwell, Consultant

#### Background

Braille Brain is a web app that is meant to teach people who can already read print how to read and write braille. It can also be used as a refresher for folks who can already generally read and write braille. When it was initially designed, its purpose was primarily to help teachers of the visually impaired learn braille. However, that limited scope was primarily due to the accessibility issues that exist with the platform, Schoology, that currently houses the project. Now that the project is being developed in partnership with APH and the accessibility piece will not be a problem, the platform will help not just TVIs but also paraprofessionals, braillists, parents of braille users, and print readers who lose their vision late in life and would like to learn braille. A key point to stress is that Braille Brain is not a platform for teaching braille and literacy at the same time. Users must already be capable of reading print to benefit from the course.

It is currently two courses. It has a UEB Literary course and a Nemeth course. Each course is a series of modules about different topics and each module is a combination of lessons and exercises. The lessons introduce concepts, and the exercises test the user's knowledge of what they learned during the lessons. Exercises are composed of multiple kinds of questions, including multiple choice, column matching, reading passages, and writing passages. The user is not given any feedback about their performance until after they submit the entire set of exercises for a particular module.

Braille Brain is a nearly completed project that is going to lose its permanent home on Schoology. It's being developed using a five-year grant that was secured by Cheryl Kamei-Hannan, Gina Michell, and Kim Blackwell (project founders). As the terms and cost of Schoology changed, the project founders realized that they would not be able to pay for access to Schoology once their grant funding ran out and so they sought a permanent home elsewhere. It was this search that brought them to APH.

#### Work Completed During FY 2022

Work on Braille Brain started near the end of FY 2022. The scope of work was finalized so that the project can be released during FY 2023. We currently plan to release the literary UEB portion of the project first and then to release the math portions, both UEB and Nemeth, during FY 2024.

The process for converting lessons from their current format to one that is suitable for the new APH platform has also begun. A proof of concept of this conversion process was also completed. This proof of concept included the actual conversion of many non-math UEB portions of the curriculum.

#### Work Planned for FY 2023

1. Refinement of the initial conversion method so that it can perfectly convert UEB Literary lessons and exercises
2. Conversion of Nemeth math courses
3. Field testing
4. Refinement of the modules based on field testing
5. Release

### Braille Reading Materials for Adult Learners

Formerly Reader’s Digest for Adult Learners

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To develop practice reading materials for newly blind adults who are learning braille

#### Project Staff

Rachel Bishop, Braille Product Manager

Sara Lee, Product Specialist

Natalina Martiniello, Project Consultant

Andrew Lueken, E-commerce Administrator

#### Background

In 2020, the Braille Product Manager, Rachel Bishop, submitted a proposal for a new product based on a recommendation from the Education Products Advisory Committee (EPAC). The committee requested that APH develop short practice reading materials with age appropriate topics for beginning adult braille learners. All materials would be electronic, easily embossed, and with themes relevant to adult learners (i.e., work, college, family, health and wellness, etc.) These materials would be used by adults who are beginning to learn braille and their teachers.

In June 2020, Cathy Senft-Graves, the Braille Literacy Product Manager, reviewed the submission and recommended that the project be accepted to the Product Ideation Committee (PIC) for further evaluation.

#### Work Completed During FY 2022

In January 2022, a Gate 1: Product Ideation Committee (PIC) meeting was held, and the project was accepted for active development. The project was assigned to the Braille Product Manager who then held a brainstorming meeting later that month. During the brainstorming meeting, the group discussed reading levels for the materials, ideas for content sources, how to provide files, and types of materials to include.

In March 2022, the product manager held a Gate 2: Design meeting to introduce the project idea and discuss the notes from the brainstorming meeting. The topics discussed in the Gate 2 meeting included how to provide files, content sources, types of materials, cost, and target markets. It was agreed that a field test would be needed and that materials for the field test would need to be gathered. The product manager would reach out to consultants, Resource Services, etc. about the content. The product manager also planned to reach out to Andrew Lueken, E-commerce Administrator, about the website. After that, the materials would need to be translated into braille. The group planned to complete the prototype by the end of the summer 2022.

In April 2022, the product manager began contacting potential consultants who could make recommendations for reading materials throughout the development of the product. In June 2022, the product manager and product specialist, Sara Lee, met with Natalina Martiniello, a Research Associate with the University of Montreal, who agreed to consult on the project. In the meeting, the group discussed the idea of creating a short market needs survey to gather information from practitioners in the field about the needs of their adult students. The group also discussed how the material could be organized and how much and what kind of materials are needed.

In July 2022, the product manager and product specialist met with Lueken to discuss how the materials would be organized on the shopping site. The product manager wanted to have a website set up for the field test so that field testers could experience downloading the products from the shopping site. Lueken agreed to set up a prototype page on the staging site. The product manager hoped to have the prototype ready for field testing in January/February 2023. She estimated the product would go into production in FY 2024.

The product manager shared a draft layout for the website and estimated 20-25 articles would be needed for the prototype, though this number may change. Lueken agreed to find out how many files the product page could accommodate and start a mockup prototype page; he would also provide the product manager with access to the staging site.

Later that month, the product manager met with Gillian Dubin, Resource Services Librarian, to discuss copyright issues with the materials and received recommendations on materials and websites from which to gather said materials. The product manager and product specialist began developing a market needs survey, which was reviewed by the consultant and submitted to the *APH News* in early August 2022. Responses were requested by the beginning of September. The product manager also spent this time gathering possible reading materials for the project.

#### Work Planned for FY 2023

The product manager and product specialist will review responses from the Market Needs survey and develop a prototype based on that feedback. When the prototype is complete, the product manager will hold a Gate 3: Prototype Evaluation meeting and send the prototype out for field testing.

## Cerebral/Cortical Visual Impairment

### CVI Complexity Sequences eBook (Modification)

(New/Hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rhoffmann@aph.org](mailto:rhoffmann@aph.org).

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To reprogram and present the CVI Complexity Sequences eBook so that the target images are movable by the parent or instructor

#### Project Staff

Rosanne Hoffmann, Science and Health Product Manager

Heather Kennedy-MacKenzie, Director of Technology Product Research

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

APH released the CVI Complexity Sequences kit, the first APH product specifically designed for individuals with cerebral/cortical vision impairment (CVI), in 2010. Comprised of ten sets of eight large cards, each set featuring a different target image, this product is a staple of training materials for teachers of the visually impaired (TVIs). For example, one set features a yellow duck: the first two cards show the duck by itself, large in the first card and small in the second. The subsequent six cards show the small duck in backgrounds of ever-increasing complexity. With appropriate instruction, use of these cards can assist a student to learn to identify the salient features of a target image, a skill that transfers to their everyday life and education.

Soon after the CVI Complexity Sequences kit was released, TVIs in the field requested digital versions of the 80 images to be rendered on an Apple iPad® for ease and convenience. Responding to this need, APH released the CVI Complexity Sequences eBook (or EPUB) in December of 2014. Not only were the images digital, but they also featured audio feedback when the target image was identified and touched on the iPad by the student (e.g., “Good job”). One problem remained: students often memorized the location of the target image, either on the cards or the digital images, making them less useful than they could be. TVIs then requested that the eBook programming enable them to move the target image within the background scenery to work around this complication.

#### Work completed during FY 2022

The product manager submitted a product modification form on October 27, 2021, which described the requested changes. A Gate 1 meeting took place on December 27, 2021, during which the criteria for product development were discussed and scoring matrix implemented. The CVI Complexity Sequences eBook Modification achieved a matrix score of 62; product development was set to begin in fiscal year 2023.

#### Work planned for FY 2023

Kennedy MacKenzie will assign a programmer from the Technology Product Research department to work on the modification of the CVI Complexity Sequences eBook. When reprogramming is completed, the product will be relaunched with appropriate marketing efforts.

### CVI Companion Guide to Developmental Guidelines for Infants With Visual Impairments (Modernization)

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

#### Purpose

To provide an expanded narrative to and guide for the *Developmental Guidelines for Infants With Visual Impairments* to include cerebral/cortical visual impairment (CVI)

#### Project Staff

Susan Sullivan, CVI Project Leader

Monica Vaught-Compton, Project Leader

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Lara Kirwan, Senior Product Specialist

Sarah Welch, Product Specialist

Amanda Lueck, Consultant

Deborah Chen, Consultant

Elizabeth Hartmann, Consultant

Jeff Williams, Manufacturing Specialist

INGrid Design, Graphic Designers

#### Description

A spiral-bound book of approximately 150 pages, *CVI Companion Guide to Developmental Guidelines for Infants With Visual Impairments* (the *CVI Companion Guide*) integrates relevant research from a variety of disciplines, along with professional and family wisdom and experiences, to provide a coordinated approach by which to document, monitor, and promote the visual and overall development of infants and toddlers with cerebral/cortical visual impairment (CVI). These methods can be individually and thoughtfully adapted for older children who have multiple challenges as well. *CVI Companion Guide* emphasizes ways to design meaningful and motivating experiences within daily routines that support and incorporate all developmental domains to maximize effective learning opportunities for each child. Contents include the following:

* a description of the manifestations of CVI in children,
* narrative chapters and tips for practice that address developmental needs and strengths of children with CVI,
* a CVI profile form to assist in the ongoing collection of data about how a child may be affected by CVI and about areas to target for intervention,
* functional vision development progress logs to monitor early functional vision developmental milestones, and
* an intervention planning and monitoring form to assist in the design and monitoring of interventions.

The *CVI Companion Guide* is designed to be used in conjunction with the *Developmental Guidelines for Infants With Visual Impairments*.

#### Work Completed During FY 2022

Because of the departure from APH of the original two *CVI Companion Guide* project leaders, the product manager and product specialists arrived to this product’s development late in the game. In February 2022 and with the product manager’s guidance, the product specialists wrote alt text and descriptive narrative and created detailed tables to accompany the book’s various forms and images so that the book would be accessible to those with visual impairments. The document was then handed over to InGrid Design for conversion into an accessible ePUB. The ePUB launched on March 4, 2022, and the physical kit launched on May 9, 2022.

### CVI: How I See

(Hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To provide parents and caregivers with information about CVI through the child’s voice in a book format that is entertaining and accessible for a young child diagnosed with CVI

#### Project Staff

Susan Sullivan, CVI Project Leader

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Leasha Twyman, Research Assistant

Frank Hayden, Director of Technical and Manufacturing Research

Andrew Moulton, Manager of Technical and Manufacturing Research

Andrew Dakin, Model Maker/Pattern Maker, Manufacturing Specialist

Katherine Corcoran, Model Maker

Anthony D. Jones, Director of Creative Services

Laura Greenwell, Graphic Designer

#### Description

This product will be a series of three board books:

* *CVI: How I See – Learning to Look*
* *CVI: How I See – Exploring*
* *CVI: How I See –* *Looking to Learn*

#### Background

This set of three books is being created for young children diagnosed with cerebral/cortical visual impairment (CVI) and their caregivers. The words are for the reader, told through the child’s voice, explaining his vision with CVI. The interactive components of the books are for the child, both for visual interest and as a tool for play-based assessment, offering insight into the child’s preferred colors, attention to movement, and understanding of concepts.

#### Work Completed During FY 2022

Field testing was planned and a survey was created. Because of constraints from other projects further along in the pipeline, CVI: See How I See was put on hold.

#### Work Planned for FY 2023

Project will remain on hold.

### CVI Website

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [drogers@aph.org](mailto:drogers@aph.org).

#### Purpose

To provide a current resource for research articles, books, websites, blogs, strategies, and support for parents, teachers, university faculty, and students as we strive to learn more about cerebral/cortical visual impairment (CVI)

#### Project Staff

Susan Sullivan, CVI Project Leader

Donna McClure-Rogers, Early Childhood and CVI Product Manager

Michael McDonald, Senior Software Engineer

Leasha Twyman, Research Assistant

Lydia Smith, Digital Content Product Specialist

#### Background

CVI Synergy, a group of nine professionals representing both educational and medical fields, met at The American Printing House for the Blind (APH) in May 2002. The group agreed to act as advisors via an electronic mailing list to help APH develop a new website dedicated to CVI. Unable to attend the meeting, Dr. Jim Jan served via telephone and email as the medical advisor.

In 2003, the Multiple Disabilities Project Leader developed an outline for the CVI Website and began writing text and requesting submissions from the field. The APH librarian obtained permissions on articles recommended by CVI Synergy to be placed on the website. Photographs of children using homemade and APH products were taken.

Dr. Jan organized CVI Synergy West in Vancouver, British Columbia, Canada. This second group, also representing educational and medical fields, addressed the issue of definitions associated with CVI. This meeting resulted in the education-based definition and the medical-based definition for CVI that APH used on the initial website.

In 2015 the APH CVI Website was completely revamped with updates of medical information, current APH products appropriate for this population, parent information, assessments, expanded core curriculum, orientation and mobility, teaming, literacy, and play as well as resource links to research articles, books, websites, webinars, tablet apps, social media support groups, and project idea sites.

With the implementation of the modernized APH website, the CVI website became inaccessible directly from the new host. While the content remains relevant many of the links were impacted by the host changes. In fiscal year 2022, work began on converting the CVI website into a webpage, to be housed on the APH website.

#### Work Planned for FY 2023

Future work on this project is to be determined.

### SwirlyMats™ (Modernization)

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [rbishop@aph.org](mailto:rbishop@aph.org).

#### Purpose

To combine Swirly Mat Sets I and II for both the CVI and FVA versions, thus simplifying the choices for customers while still providing mats with increasing complexity

#### Project Staff

Rachel Bishop, Braille Product Manager

Emily Grimany, Product Specialist

Jeff Williams, Manufacturing Specialist

Matthew Poppe, Graphic Designer

Andrew Moulton, Director of Technical and Manufacturing Research

Anthony D. Jones, Director of Creative Services

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

#### Background

Swirly Mats are sets of colorful mats designed to be used by teachers performing functional vision assessments (FVAs) with students with cortical vision impairment (CVI) and low vision. The original Swirly Mats sets include FVA Kits I and II, which are more complex, and CVI Kits I and II, which are less complex. To make choices easier for customers, it was suggested that the kits be combined, creating one set of mats for FVA and one set for CVI.

In November of FY 2021, Rachel Bishop, the product manager, submitted a Product Modification form to the Product Ideation Committee (PIC). Suggested modifications to the product included combining Swirly Mat Sets I and II and merging Swirly Mats FVA, thus creating one kit for FVA and one kit for CVI. It was noted that the original CVI kit had been obsoleted, so the mats would need to be regenerated with the vendor. Other changes included updating the guidebooks into Unified English Braille (UEB), updating the parts lists, taking new photos, and eliminating some mats so that there are five mats per kit.

In July of 2021, the product manager sent the updated files to Graphic Design for layout.

#### Work Completed During FY 2022

In October 2021, braille and print brochures were completed as well as a VELCOIN® braille and print insert. A combined Gate 3: Prototype Evaluation and Gate 4: Modifications meeting was held in November 2021. In the meeting, changes to the old product were reviewed and discussed as well as quotes from the vendor, completed box art, and next steps.

Following the meeting, the Manufacturing Specialist, Jeff Williams, began working on the specifications, and the product manager supplied him with the updated parts lists.

The manufacturing specialist contacted the vendor about regenerated mats from the obsoleted Swirly Mats kits, and the vendor responded that they still had all of the tooling needed to create the mats. The product manager submitted all files (braille and print) to the manufacturing specialist and also created a warning label for the carry-case. The manufacturing specialist sent a catalog number request to operations-engineering. Catalog numbers were generated and sent to the product manager, who added them to the brochure, box art, and braille. Final files were sent to the manufacturing specialist, including VELCOIN® inserts, Portable Document Format (PDF) brochures, and the updated Braille Ready Files (BRFs).

In December 2021, the product manager submitted the carry-case warning label to the manufacturing specialist. The manufacturing specialist added the labels to the specifications sheet and sent it to Translation to be generated.

In April 2022, updated BRFs were supplied to the manufacturing specialist. In May, the Parts List was generated, and proofs were sent to the product manager. The product manager checked the braille proofs for both CVI and FVA and approved them.

In June 2022, confetti for the turquoise mat was dropped by the vendor, so replacement confetti was chosen and specs were updated accordingly.

In July 2022, the manufacturing specialist held a Gate 5: Specifications meeting to discuss tooling status, production quantities, and sales dates for the kits. The group agreed that the product could be released in December 2022 with a pilot run of 100 units for each kit. The current inventory would be sold off as much as possible and obsoleted when the new kits become available.

#### Work Planned for FY 2023

The product is currently in production. A Gate 6: Product Launch/Lessons Learned meeting will be held and the product will be released for sale in FY 2023.

## Independent Living

### Independent Living Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzierer@aph.org](mailto:lzierer@aph.org).

#### Purpose

To develop independent-living products and services that are affordable, user-friendly, and consumer-driven, while addressing the diverse needs of the blind and low vision population

#### Project Staff

Laura Zierer, Independent Living and O&M Product Manager

#### Background

Product development in the area of Adult Life was initiated at The American Printing House for the Blind (APH) in the summer of 1998. The first products derived specifically from this effort were made available during FY 1999. Product research, along with consumer and professional networking, has continued to characterize the development of products for adults. In FY 2021, the area of focus was switched to independent living, which encompasses adult-life products.

#### Work Completed During FY 2022

Investigation and development of new products for independent living continued in FY 2022. The promotion of recently released music braille products was a goal for this past year. Data analysis and performance tracking of legacy products was also a focus during FY 2022.

#### Work Planned for FY 2023

Laura Zierer plans to launch a survey focusing on the current needs in the field within this category. Zierer will work with various departments to distribute information regarding this survey once it is made available. Work will continue with product-idea reviews and research.

## Low Vision

### Envision Kit (Modification)

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jstaylor@aph.org](mailto:jstaylor@aph.org).

#### Purpose

To revise Envision I and II kits into one optical device kit to teach children and adults new to vision loss how to use optical low vision aids

#### Project Staff

Justine Taylor, Low Vision Product Manager

Laura Zierer, Independent Living and O&M Product Manager

Jennifer Gendeman, Low Vision Consultant

Leasha Twyman, Research Assistant

Emily Grimany, Product Specialist

Laura Greenwell, Graphic Designer

Anthony D. Jones, Director of Creative Services

Bryan Rogers, Manufacturing Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Bobby Fulwiler, Product Specialist

#### Background

The Revised Envision Kit will be a modernization of the Envision Training programs. The Envision I and Envision II kits will be combined into one kit of teaching optical aids. Magnifiers and telescopes are being updated and instructional materials revised. The activities binder will include updated lessons. The changes were decided based on a needs survey conducted to determine what materials were needed and being used in the kits. Several focus groups were conducted with consumers and teachers to determine the preferences of low vision users. Low vision eye doctors and a Certified Low Vision Therapist (CLTV) consultant provided feedback on the style and power of magnifiers and telescopes recommended for low vision patients. Feedback was also received from the 151st The American Printing House for the Blind’s Annual Meeting in 2019 regarding kit updates.

#### Work Completed During 2022

The product manager (PM) presented virtually on the Revised Envision Kit in November 2021 at the annual AVRT conference. Positive feedback was received on the inclusion of adults and on VRT service providers being able to use the kit more effectively for training older adults new to vision loss learning the use of optical magnification.

The Gate 5: Specifications meeting was held on June 15, 2022. There continues to be a hold on the product release due to production schedule delays and supply chain delays. The PM is working on finding a replacement for one of the optical aids selected for the kit that has up to an 8-month shipping delay. There will be new photography and edits made to the guidebook to include the replacement item.

The release of the revised Envision Kit is anticipated for Fall or Winter 2022.

#### Work Planned for FY 2023

The PM will provide product support and training.

### Low Vision Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jstaylor@aph.org](mailto:jstaylor@aph.org).

#### Purpose

To develop low vision products and services that are affordable, user-friendly, and consumer-driven and that address the diverse needs of the visually impaired and low vision population

#### Project Staff

Justine Taylor, Low Vision Product Manager

Leasha Twyman, Research Assistant

Bobby Fulwiler, Product Specialist

Stephanie Lancaster, Creative Services Project Manager

Anthony D. Jones, Director of Creative Services

Ricky Irvine, Graphic Designer

MaryGen Boley, Director of Communications and Engagement

Colin Ratchford, Consumer Engagement Specialist

Andrew Lueken, E-Commerce Administrator

#### Background

Product development in the area of low vision has continually been a focus of the Educational Product Innovation department. Various product managers (PMs) have sought input from the field to develop products that meet the needs of low vision consumers. Justine Taylor assumed the Low Vision Project Leader position on July 30, 2018. Product research, along with consumer and professional networking, has continued to characterize the development of low vision products.

#### Work Completed During 2022

The PM continues to report on project updates and sales for low vision products at Humanware® and Vispero® monthly vendor meetings. In May 2022, Taylor presented the Juno™ to the Department of Education. The PM continued to work on the National Library of Science (NLS) braille courses. Taylor has completed all 20 lessons and has started the manuscript for certification. The PM continues to provide presentations for the Access Academy webinar series and blog content for The American Printing House for the Blind (APH) website. Taylor presented on low vision products and attended several conferences including the AER International Conference in St. Louis, MO in July 2022 to earn continuing education credits and promote APH products and services in the exhibit booth.

The PM continues to make sure content for low vision products on the website’s product pages and photos are accurate, current, and relevant to customers. Taylor has created Skills Performance Checklists for the Juno and Jupiter Portable Magnifier for instructors to use to monitor student progress during assistive technology training. These are available for download on the product page on the APH website.

#### Work Planned for FY 2023

Development of low vision products will continue. The PM continues to work on her NLS braille certification and legacy product presentations, and she will perform other product-management tasks.

## Low Vision Technology

### APH Visual Interpreter

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jhodge@aph.org](mailto:jhodge@aph.org).

#### Purpose

To provide visual interpreter service to our customers through Federal Quota funds

#### Project Staff

Greg Stilson, Head of Global Innovation

Joe Hodge, Technical Innovations Product Manager

Kevin Phelan, Aira Tech Corp. Vice President of Sales

#### Background

The need for remote visual support for students is twofold: the short-term need that surfaced during the COVID-19 pandemic and the ongoing need and demand for remote teaching techniques for distance learners. In this remote-learning reality, the APH Visual Interpreter gives thousands of students with visual impairments access to remote education content via various learning-management systems.

#### Work Completed During FY 2022

* APH project staff submitted the teacher dashboard guidelines to Aira. With information gleaned from field-test data, Aira is working on enabling the teacher of the visually impaired to:
* upon logging in, see the existing student accounts and be able to add or remove accounts;
* on the standard dash screen, see the student’s average daily usage over the past week on the; and
* on the standard dashboard screen and inside the account details screen, change the permissions for each student.

#### Work Planned for FY 2023

* Continue work on the teacher dashboard.
* Field-test the dashboard.
* Create marketing videos.
* Create APH Visual Interpreter use cases.

### Desktop Tablet Magnifier

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tmaddox@aph.org](mailto:tmaddox@aph.org).

#### Purpose

To develop a new generation of desktop tablet magnification on a mainstream technological platform to ensure that low-vision tools necessary to curriculum access can be learned organically

#### Project Staff

Tyler Maddox, Technical Innovations Product Manager

Umang Dua, TrySight, Inc., Project Manager

Justine Taylor, Low Vision Product Manager

Greg Stilson, Head of Global Innovation

Brian Magsalansan, TrySight, Inc., Software Lead

Cheng Pan, TrySight, Inc., Hardware Lead

#### Background

The American Printing House for the Blind (APH) supports the creation of a global low-vision technology community, where companies, agencies, and educators work together to provide students and adults with quality low-vision magnification products that meet and anticipate their needs, are affordable, and employ technology and innovation. To that end, APH is pioneering a low-vision roadmap built on the philosophy that accessible technology is not one-size-fits-all. We are committed to serving users from all stages of life to improve the likelihood of school, college, work, and lifetime success. To fulfill the diverse requirements of a modern userbase, APH is developing an array of cutting-edge tools, from spot-reading solutions to comprehensive learning-management systems.

The long-term goal of this roadmap is to create a portfolio of diverse, universally designed magnification tools that are flexible and simple enough to be used by anyone, including those with low vision and multiple disabilities. This roadmap ultimately culminates in the ideal wearable for hands-free dynamic magnification access.

In June 2021, APH released a Request for Proposal on its business opportunities page (<https://www.aph.org/business-opportunities/>), seeking a development partner for the redesign of the APH MATT Connect™ Desktop Tablet Magnifier, released in 2016. After a series of written proposals and technology/business demonstrations from assistive technology companies, APH selected TrySight, Inc., as its development partner, with a projected release for the Desktop Tablet Magnifier redesign in late 2023. A final development agreement was signed in June 2022.

Apart from refreshing the hardware and software to meet current standards, APH has considered user feedback throughout the life of the MATT Connect and is focusing on a few key aspects in the updates to the desktop tablet magnifier product line:

* offering low-vision tools for curriculum access on a mainstream ecosystem to support the development of essential technical skills,
* improving synergy between the stand and tablet, along with a complete stand overhaul to address ergonomics issues, and
* providing strong onboard user support and a reimagined user-interface (UI) system to ensure users of all technical fluencies can operate the device.

#### Work Completed During FY 2022

Most of the work on the Desktop Tablet Magnifier occurred in the last quarter of fiscal year 2022 and has centered on hardware and general UI decisions. The development cycle comprises seven quarters of development and culminates in the completion of seven agreed-upon major development milestones. The milestone for fiscal year 2022 involves building the stand-form factor, which will house the computer tablet, and includes designing the:

* opening and folding mechanisms;
* main camera up-, down-, left-, and right-rotation with appropriate tension to set orientation;
* USB data-port location and design for tablet connection;
* full-page optical character recognition (OCR) camera at an appropriate height for full-page captures when stand is opened; and
* keyboard integration, including stow-away location and latching mechanism.

The team at TrySight designed CAD mockups and prototyped the stand using aluminum and selective laser sintering-printed plastics. They completed the principal design around the tablet housing, button/knob panel, stand body, hinge points, and document base, and they demonstrated how to fold the device for travel.

The system software will include multiple user interfaces designed to fine-tune the scope of features that users want.

#### Work Planned for FY 2023

The development milestones for fiscal year 2023 involve the electronics, magnifier/OCR software, user-experience software, and hardware/software hookups, as follows:

* electronics:
  + internal wiring
  + USB hub connection and stand ports
  + dock front panel, including functional knobs and buttons
  + camera video
  + camera-orientation sensing
  + lighting with software control
* magnifier/OCR software:
  + magnification software utilizing 60 FPS (frame rate) magnification
  + full-page OCR capture
  + video-stabilization
  + hand-detection
* user-experience software
  + Setup Wizard
  + Carousel view
  + Exam mode
  + Kiosk mode
* hardware/software hookup
  + front panel button/knob integration with various modes (Carousel, Open Windows®, ZoomText, Kiosk) and magnifier software
  + front panel button/knob integration with various software (magnification, contrast, camera cycling)
  + camera-orientation functionality in software

### Juno™

Formerly Handheld Video Magnifier with Speech

(Completed)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jstaylor@aph.org](mailto:jstaylor@aph.org).

#### Purpose

To provide a product that expands the Handheld Video Mag HD product line and to develop a handheld video magnifier to include Optical Character Recognition (OCR), document and image storage, file transfer, a larger 7-inch screen, and other features

#### Project Staff

Justine Taylor, Low Vision Product Manager

Emily Grimany, Product Specialist

Bobby Fulwiler, Product Specialist

William Freeman, Tactile Technology Product Manager

Laura Greenwell, Graphic Designer

Anthony D. Jones, Director of Creative Services

MaryGen Boley, Director of Communications and Engagement

Greg Stilson, Director of Global Innovation

Tyler Maddox, Technical Innovations Product Manager

#### Background

This project began with The American Printing House for the Blind (APH) developing and publishing a Request for Proposals (RFP) for a handheld video magnifier with speech. The RFP was released in May 2019. Vispero® was selected to produce the handheld video magnifier with OCR and development began in FY 2020.

#### Work Completed During 2022

The product was released on May 12, 2021. The product manager (PM) monitored sales and made projections for FY 2022 through FY 2023 to help determine inventory needs and reduce backorders. The PM continues to hold monthly meetings with the vendor to track sales trends and inventory needs. The PM worked with Vispero® to provide a series of webinar trainings for the customer beginning with unboxing and tips and tricks learning to use Juno’s rotating camera, menus, and OCR as well as capturing and saving documents in the file manager, transferring files using the computer, and using Juno in the classroom. Webinars are scheduled through December 2022.

#### Work Planned for FY 2023

The PM continues to provide support and training on the device. The PM is working with Vispero® to improve Juno’s features with future updates.

### MATT Connect™

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jstaylor@aph.org](mailto:jstaylor@aph.org).

#### Purpose

To develop a tablet-based magnifier for near and distance viewing which would allow low vision students in a classroom setting to access information electronically (shared desktop/whiteboard) and would function as a typical electronic magnifier and tablet

#### Project Staff

Justine Taylor, Low Vision Product Manager

Laura Zierer, Independent Living, and O&M Product Manager

Leasha Twyman, Research Assistant

Bobby Fulwiler, Product Specialist

Sarah Welch, Product Specialist

Laura Greenwell, Graphic Designer

Anthony D. Jones, Director of Creative Services

MaryGen Boley, Director of Communications and Engagement

Tyler Maddox, Technical Innovations Product Manager

Greg Stilson, Director of Global Innovation

#### Background

The MATT Connect™ is a partnership project with HumanWare®. As The American Printing House for the Blind (APH) was interested in developing a tablet-based magnifier, the product manager (PM) submitted a product submission idea form. It was approved by both the Product Evaluation Team and the Product Advisory and Review Committee.

#### Work Completed During 2022

The PM continues to participate in monthly meetings with HumanWare to discuss projects and provides sales and inventory updates. The Prodigi® software was updated to version 4.6 and released on February 1, 2022. New software features include:

* **“Go to Page” functionality for books with a table of contents**
  + You can now navigate to any page of a downloaded book that has a linked table of contents or page numbers included.
* **Annotate a book**
  + Books can now be marked up with annotations when opened.
* **Add Bookmarks to books and audio books**
  + You may now insert, name/rename, navigate, and delete bookmarks in books/audio books. In books, bookmarks can be placed in a page, column, or line reading modes.
* **Usage Metrics**
  + A feature to send *anonymized* Prodigi usage data has been added to help us understand how the software is being used and to inform future development. Users can opt-out of this important functionality. Data like text-to-speech and optical character recognition language, selected user interface, and contrast colors used are submitted anonymously.
* **Updated Desmos calculator API**
  + Desmos has been updated to the latest v1.6. Two key features:
    - Applies embedded font sizes in calculator settings
    - Use’s Prodigi color schemes when selected

Customers were informed of the latest software update with new features on the MATT Connect blog and in the APH News. Webinars and tutorial videos demonstrating new features were completed and are available on the APH Website in the archived webinar playlist on YouTube. The product page and User Manual were updated with new version features.

#### Work Planned for FY 2023

The PM will continue to offer training and support for this device. The PM is working with the vendor for future upgrades.

### Video HD Magnifier (Modification)

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [jstaylor@aph.org](mailto:jstaylor@aph.org).

#### Purpose

To refresh the Video Mag HD to be more accessible to all ages, easier to handle and use, and more durable

#### Project Staff

Justine Taylor, Low Vision Product Manager

Bobby Fulwiler, Product Specialist

Tyler Maddox, Technical Innovations Product Manager

Greg Stilson, Director of Global Innovation

#### Background

A product modernization form was completed by Tyler Maddox, the product manager, in July 2021. The simple, easy-to-use design and current functions of the device will remain. The purpose of the remodeled version is to upgrade the look and feel and make feature improvements. The Video Mag Refresh will include an increased screen size from 4.3 in. to 5.5 in. with a glare-resistant screen, ergonomic stand and grip with a durable case, longer battery life, improved magnification, adjustable LED lights, adjustable screen brightness, handwriting function, and other features to APH’s specifications.

#### Work Completed During 2022

Meetings have taken place with the vendor since March 2022 to determine the design, scope of the project, and timeline.

#### Work Planned for FY 2023

Product release anticipated for Fall 2023.

## Orientation & Mobility

### Orientation & Mobility Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lzierer@aph.org](mailto:lzierer@aph.org).

#### Purpose

To develop products focused on skills, techniques, and research within orientation and mobility (O&M)

#### Project Staff

Laura Zierer, Independent Living and O&M Product Manager

#### Background

This grant was opened in FY 2017 in response to a growing need for further research and development within the field of O&M.

#### Work Completed During FY 2022

Investigation and development of new products for orientation and mobility continued in FY 2022. The modernization of a past O&M product was submitted and assigned to Zierer in October 2021. Partnering with a fellow product manager, a curriculum product idea was submitted to the Product Ideation Committee in April 2022. This submission in under review.

#### Work Planned for FY 2023

Zierer will continue to research and review products in the area of O&M. Legacy products within this category will continue to be tracked and adjusted, as needed.

### O&M Grid Sheets

(Hold)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).

#### Purpose

To provide pre-cut hook-backed grid sheets to complement APH’s Picture Maker felt board and accessories for the purpose of convenient O&M mapping

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

#### Background

On October 11, 2021, the product manager submitted a formal review of a product submission form from a teacher of the visually impaired(TVI)/Orientation and mobility in Maine who requested that The American Printing House for the Blind (APH) provide grid sheets in various sizes that could be used in combination with APH’s Picture Maker felt board and/or other hook-receptive boards. The product idea submitter explained the difficulty of having to use straight-line strips to build a grid on the Picture Maker board. As she explains, “Because you can’t overlap the pieces without them bumping up, you have to use so many pieces and students push them right off the map at times.” A grid with approximately 1-inch or 2-inch openings to fit on one-half of the Picture Maker felt board was requested.

After a careful and thorough review, the product manager recommended to pursue the product idea and produce ready-to-use grids available from APH. She anticipated that more space within each square of the grid(s) would be necessary to provide more wiggle room for inserting shapes or 3D pieces (e.g., Tactile Town models). Determining the ideal grid options as related to both the size of square openings and various grid configurations to satisfy a broad audience will be the greatest challenge of the product. The product manager also noted in her review form that the grids will likely support learning activities beyond mapping (e.g., graphing, calendar activities, games, etc.).

On December 22, 2021, a product submission form was reviewed and scored by the Product Ideation Committee (PIC) at the Gate 1 meeting. The modernization proposal received a rating of 73. The grant number 786 was assigned to the project and the product moved into an on-hold status.

#### Work Completed During FY 2022

No active work was undertaken on this newly approved product idea during the fiscal year due to unfinished products that are farther along in the New Product Development continuum.

#### Work Planned for FY 2023

After the product transitions to active development, the product submitter will be invited to partake in the design of the grid sheets prior to field-testing. Feedback will also be garnered from other O&M instructors and TVIs as the prototype is designed for formal testing.

### Room with a View: Map-Reading Concepts and Skills

Formerly Room with a View: A Tactile Model of Indoor Settings

(Continued)

Front cover art for Room with a View prototype

For information about product development of Room with a View from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).

#### Purpose

To provide an interactive “room” with an assortment of realistic models that can be used to represent the interior layout of a single room (e.g., bedroom, kitchen, school classroom) or larger venue (e.g., grocery store, library).

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

Emily Grimany, Product Specialist

Andrew Dakin, Model Maker/Pattern Maker

Ben Taylor, Model Maker/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Laura Greenwell, Graphic Designer

Matthew Poppe, Graphic Designer

Anthony Jones, Director of Creative Services

#### Background

As conceptualized by the product manager, the product will be an “indoor” equivalent to The American Printing House for the Blind’s (APH) Tactile Town. Tactile Town primarily focuses on outdoor settings (e.g., street layouts, multi-block arrangements). In contrast, Room with a View: Map-Reading Skills and Concepts will address indoor surroundings and layouts. With the use of this tactile room, cognitive-mapping skills and spatial understanding can be encouraged and practiced. The product will encourage the transition from three-dimensional models to abstract, two-dimensional layouts, as typically encountered in Picture Maker and static raised-line maps. The concept of perspective will also be emphasized via tactile observation of the room from various angles (i.e., front view, top view, side view). Lesson plans will encourage the student to “re-draw” the room independently using a variety of tactile materials (e.g., the DRAFTSMAN Tactile Drawing Board and flat hook-backed or magnetic pieces).

The product addresses the following needs and requests from the field:

* Provide additional interactive tactile materials to assist students’ understanding of the world around them.
* Allow exposure to tactile graphic displays within a purposeful context (e.g., understanding a room layout and how the view of a room can change depending on one’s perspective and physical position in a room).
* Promote the transition from three-dimensional layouts to abstract and/or permanent raised-line graphics.
* Design materials that engage a young child/student in open-ended creative activities (e.g., building and designing room layouts).
* Address specific requests from the field, as similarly garnered from Tactile Town field evaluators and attendees of Tactile Town product-training sessions, such as the following:
* “Expand this fantastic tool to include parts of the inside of buildings to orient students to a library, grocery store, and school building.”
* “I would love to have a doll-sized house and store that is designed for teaching O&M to illustrate floors and how rooms and hallways exist in all these structures.”
* The need for this product was echoed at the National Federation of the Blind’s 2013 Tactile Graphics Conference in Baltimore, MD, by an audience member during the product manager’s presentation on the development of early tactile skills and concepts.

#### Work Completed During FY 2022

Construction of production tooling for Room with a View, as well as the authoring of the related Activity Guide, encompassed most of the project team’s efforts in the fiscal year. Specifically, the following tasks were accomplished:

* The product manager posted a summary of a Gate 4 refresher meeting that was conducted with new APH staff and Gate-form signers who recently joined the APH team to make certain all in-house parties were versed in the product’s scope, planned components, and anticipated in-house and outside-vendor involvement in the kit’s eventual production.
* Ben Taylor constructed the fiberglass setups of the RWAV 2D layouts using masters generated from the Roland® UV printer.
* The product manager worked with Andrew Moulton to identify a replacement housing box for the more expensive plasticized box. A blue, fluted cardboard box is expected to be used for the final product.
* The Model Shop furnished the product manager with a full set of 3D-printed models in the three assigned colors.
* Patrick White continued to construct the Product Specifications document.
* Modified art specifications were provided to Laura Greenwell. The Activity Guide will be printed with a full-bleed cover and non-bleed text pages.
* The product manager made significant strides during the third quarter of the fiscal year with regard to the authoring and refining the content for the Activity Guide.
* A clean file of the Activity Guide was thoroughly reviewed and edited by Bobby Fulwiler and Emily Grimany. This file incorporates final editing prior to layout design and photography by Dot 6.
* The product manager determined the needed photos/images for placement in the final Activity Guide.

#### Work Planned for FY 2023

Preparation of the production tooling will continue into the first and second quarters of the new fiscal year, including tooling for the final print Activity Guide and the braille translation. Product specifications will be completed and the product will enter Gate 5 status. A formal Gate 5: Specifications meeting will be conducted and firm goal dates for pilot/production runs will be established by the end of the fiscal year.

## Recreation & Leisure

### Tactile Skills Matrix

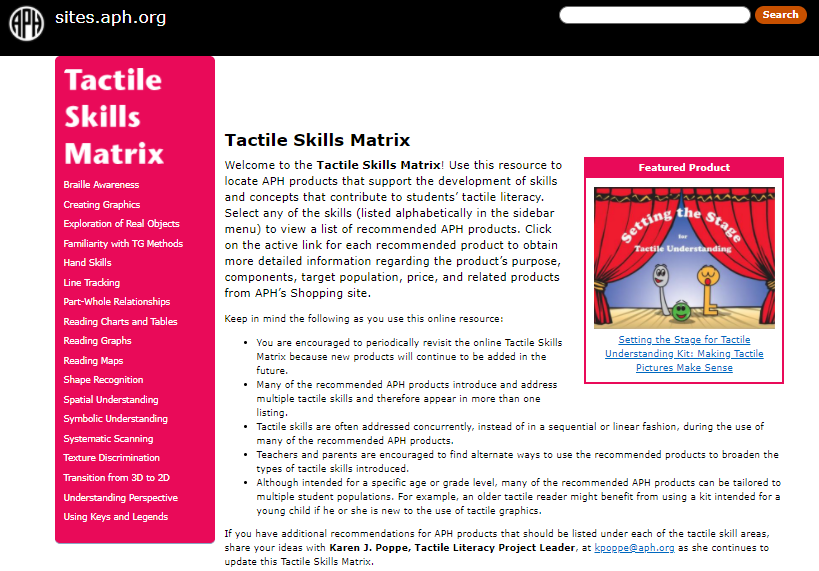
Formerly Tactile Skills Online Matrix

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).

For information about the development of the Tactile Skills Matrix from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).



#### Purpose

To provide an online document, or matrix, that cross-references important tactile skills with available APH products

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

#### Background

The American Printing House for the Blind (APH) frequently receives comments that teachers do not know about our products or how they can be used in conjunction with others. Just as importantly, APH does not have well-established ways to reach parents to inform them about the need for tactile skills development and what that means for their child or how they can begin to nurture tactile skills development early on. The continuum of tactile skills—such as body and spatial awareness, shape recognition, scanning/tracking ability, perspective understanding, and so on—are known to contribute to successful tactile interpretation. The basic progression needed for tactile learning—from experiences with real objects to models to raised-line images—is well-documented and modeled in a variety of APH products (e.g., Setting the Stage for Tactile Understanding). However, students who are tactile learners are likely to be getting piecemeal instruction and are, therefore, poorly equipped to handle the increasing variety of graphically presented material in textbooks and high-stakes tests.

The initial launch of the Tactile Skills Matrix was officially announced in the May 2017 issue of *APH News*. The Tactile Skills Matrix cross-references 18 distinct tactile skills/concepts with available and appropriate APH products. The tactile skills/concepts featured in the matrix are the following:

* braille awareness
* creating graphics
* exploration of real objects
* familiarity with tactile-graphic methods
* hand skills
* line-tracking
* part-to-whole relationships
* reading charts and tables
* reading graphs
* reading maps
* shape recognition
* spatial understanding
* symbolic understanding
* systematic scanning
* texture discrimination
* transition from 3D to 2D
* understanding perspective
* using keys and legends

Users of this online resource merely navigate through the list of skills on the homepage and then click on the desired skill/concept. This reveals a list of available APH products, such as the ones in this [example for symbolic understanding](https://sites.aph.org/tactile-skills/symbolic-understanding/).

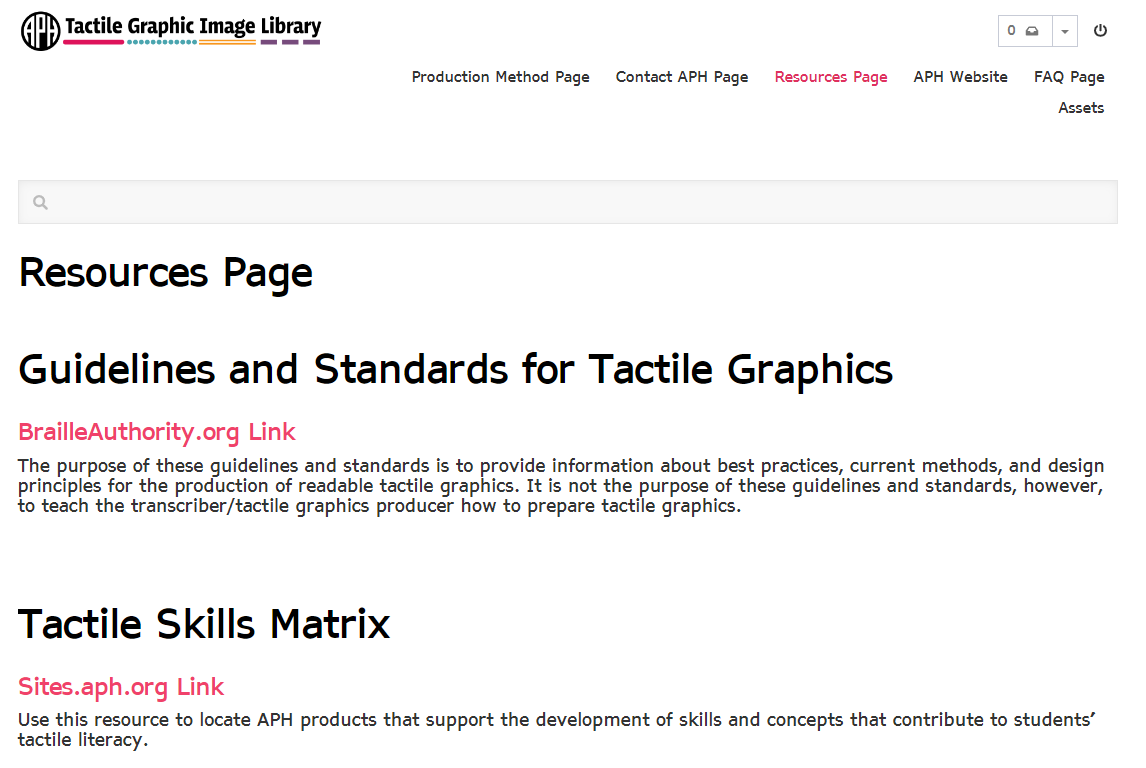
#### Work Completed During FY 2022

The product manager incorporated regular updates to the [Tactile Skills Matrix](https://sites.aph.org/tactile-skills/) as new APH products were introduced to the market throughout the fiscal year. New products referenced included the following:

* Accessible Code and Go Mouse
* Health Education Tactile Graphics
* Animal Recipes: Farm Animals
* *How to Recognize a Monster*
* Updated APH book, *The Caterpillar*
* Paint-by-Number: Endangered Species
* Tactile Theme Pack: In My Yard

Hyperlinks to obsoleted APH products were removed from the matrix, but the names of some retired products remained in the skill lists, given the strong likelihood that many of the obsoleted items are still in circulation and available for continued use by teachers of the visually impaired and students. The product manager highlighted the availability of the Tactile Skills Matrix at several tactile graphic presentations. The matrix continues to be among the most visited resources on the APH website.

A link to the Tactile Skills Matrix was added and prominently featured on the Tactile Graphic Image Library’s Resources page: <https://imagelibrary.aph.org/portals/aphb>



#### Work Planned for FY 2023

The Tactile Skills Matrix will remain an available resource on the APH website. The product manager will continue to monitor the launch of new APH tactile products and categorize them by the various skill areas within the matrix. She will also continue to showcase this online resource at tactile graphic workshops, as well as monitor feedback from the field regarding the usefulness of the Tactile Skills Matrix.

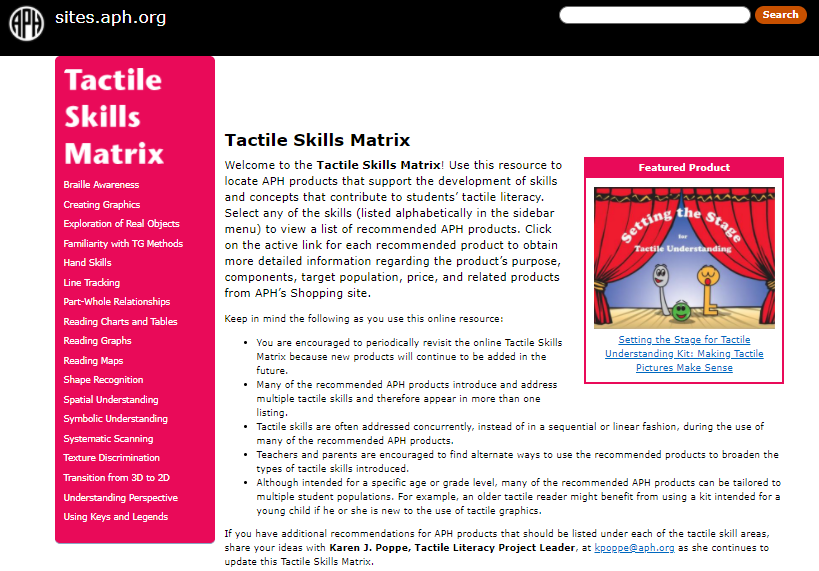
### Tactile Skills Matrix

Formerly Tactile Skills Online Matrix

(Ongoing)

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#### Purpose

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#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

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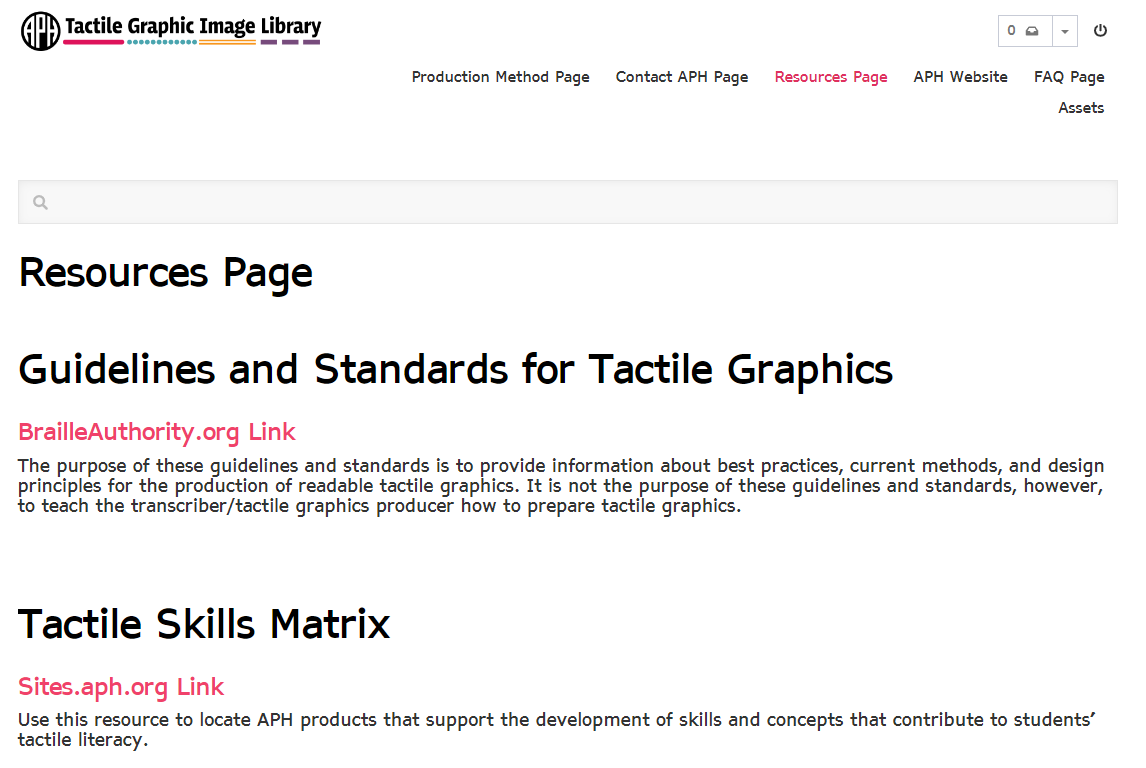
Work Completed During FY 2022

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#### Work Planned for FY 2023

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## Sensory Efficiency Skills

### 3D Universal Core Communication Symbols

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).



#### Purpose

To provide a set of 3D symbols to support teachers in helping nonverbal students who have multiple disabilities—including blindness or deafblindness—learn to communicate symbolically using only one hand, if necessary

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Karen Erickson, Consultant

Emily Grimany, Product Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

#### Description/Background

The symbols represent universal core vocabulary that is unique in that it is conceptual and applicable across settings and purposes. The Center for Literacy and Disability Studies at the University of North Carolina (UNC) Chapel Hill has used these symbols in its research and has made them publicly available on its project website. At product submission, they had 18 symbols designed and in use. These symbols reflect words that are part of the DLM First 40, which is a set of core vocabulary used as part of the Dynamic Learning Maps™ alternate assessments in 18 states in the U.S. Learn more about [3D Symbols and Project Core online](http://www.project-core.com/3d-symbols/).

Dr. Karen Erickson (6/19/20) agreed to an additional fourth symbol in Set 1: Red—-go and like, Yellow—not and more, which requires two molds. Adding the fourth symbol should reduce some cost, per symbol, on each mold.

#### Work Completed During FY 2022

The circle symbol with three rows of bumps on the side cannot be manufactured using injection molding. APH redesigned it to only have one row of bumps and to make it not so thick to prevent sinking during curing. The UNC team rejected the proposed design. The APH team then went in a different direction and created a symbol replicating a typical round cookie cutter shape with scalloped edges. A second option was made alternating scallops to star-like points. The UNC team liked these so much that they are rethinking and reaching out to people who are actively using the symbols about some design issues. They report that this different approach to shape may solve some other issues.

#### Work Planned for FY 2023

The APH team will continue to work with the UNC team to solidify the two shapes for the red and yellow starter set.

### *Sensing and Learning*

Formerly Sensory Learning Kit

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).

#### Purpose

To update this successful product using feedback from the field and to add a video component to match its sister product, SAM: Symbols and Meaning

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Millie Smith, APH Consultant/Author

Stacey Chambers, Teacher of Students with Visual Impairments

Emily Grimany, Product Specialist

Lydia Smith, Digital Content Product Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Joe Wegner, Electronic Product Design/Manufacturing Specialist

#### Description/Background

*Sensing and Learning* is the new name for the modernization of the Sensory Learning Kit (SLK). The new product will be a publication to teach the SLK methodology that has been successfully implemented since the debut of the SLK in 2005. The SLK is the first of three sequential products that The American Printing House for the Blind (APH) offers as an intervention continuum—Sensory Learning Kit, SAM: Symbols and Meaning, and Tactile Connections: Symbols for Communication. During that time, APH has co-hosted numerous training events across the country. Based on newer published research and input from the field, we have learned about additional information, resources, and educational aids to aid teachers, parents, and sensorimotor learners. Through field-testing SAM, the second product of the continuum, we learned how valuable videos are to the consumer. In tandem with the development of this new publication, APH developed and launched a series of [sensory learning videos](https://www.youtube.com/playlist?list=PLUj6DcM1nN3G9IiNMfQXJ0P2rg2iQe35E).

#### Work Completed During FY 2022

The team completed the Sensing and Learning manuscript, researched and collected most photos, and submitted materials to APH’s internal design team, Dot 6. Team consultants presented SLK webinars using the newer assessment documents in *Sensing and Learning*. APH decided to continue selling separately any item in the SLK that has a catalog number: Power Select, Vibrating Pad, Turbo-on-the-Go folding fan, flashlight with color lenses, Scallop Switch, Adaptable Stick Switch, and the Adaptable Tactile Switch. APH will no longer sell pinwheels, tactile rollers, and bell bracelets. The team held a Gate 2: Product Design meeting on December 9, 2021.

#### Work Planned for FY 2023

Once the sample layouts are submitted, the team will schedule the Gate 3: Prototype Evaluation meeting. APH will finish the design and layout of the book and schedule the corresponding gate meetings leading up to the launch of the publication. Marketing, presentations, and webinars will be forthcoming.

## Mutliple Disabilities

### Visual and Multiple Impairments Website

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [tpierce@aph.org](mailto:tpierce@aph.org).

#### Purpose

To provide parents, teachers, and support professionals with product support, information, and resources to help them serve individuals who have multiple disabilities in addition to visual impairment, blindness, or deafblindness

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Millie Smith, TVI Consultant

Stacey Chambers, TVI Consultant

Emily Grimany, Product Specialist

Matt Poppe, Graphic Designer

Jill Fox, Narrator

#### Background

The American Printing House for the Blind (APH) Customer Experience department receives calls and email messages from parents and teachers who ask questions about APH multiple disabilities products and services. Attendees of APH National Instructional Partnership workshops requested a location where they could look for information about multiple disabilities and APH products. Over time, products that are stored at resource centers and shipped to various schools year after year may experience loss of documentation that would assist teachers in using the product. APH decided that a website to support these products that includes videos, questions and answers, sample assessments, downloadable forms, and more would benefit teachers and parents. Staff collected research, documentation, and photos for the future site. the product manager, along with a team of consultants, graphic designers, and narrators, continue to develop Sensory Learning Kit (SLK) videos: [Max’s flag routine](https://www.youtube.com/watch?v=N95JzkkhB_c), [Adam’s snack routine](https://www.youtube.com/watch?v=_FA0P538uS0), [Freddy’s brush hair routine](https://www.youtube.com/watch?v=yZrz9iNlByw), [Isaiah’s applesauce routine](https://www.youtube.com/watch?v=1cByUUqrQF8), [Cynthia’s fan routine,](https://www.youtube.com/watch?v=p-fU3FP9MYQ)

and [Aarna’s iPad® routine](https://www.youtube.com/watch?v=RbQnwin2Qz8). All videos are on YouTube™.

#### Work Completed During FY 2022

The team launched [Brandon's Make Food Routine](https://www.youtube.com/watch?v=2Xih4KLDZyY).

#### Work Planned for FY 2023

The team will review existing video footage for the next video in the series. The team and consultants will collaborate and create material as needed.

### Multiple Disabilities Projects and Needs

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to tpierce@aph.org.

#### Purpose

To assess needs, plan research, and manage product development to serve individuals who are visually impaired and have additional disabilities

#### Project Staff

Tristan Pierce, Multiple Disabilities and Physical Education Product Manager

Emily Grimany, Product Specialist

#### Background

Since 2001, The American Printing House for the Blind (APH) has conducted three Multiple Disabilities Focus Groups with surveys. The reports are available on the APH website.

* [Report of the APH Birth to Grade 12 Multiple Disabilities Focus Group and Survey](https://www.aph.org/rd/research-resources/report-of-the-aph-birth-to-grade-12-multiple-disabilities-focus-group-and-survey/)
* [Report of the APH Adult Multiple Disabilities Focus Group and Survey](https://www.aph.org/rd/research-resources/report-of-the-aph-adult-multiple-disabilities-focus-group-and-survey/)
* [Multiple Disabilities Survey Results](https://www.aph.org/rd/research-resources/multiple-disabilities-survey-results/)

More recently, the team uses online, product-specific focus-group webinars and product-specific surveys to gather information, in addition to submissions from the field, to guide APH in the development of products for learners who have severe disabilities in addition to visual impairments.

#### Work Completed During FY 2022

The team continued to work on the modernization of the Sensory Learning Kit, 3D Universal Core Communication Symbols, and Astro Adventure Balls.

The team completed three products: DC Supplement Adapter, Joy Player Cartridges, and *Paint-by-Number Safari: Endangered Species*.

#### Work Planned for FY 2023

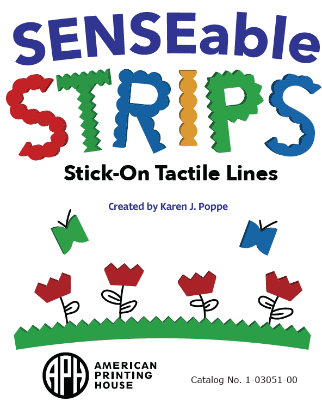
The product manager will continue to review and work on products and projects, as assigned, based on recommendations from surveys and submissions from the field, as well as on existing APH products that may need updates to meet current APH and educational standards. The team will continue to participate in podcasts, create blogs, and present webinars, as requested and/or assigned. Pierce will continue to represent APH, as needed and/or assigned, including on the National Center on Deaf-Blindness Forum and the Kentucky Deaf-Blind Steering Committee.

## Tactile Graphics

### SENSEable STRIPS: Stick-On Tactile Lines

Formerly Textured Graphic Art Tape

(Continued)



For information about the product development of SENSEable STRIPS from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).

#### Purpose

To provide an extended collection of graphic art tape in a variety of textures for myriad tactile-graphic applications by teachers and braille transcribers, as well as by students with visual impairments and blindness

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

Matthew Poppe, Graphic Designer

Ben Taylor, Model Maker/Pattern Maker

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

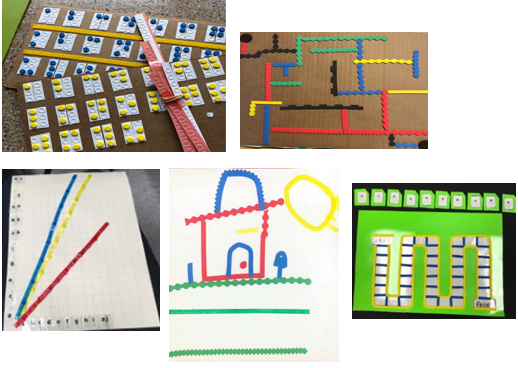
In January 2017, Cindy Queen, a teacher of the visually impaired from Kentucky, submitted a formal product submission form that described the need for textured art tape that “could be used for numerous purposes: graphs, charts, artwork, underlining (highlighting), graphic organizers, and tactile graphics of all types.”

In March 2017, the product manager reviewed the product idea and submitted a formal review of the concept based on several criteria, including the need for the product, originality, appropriate target populations, similarity to existing or planned APH products, and importance when compared to other ongoing projects.

A representative prototype of the product was field tested during FY 2019 by qualified individuals. Evaluators’ photos of their tactile constructions and adaptations spoke to the versatility of the Textured Graphic Art Tape kit. See Figure 1 for a few examples of their creations (graphs, mazes, art, adapted games, braille alphabet charts).

**Figure 1**

Examples of Evaluators’ Tactile Constructions Using Prototype Materials



On September 24, 2019, the product manager conducted a Gate 4: Modifications meeting to reacquaint the project team, including those who recently joined APH’s marketing division, with the kit components and anticipated production processes. The project received a matrix score of 64 out of a possible 93—an increase from its original score of 51 prior to field-testing.

On June 8, 2021, a formal Gate 5: Specifications meeting was conducted with all key in-house staff. Required signatures were obtained on the Gate 5 form. However, after extensive and careful in-house time studies, the product manager, TMR staff, Operation Engineering staff, and the Production manager reconvened to review and consider needed retooling efforts to minimize materials-handling on the production floor and accommodate large-volume production runs.

#### Work Completed During FY 2022

The first and second quarters of the fiscal year were focused entirely on retooling efforts to accommodate higher-volume production runs and to minimize handling, specifically collation, on the production floor. Retooling will also translate into a significant cost-savings for the customer. New cutting dies and new vacuum-form patterns had to be refabricated to accommodate the revised production-assembly strategy. A related bill-of-materials, cost-roll-up documents, and product specifications were updated. By March 1, 2022, a pilot run of 100 units was initiated. Concurrently, duplicate vacuum-form patterns were built to support larger production runs in the future. All related production proofs of labels, print files, and braille files were checked and approved.

Although the available-for-sale date was originally slated for March 2022, the pilot run of SENSEable STRIPS: Stick-On Tactile Lines competed with other existing and new products in the production pipeline throughout FY 2022. During the third and fourth quarters of the fiscal year, the product manager and other project team members closely monitored the quality of the pilot run and initial production run. Progress was intermittent and some tooling (e.g., cutting dies) unexpectedly needed to be refined along the way to achieve the desired outcomes. The pilot run was still underway in September 2022. In anticipation of the coming-soon release of the product, the product manager worked with Marketing staff to prepare a Creative Kick-off form.

#### Work Planned for FY 2023

The pilot run and initial production run of SENSEable STRIPS: Stick-On Tactile Lines is expected to be completed during the first quarter of FY 2023. A Gate 6: Product Launch/Lessons Learned meeting will be conducted. The product will be priced and officially launched for purchase with Quota funds or with cash. The project manager will participate in related marketing endeavors and showcase the final product at tactile graphic workshops.

### Tactile Graphics Research and Needs

Formerly Tactile Graphics Research

(Ongoing)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

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#### Purpose

To study and develop techniques for making useful tactile graphics, work toward standards in tactile-graphic presentations, evaluate product submissions and ideas from the field related to tactile literacy, manage legacy products, assess product needs, and oversee product development to serve individuals who are visually impaired and blind

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

#### Background

The American Printing House for the Blind (APH) has a variety of means for producing tactile graphics, including embossed paper, thermography, vacuum-formed graphics, and Roland® UV printer thermoform masters, 3D-printed models, etc. One goal of this research project is to learn which media are appropriate for which uses. Another goal is to identify and expand the available methods/tools useful for the production of tactile displays, whether by APH or by teachers, transcribers, or students.

In addition, tactile-graphic product ideas are frequently submitted by teachers and other professionals who would like to collaborate with APH to produce their materials. The product manager provided written reviews of these submissions.

Yet another aspect of this research project is to monitor evolving developments in practice, technology, and philosophy related to tactile-graphic design and production methods.

#### Work Completed During FY 2022

Throughout the fiscal year, the project manager participated in a variety of activities specific to the area of tactile graphics and tactile literacy, including the following:

* The product manager reviewed product ideas submitted from the field, as needed/requested.
* The product manager conducted numerous tactile-graphic and tactile-literacy presentations (refer to the Presentations and Workshops section for a complete listing).
* The product manager experimented and reviewed new tactile-graphic materials/processes available in-house (e.g., THERM-O-TYPE graphics).
* The product manager allocated significant time throughout the fiscal year to the quality-upkeep and continued maintenance of many legacy products that she designed and introduced over the past three decades. For example, she assisted Purchasing staff with locating and approving replacement materials for existing tactile products, reviewed and approved new shipments of kit components and materials from outside vendors, oversaw the modernization of product-related artwork and tooling, and problem-solved product quality issues.
* The product manager furnished requested tactile products and materials to other APH staff who were conducting workshops/presentations across the country or internationally.
* The product manager provided advice and guidance to fellow Educational Product Innovation staff during the development of tactile items and physical features for newer projects.
* The product manager participated as a member on the steering team currently overseeing the design of the Dynamic Tactile Display (see separate product report).
* The product manager assisted in the development of a survey about tactile-graphics instruction to glean teachers’ current use of tactile graphics with their students and to identify which tactile training products and materials are currently utilized for instructional purposes. Results from this study were reviewed.
* The product manager posted online product surveys to garner feedback about existing APH tactile products and the need for specific products.
* The product manager conducted product-specific webinars to invite feedback from customers about existing products’ effectiveness, potential improvements to the physical design of the products, and current provision style of the products (e.g., replacement-part options). One such webinar focused on the entire suite of Picture Maker components and accessories.
* The product manager frequently assisted Customer Service staff with incoming customer questions about existing APH products.
* The product manager authored product-related blogs.
* The product manager conducted multiple webinars and virtual workshops focused on tactile-literacy products (see the Presentations and Workshops section for a complete listing).
* The product manager originated a series of product-specific presentations titled “Relevant Classics” routinely presented at virtual EOT meetings throughout the year. These presentations revisited older existing APH products (e.g., Picture Maker, Setting the Stage for Tactile Understanding, StackUps).
* The product manager continued to provide tactile-adaptation guidance to staff from the *FIRST*® LEGO® League for ways to make a large playing-field mat accessible to tactile readers.
* The product manager provided advice and recommendations regarding product-obsolescence as the APH’s product line continued to be pruned.
* The product manager continued to become knowledgeable and skilled in the use of Reports Manager to access the latest sales information on her tactile legacy products and to generate related sales charts and graphs. In August, the product manager delivered a formal presentation on the product sales and sales projections for her legacy products: the All-in-One Board, Student Model All-in One Board, ReadWrite Stand, ReadWrite Mini, Picture Maker: Wheatley Tactile Diagramming Kit (entire suite of related catalog numbers), PixBlaster™ embosser, Color-by-Texture Marking Mats, both Carousel of Textures kits, TactileDoodle, Tactile Town, Tactile Treasures, and Quick-Draw Paper. These products met the definition of garnering high sales, having broad educational impact, and demonstrating staying power. The primary audience for this presentation included APH vice presidents, division managers, and key staff. The videotaped presentation was archived for review by other APH staff.
* The product manager continued to participate in product-management training sessions and activities required for all product managers.
* The project staff conducted bi-monthly meetings with ViewPlus, vendor of the PixBlaster embosser, to monitor sales, address customer tickets related to repairs and/or needed technical support, review video-view analytics, and plan marketing opportunities (e.g., webinars, conferences, etc.).
* The product manager continued to provide advice during multiple product roadmap meetings conducted by other APH product managers. These sessions were intended to identify product gaps in the following product areas: Braille Literacy, STEM, and Math. The tactile literacy product manager’s advice was sought because she had developed many APH products that addressed these areas of instructional focus.
* The product manager participated in multiple in-house AFFIRM meetings to coordinate with other APH departments on cost-related procedures and processes affecting existing and new products.

#### Work Planned for FY 2023

The tactile literacy product manager will continue to monitor advances in technology and practice as they relate to tactile design and teaching, conduct workshops and conference presentations, create blogs, participate in podcasts, review and submit product ideas, manage the upkeep and marketing of legacy products, and work in-house to promote consistently good tactile design.

### Tactile Point Symbol Slate

(New)



For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).

#### Purpose

To provide a unique APH-designed slate, in combination with an appropriate stylus, that can be used by teachers, transcribers, students, and adults to tool various types of discriminable and common tactile point symbols within tactile displays, graphs, worksheets, and more

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

Patrick White, Manufacturing Specialist

Andrew Moulton, Director of Technical and Manufacturing Research

Rod Dixon, Manager of Technical and Manufacturing Research

#### Background

On November 27, 2018, the product manager submitted a formal Product Submission form detailing the purpose, general design, and intended target audiences for the Tactile Point Symbol Slate. The expected design and purpose of the Tactile Point Symbol Slate, as conceptualized by the product manager, were clearly defined as the following:

* the slate will feature tactually identifiable point symbols that are commonly used within tactile graphic displays, based on research conducted by The American Printing House for the Blind (APH) and featured in BANA’s Tactile Graphic Guidelines;
* the slate will be user-friendly with an intuitive design that mimics hinged braille slates;
* the slate will broaden the selection of available tactile graphic tools provided by APH;
* the slate will accommodate the tooling of graphics across all educational areas of the Core Curriculum (e.g., math, science, social studies), as well as graphics used to demonstrate concepts related to the Expanded Core Curriculum (e.g., orientation and mobility, recreational worksheets/games, labeling); and
* the slate will be appropriate for teachers, braille transcribers, and tactile artists, as well as students and adults with visual impairments and blindness.

Tactile point symbols are encountered in most tactile graphic displays. They are typically a size that fits comfortably under the fingertip and can be recognized in an instant “tactile glance.” Point symbols often denote landmarks within a map, data points on a graph, specific parts of a science diagram, etc.

On February 5, 2019, the product manager’s Product Submission form for the Tactile Point Symbol Slate was reviewed and scored by the Product Ideation Committee (PIC) at the Gate 1 meeting. The product idea received a rating of 66. The grant number 688 was assigned to the project and the product moved into an on-hold status while other active products were addressed and completed.

On September 29, 2021, the product manager conducted a Brainstorming Meeting with representatives from various in-house departments including the Model Shop and Technical and Manufacturing Research (TMR), Operations Engineering, Graphic Design, Marketing, Purchasing, Production, Customer Service, and Educational Product Innovation (EPI). The meeting agenda focused on design considerations, expected prototype fabrication, planned product components (e.g., slate, two-ended stylus, storage pouch, print and braille suggested uses booklets), field-testing plans, and anticipated sales. The product manager provided detailed information regarding the sales history of the Tactile Graphic Line Slate (1-00100-00) that had sold over 1,500 units since its original launch in 2016. The sales information on this companion product also gave insight to the expected target audiences for the Tactile Point Symbol Slate which were not limited to Quota customers. Cash customers of the Tactile Graphic Line Slate were an eclectic group, including many US individuals, public schools, universities, as well as international agencies and individuals. The product moved into active development.

#### Work Completed During FY 2022

In mid-January 2022, the product manager reached out via email to the former field evaluators of the Tactile Graphic Line Slate and invited comments regarding the need for a companion Tactile Point Symbol Slate. The types of symbols that would be captured in the slate’s design were outlined and complemented by a simple sketch. Supportive feedback from those contacted included the following: “This would be much more durable and much easier for a student to use with little assistance,” and “I really enjoyed field testing the Tactile Graphic Line Slate and feel this Tactile product will be just as successful. It looks great!”

On January 19, 2022, the product manager conducted a Gate 2: Product Design meeting. Although the expected production method for the final product will eventually involve injection-molding via a two-part mold, it was recommended that the limited number of prototypes be produced by way of an in-house 3D-printer using a transparent filament. The product idea continued to garner a matrix score of 66. All Gate members approved moving forward with prototype development.

On February 10, 2022, the product manager conducted the first Prototype Design Working meeting with key project staff who were directly involved in the design and fabrication of the prototype. These design-focused meetings were conducted intermittently throughout the remainder of the fiscal year as iterations of the 3D-printed slate were generated and tested for ideal tactile outcome. Related testing involved the product manager using the slate to tool on different types of tactile media (e.g., standard braille paper, tactile drawing film, heavy-gauge aluminum diagramming foil, PermaBraille™, adhesive-backed clear labeling sheets). Needed modifications and refinements were made by Patrick White to the 3D-file to achieve the ideal height, line thickness, and line-width consistency for all included tactile symbols. The symbols were modeled after those tooled in-house on the Plate Embossing Apparatus for Raised Lines (PEARL) machine. Given the extra space between the point-symbol arrangement and the hinge-side of the slate, the product manager decided to incorporate stencils of three different shapes (i.e., circle, square, and triangle) in three different sizes to provide extra tooling options.

**Figure 1**

*Point symbols and stencil shapes tooled on heavy-gauge aluminum diagramming foil using the prototype of the Tactile Point Symbol Slate*



To help guide the selection of the most desired tactile point symbols, the project manager conducted a survey with the Building on Patterns (BOP) writers, all of whom are very versed in braille and tactile graphics. The BOP writers were asked to choose the six most needed point symbols. The BOP writers were nearly unanimous in their preferences of the six most needed point symbols when presented with a variety of options. Their most desired tactile point symbols are indicated in Table 1. The BOP writers were also asked about ideal color for the slate; transparent yellow was highly recommended.

**Table 1**

*BOP Writers’ Preferences for Tactile Point Symbols for Slate Design*

| Point Symbol | Image of Point Symbol | Percentage of BOP Writers (N=3) who included the symbol in their “Top 6” for inclusion in slate design |
| --- | --- | --- |
| Outline circle | outline circle | 100% |
| Outline square | outline square | 67% |
| Outline triangle | outline triangle | 100% |
| Semicircle | semicircle | 0% |
| “Stairstep”—bold line over narrow line | Stair-step symbol (a bold horizontal line over a narrow horizontal line) | 0% |
| Vertical line | vertical line | 67% |
| Dot inside an outline circle | dot inside an outline circle | 0% |
| T-shape | T-shape | 0% |
| X-shape | X-shape | 100% |
| Three-dot triangular arrangement | three-dot triangular arrangement | 0% |
| Arrow (can be turned in any direction needed) | arrow that can be turned in any direction needed | 100% |
| Outline diamond shape | outline diamond shape | 0% |
| Bold dot/large bump | bold dot/large bump | 67% |
| V-shape | V-shape | 0% |
| Other: (draw or describe) |  |  |

The most desired point symbols as indicated by the BOP writers, plus all those shown and described in Table 1, were incorporated in the final prototype design. Some symbols allow tooling of multiple symbols (e.g., the outline circle with a center dot OR an outline circle without a center dot). The user can also tool a portion of a point symbol (e.g., vertical line of the T-shape), or shift the direction of a symbol within a graphic (e.g., an up arrow versus a down arrow). One of the BOP writers volunteered to field test the product.

Once the project team was confident of the planned prototype design, a Gate 3: Prototype Evaluation meeting was conducted on June 29, 2022. Cost and selling prices were estimated, a goal date for field-testing was determined, and although unaltered from the original plan, the components were reviewed again with greater detail. The matrix score at this stage remained 66. A non-voting member saw obvious applications for adults with blindness for labeling purposes and other daily-living applications. If her expectation is echoed in field-test feedback, the score is likely to increase since the slate will address one of APH’s highest-priority target groups. All Gate 3 members approved going forward with field-testing endeavors.

The last month of the fiscal year was dedicated to the 3D-printing of multiple prototypes in a transparent yellow, preparation of the accompanying suggested uses booklet, location of ideal field-test sites, and construction of a field-test evaluation form.

At the end of the fiscal year, the product manager posted a formal announcement of the upcoming field-test opportunity in *APH News*. The announcement was also shared at the August EOT Virtual Meeting, as well as posted on social media channels.

#### Work Planned for FY 2023

The Tactile Point Symbol Slate will be formally field-tested by qualified individuals who mirror the intended target audiences for the final product. Field evaluators will be given sufficient time to use the slate for their routine tactile-graphic tooling needs and applications. They will also be requested to return or share photos of some of their tactile creations.

After field-testing activities are completed and field-test results have been compiled and reviewed, a Gate 4 Modifications meeting will be conducted to review any necessary refinements to the slate and related components based on recommendations from field evaluators. Federal Quota approval will be requested from the Educational Product Advisory Committee (EPAC).

The remainder of the fiscal year will focus on the preparation of final tooling necessary to manufacture the Tactile Point Symbol Slate in mass quantities. A Gate 5: Specifications meeting will be conducted in the fourth quarter of the fiscal year. Production of the slate itself, as well as the storage pouch and two-ended stylus (also used for the Tactile Graphic Line Slate), will be undertaken by an outside vendor. Related in-house tooling and production will be minimal and focus on the production of the print and braille suggested uses booklet and eventual kitting of the final product. The project staff will review and approve vendor-produced samples of the slate, monitor quality of all product components, and usher the product through the first pilot and production runs. The actual product launch date is yet to be determined, but it is anticipated that the Tactile Point Symbol Slate will likely be launched in early FY 2024.

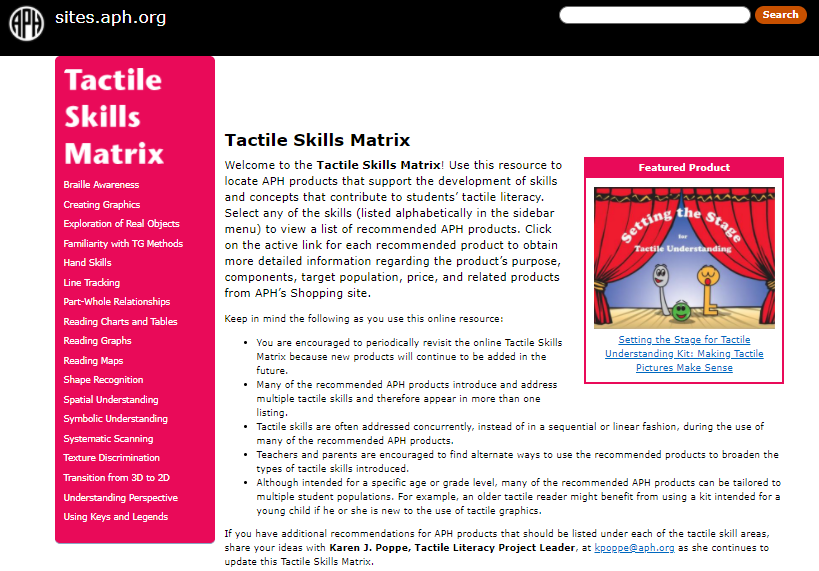
### Tactile Skills Matrix

Formerly Tactile Skills Online Matrix

(Ongoing)

For information about the development of the Tactile Skills Matrix from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [kpoppe@aph.org](mailto:kpoppe@aph.org).



#### Purpose

To provide an online document, or matrix, that cross-references important tactile skills with available APH products

#### Project Staff

Karen J. Poppe, Tactile Literacy Product Manager

Bobby Fulwiler, Product Specialist

#### Background

The American Printing House for the Blind (APH) frequently receives comments that teachers do not know about our products or how they can be used in conjunction with others. Just as importantly, APH does not have well-established ways to reach parents to inform them about the need for tactile skills development and what that means for their child or how they can begin to nurture tactile skills development early on. The continuum of tactile skills—such as body and spatial awareness, shape recognition, scanning/tracking ability, perspective understanding, and so on—are known to contribute to successful tactile interpretation. The basic progression needed for tactile learning—from experiences with real objects to models to raised-line images—is well-documented and modeled in a variety of APH products (e.g., Setting the Stage for Tactile Understanding). However, students who are tactile learners are likely to be getting piecemeal instruction and are, therefore, poorly equipped to handle the increasing variety of graphically presented material in textbooks and high-stakes tests.

The initial launch of the Tactile Skills Matrix was officially announced in the May 2017 issue of *APH News*. The Tactile Skills Matrix cross-references 18 distinct tactile skills/concepts with available and appropriate APH products. The tactile skills/concepts featured in the matrix are the following:

* braille awareness
* creating graphics
* exploration of real objects
* familiarity with tactile-graphic methods
* hand skills
* line-tracking
* part-to-whole relationships
* reading charts and tables
* reading graphs
* reading maps
* shape recognition
* spatial understanding
* symbolic understanding
* systematic scanning
* texture discrimination
* transition from 3D to 2D
* understanding perspective
* using keys and legends

Users of this online resource merely navigate through the list of skills on the homepage and then click on the desired skill/concept. This reveals a list of available APH products, such as the ones in this [example for symbolic understanding](https://sites.aph.org/tactile-skills/symbolic-understanding/).

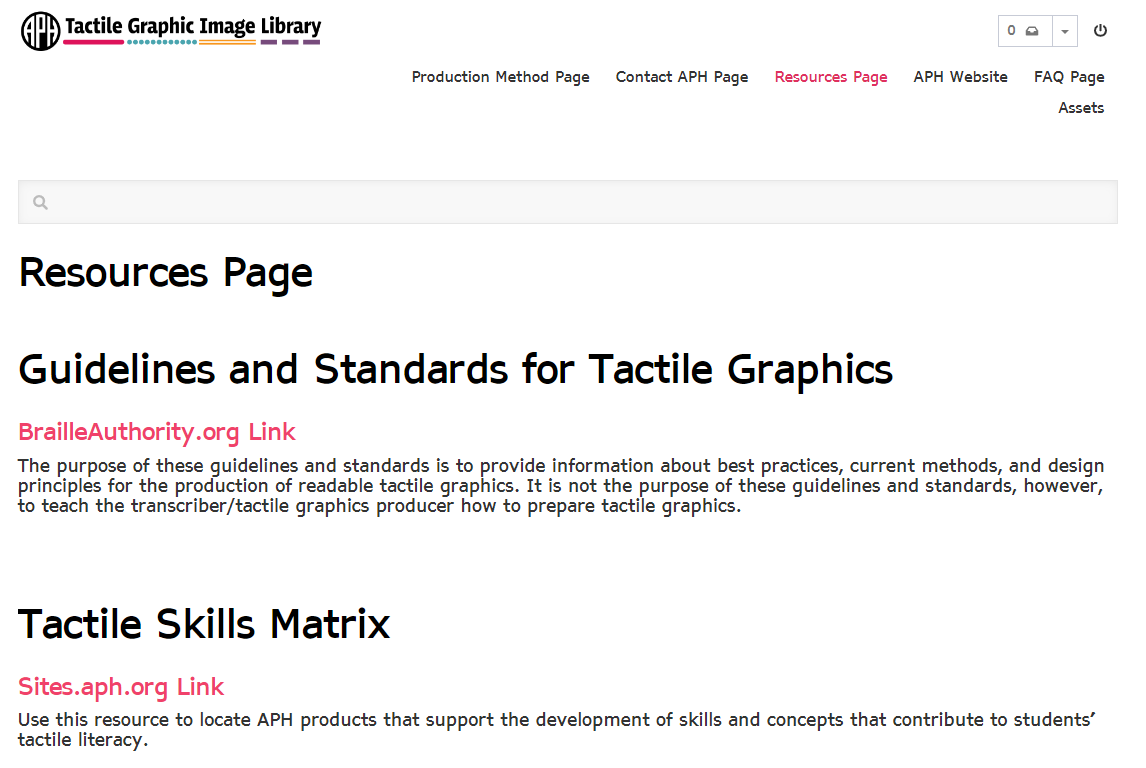
#### Work Completed During FY 2022

The product manager incorporated regular updates to the [Tactile Skills Matrix](https://sites.aph.org/tactile-skills/) as new APH products were introduced to the market throughout the fiscal year. New products referenced included the following:

* Accessible Code and Go Mouse
* Health Education Tactile Graphics
* Animal Recipes: Farm Animals
* *How to Recognize a Monster*
* Updated APH book, *The Caterpillar*
* Paint-by-Number: Endangered Species
* Tactile Theme Pack: In My Yard

Hyperlinks to obsoleted APH products were removed from the matrix, but the names of some retired products remained in the skill lists, given the strong likelihood that many of the obsoleted items are still in circulation and available for continued use by teachers of the visually impaired and students. The product manager highlighted the availability of the Tactile Skills Matrix at several tactile graphic presentations. The matrix continues to be among the most visited resources on the APH website.

A link to the Tactile Skills Matrix was added and prominently featured on the Tactile Graphic Image Library’s Resources page: <https://imagelibrary.aph.org/portals/aphb>



#### Work Planned for FY 2023

The Tactile Skills Matrix will remain an available resource on the APH website. The product manager will continue to monitor the launch of new APH tactile products and categorize them by the various skill areas within the matrix. She will also continue to showcase this online resource at tactile graphic workshops, as well as monitor feedback from the field regarding the usefulness of the Tactile Skills Matrix.

# TESTS AND ASSESSMENTS

### BRIGANCE® Comprehensive Inventory of Basic Skills II (Modernization)

Formerly BRIGANCE® CIBS II

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lrandles@aph.org](mailto:lrandles@aph.org).

#### Purpose

To provide a curriculum-based, grade placement assessment for teachers of the visually impaired

#### Project Staff

Lauralyn Randles, Tests and Assessments Product Manager

Carolyn Williams, Tests and Assessments Product Manager

Kay Ferrell, Consultant

Rod Dixon, Manufacturing Specialist

INGrid Design, Graphic Design

Lydia Smith, Digital Content Product Specialist

#### Background

Curriculum Associates quietly discontinued the BRIGANCE CIBS II assessment and replaced it with the NWEA assessment. (NWEA was formerly known as the Northwest Evaluation Association). The NWEA is a dynamic computer-based assessment that has very limited accessibility to students with low vision or blindness. Due to this, The American Printing House for the Blind (APH) product team determined it was in the best interest of our population to continue production of the BRIGANCE. Professionals in the field reached out to the Tests and Assessments Product Manager (PM) and other PMs, indicating there is a need for the accessible format of the BRIGANCE.

#### Work Completed During FY 2022

All suggested modifications and tooling were completed. The timeline for completion of the tooling was adjusted several times due to the plant shutdown and the large number of plates needing to be created. A Gate 5: Specifications meeting was convened on April 27, 2021, to discuss adjustments to the timeline and a possible release. At this meeting, final specifications, production methods, and timelines were discussed and agreed upon. Due to the large quantity of pages and components of the large-print and braille kits, it was suggested by Operations Engineering that each part have its own unique number to assist Production in the collation process. Production was anticipated to begin in October/November 2021, with release in December 2021. However, in November 2021, several significant errors in the graphs were flagged by Quality Assurance. During investigation of the noted plates, additional plate errors were found, and that triggered a complete review of all existing plates and a complete halt in production. The review of the plates and graphics was completed by January 2022.

Considering the significant number of errors found on the graphic plates, a full review of the thermoform masters was ordered and completed by the end of February. The team then met again in March and opted to shift production from thermotype to thermoform, since that method produces graphics that are more accurate and legible. Rod Dixon and his team then began the work of updating the specs to reflect the new production path.

In May 2022 the specs were completed, and the BRIGANCE was cleared to return to the production floor again. The estimated launch is Fall 2022.

#### Work Planned for FY 2023

With the anticipated release of the BRIGANCE® CIBS II braille and large-print kits, a Gate 6: Product Launch/Lessons Learned meeting will be conducted to discuss areas of concern during the development process. A finalized marketing plan will coincide with the release of the kits.

Product modernizations to create the assessment in Spanish as well as the UEB Math/Science pages to complement pages in Nemeth have been submitted.

### Jerry Johns Basic Reading Inventory (Modernization)

Formerly JJ BRI

(New)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lrandles@aph.org](mailto:lrandles@aph.org).

#### Purpose

To provide an accessible, quick reading inventory that includes both grade-level word lists and reading samples

#### Project Staff

Lauralyn Randles, Tests and Assessments Product Manager

Rod Dixon, Manufacturing Specialist

INGrid Design, Graphic Design

Lydia Smith, Digital Content Product Specialist

Kim King, Transcriptionist

#### Background

The Jerry Johns Basic Reading Inventory is a widely used reading assessment for use with all emerging and accomplished readers from kindergarten to 12th grade level. The instrument was heavily requested by vision professionals and ex officio trustees, as well as in responses to questions in a survey of teachers of the visually impaired (TVI) that was completed in September 2021. The American Printing House for the Blind (APH) held a contract with the publisher to provide the adapted version of this assessment until the 10th edition. In October 2021, the tests and assessments product manager submitted a product modification form, seeking approval to publish the 12th edition to the Product Ideation Committee (PIC).

#### Work Completed During FY 2022

PIC approved development of the Jerry Johns Basic Reading Inventory in March 2022. In April 2022, a Gate 2: Product Design meeting was held to discuss the project’s potential structures. The team opted to continue with project. Following the meeting, Rod Dixon initiated the production specifications.

In May 2022, William Scott Smith assigned Kimberly King to transcribe both the contracted and uncontracted braille versions of the Jerry Johns Basic Reading Inventory from the publisher-provided PDF; King finished transcribing the PDF in September 2022, The final, proofed transcription is estimated to be completed in late October 2022. While the publisher-provided PDF was accurate, which meant transcription could proceed, Lauralyn Randles was alerted by Creative Services that the publisher-provided PDF was not accessible. After several attempts to contact the publisher’s product manager, the decision was made to manually convert the publisher’s PDF to the correct format. Randles and Lydia Smith completed this task in June 2022, and the new PDF was handed over to APH’s creative team. This project was assigned to the graphic design contractor INGrid and is estimated to be completed by the end of September 2022.

#### Work Planned for FY 2023

In FY 2023, this product modification will be reviewed by a small group of visually impaired TVIs who are familiar with the previous versions of the Jerry Johns Basic Reading Inventory. After considering their feedback, Randles will implement approved changes. At that point, development will move to the Production floor for a complete run of 100. Currently, the estimated launch date for this project is Spring/Summer 2023.

### KeyMath™-3 UEB Supplement (Modernization)

(Continued)

For information about product development from previous fiscal years, please see the R&D tab on the APH website at the following link: [Previous Annual Research Reports](https://www.aph.org/rd/research-resources/).

For more detailed information about field tests and expert reviews, send email to [lrandles@aph.org](mailto:lrandles@aph.org).

#### Purpose

To incorporate math figures, equations, and diagrams in UEB Math Science Technical code to the existing KeyMath™-3 kit in Nemeth

#### Project Staff

Lauralyn Randles, Tests and Assessments Product Manager

Carolyn Williams, Tests and Assessments Product Manager

Rod Dixon, Manufacturing Specialist

INGrid Design, Graphic Design

Lydia Smith, Digital Content Product Specialist

#### Background

An increased number of states adopting Unified English Braille (UEB) Math necessitated the development of a UEB supplement to the existing KeyMath-3 kit. This supplement will provide replacement pages for pages originally transcribed in Nemeth, thereby providing greater flexibility in the braille edition and meeting the needs of more students. This will prompt a structural change to the original kit. The student books will now need to be three-hole punched and placed in binders, instead of being spiral-bound. No changes will need to be made to other components in the kit.

#### Work Completed During FY 2022

The transcription for the UEB pages was completed, and plates were made for these pages. Due to a Production shutdown, the timeline for completion needed to be adjusted. A Gate 5: Specifications meeting convened in August 2022, after which the final specifications were sent to Production. A plan was put in place to allow customers who previously purchased the KeyMath-3 to purchase the supplemental pages only; this is similar to how the Woodcock Johnson IV supplement release was handled. A structural change was added to the original kit’s braille student books (catalog numbers 5-65703-00 and 5-65704-00) to accommodate the UEB pages. The student braille books, originally spiral-bound, were changed to three-hole punch, and binders were supplied for the student pages. This allows teachers to use either the Nemeth or UEB pages. No changes were needed for the teacher materials. In March of 2022, Quality Control flagged several pages of the KeyMath-3 after identifying some issues in the accuracy and clarity of the graphics. A proof of the masters was completed, and numerous additional errors were found. At that time the team opted to pivot from metal plates to thermoform masters. The specifications change was completed in June 2022. The KeyMath-3 UEB Supplement is slated for its first production run early this fall.

#### Work Planned for FY 2023

With the anticipated release of the KeyMath™-3 UEB Supplement, a Gate #6: Product Launch/Lessons Learned meeting will be conducted to discuss areas of concern during the development process. A marketing plan for the release of the kits will be finalized. We will closely monitor the structural change to the KeyMath-3 UEB Supplement braille student books.

# TECHNICAL AND MANUFACTURING RESEARCH

## Technical and Manufacturing Research Activities

### Purpose

The Technical and Manufacturing Research (TMR) Department functions as a “bridge” between the concepts of the product manager’s (PM) product and the concrete reality on the production floor. This area is a concentration of specialized skill sets within the Educational Product Innovation (EPI) Department. The purpose of this area is to remain as faithful as possible to the PM’s intent and function of the product while making it as inexpensive and as easily produced on the manufacturing plant’s floor as possible. This area is involved in all aspects of the product including design work, materials selection, tooling development, vendor selection, and process development. While both areas are involved in process and tooling development, the model makers’ primary focus is the physical development of tooling. TMR is heavily involved in tooling, materials, and process development and research with an emphasis on the documentation of the product’s specifications and manufacturing processes. After developing and documenting the product’s specifications, TMR works with production workers, floor supervisors, upper levels of The American Printing House for the Blind (APH) management, and outside vendors to shepherd the PM’s product throughout its entire pilot and first production runs.Some of the contributions TMR makes to product development on a regular basis include:

* development of conceptual drawings and the construction of prototypes for field testing purposes;
* computer aided drafting (CAD) layout and design of injection molds, cutting dies, and some product artwork;
* development of 3D CAD files for rapid prototyping of products for hands-on evaluation of a concept, when appropriate;
* creation of an in-house 3D-printing station for rapid prototyping of products, reducing the need for outside rendering of 3D CAD files;
* development of CAD files and fixtures for in-house machining of parts on a computer numerically controlled (CNC) router;
* development and fabrication of in-house tooling (vacuum-form molds, assembly fixtures, special assembly tools, etc.);
* researching new materials and vendors;
* researching and implementing new processes;
* development and documentation of product packaging, particularly any special packaging or packaging needs;
* documentation of all aspects of a product for both in-house production use and outside vendor manufacture;
* entry of the initial bill of materials into the APH materials-resource-planning program (SYSPRO);
* distribution of product specifications to all APH production and production support areas, as well as to any outside vendors that may be involved;
* monitoring the progress of products under development; and
* shepherding the project through its entire production process, both on the APH production floor and with any outside vendors that may be involved.

This development, documentation, and preparation of the product for actual manufacture, along with the monitoring of the manufacturing process by this area, helps to assure the greatest probability of success for a new product.

### Work During FY 2022

##### Accessible Code and Go® Mouse

This product was made available for sale in September 2021.

##### Accessible STEM Maker Parts

TMR will develop product specifications once more information has been received.

##### Adapted Biology Lab Manual

This product is currently in the early stages of development between the PM and consultant. A Gate 2: Product Design meeting is expected before the end of the current fiscal year. Once the project passes Gate 2, TMR will begin to develop prototypes in preparation of the Gate 3: Prototype Evaluation meeting.

##### Alphabet Scramble Modification

Work on this product is in the very early stages at this time. TMR will schedule meetings to organize and monitor the progress of the product.

##### AnyMath Kit Nemeth, AnyMath Kit UEB

TMR has designed a vacuum form mold for the Label tiles, multiple cutting dies used to create the Label tiles, cutting dies used to create the geometric shapes, and multiple cutting dies used to create the AnyMath Grid Board, Storage Board, and Blank Board. Product specifications are expected to be turned over to Production in September 2022 via a Gate 5: Specifications meeting. TMR will continue to work with the PM and monitor the progress of the project.

##### APH Customer Care – Braille Trail Reader LE – 2yr

TMR will continue to monitor the progress of this project and facilitate the passthrough process once more information has been received.

##### APH Customer Care – MATT Connect™ – 2yr.

TMR will continue to monitor the progress of this project and facilitate the passthrough process once more information has been received.

APH InSights Calendar 2023 and APH InSights Calendar, Custom 2023  
This product is currently being produced at APH and will be made available for sale before the end of the fiscal year. TMR will continue to monitor the progress of this project.

APH InSights Calendar 2024 and APH InSights Calendar, Custom 2024  
Artwork finalists have been selected, and the art is currently being photographed for layout on the calendar pages. The pages will be arranged by an outside Graphic Design vendor and then turned back over to APH to review and approval. Once approved, the pages will be handed over to Braille Transcription for braille embossing plates to be made. Production is also experimenting with using the thermotype embosser to stamp detailed tactile images of the cover artwork onto the cover page of the calendar. TMR will continue to monitor the progress of this project.

##### APH Visual Interpreter

Product is on hold due to staff issues with the partner vendor, HumanWare. APH will continue work on this project once HumanWare is ready. TMR will continue to monitor to progress of this product.

##### Astro Adventure Balls (Modification [Formerly Revolution Sports Ball])

TMR and the PM met with an engineer from Infiniti Plastics in September 2021 to discuss the issue of the Ball not making sound for a long enough period of time. The group agreed that the vendor would smooth out the injection mold to see if that would provide a better surface for the ball bearing to move across. The vendor delivered sample parts from the updated mold in February. The PM reviewed these parts but determined that they did not sufficiently increase the length of sound enough. TMR and the PM decided then to send out bid packages to various outside vendors to see if any were interested in helping us tweak the design and producing a Ball that would produce the desired length of sound. Bid packages were sent out in May. By August, only two of the five vendors opted to place a bid. Only one of these bids was priced to help APH design the product so that an average of 20 seconds of sound was made by each ball, and though the price of this bid was much higher, it was the only of the two that TMR and the PM considered worthwhile pursuing. A pre-Gate 2 meeting was held on August 18th. It was agreed upon in that meeting that more research should be done to see if there was a cheaper option to revise the design of the balls and have them produced than the bid we had. TMR will continue to attempt to get the plastic of the original and prototype balls tested while the PM contacts other vendor and toymakers to see if there are any other companies we could partner with on this project.

##### Baby Lizard, Baby Bizarre

This is the next book in the LDQR of books. Virtual passthrough was held in December 2021. LDQR is currently manufacturing the book, and APH is waiting to receive a shipment of completed books before this product is officially made available for sale. TMR will continue to monitor the progress of this product.

##### BANA Braille Code f/ Chemical Notation 1997

TMR will continue to monitor the progress of this project. More information is expected after the next BANA committee meeting.

##### BrailleBuzz™(Modification) and BrailleBuzz™ App (Modification)

Most of the work on this has been to develop the app. Once the app is fully developed, TMR will facilitate the Passthrough process on the app. We will also continue to monitor the development of this product, including any modifications to the physical device.

Braille Datebook 2022 Calendar and Braille Datebook 2022 Calendar Tabs  
The 2022 Braille Datebook Calendar and Calendar Tabs were made available for sale in November 2021.

##### Braille Datebook 2023 Calendar and Braille Datebook 2023 Calendar Tabs

The catalog/part numbers were created on March 2, 2022. The original saddle stylus (1-00120-00) used in the kit was obsoleted. It was replaced with the large yellow stylus (1-00122-00). Files were sent to translation on March 5, 2022, and both the BRF files of the braille parts list and the calendar tabs were reviewed and approved on March 29, 2022. Plates were proofed and approved on April 5, 2022. A virtual spec meeting went out on April 11, 2022. Based on last year’s production run, the following quantities will be produced:

* 1-07899-23 – Qty. 30
* 1-07898-23 – Qty. 40

TMR will continue to monitor the progress of this product as it is produced.

BRIGANCE® Comprehensive Inventory of Basic Skills II  
Production began working in earnest on the various components of BRIGANCE in October 2021. By mid-November, it was discovered that the plates created to emboss the tactile graphics had issues not only with content but also with quality. The PM worked with Process Support and Improvement Engineering to determine that we should switch production method for the graphics to thermoform masters as these would be able to produce graphics with an acceptable level of quality. The BRIGANCE kits were initially designed to include thermoform graphics, but embossment was switched to plates in July 2019 when the former VP of Production and former Graphics Supervisor determined that Graphics would not be able to handle the workload. Thankfully, Pre-Production still had the old masters, and it was determined Graphics would now be able to handle the work. Some of the masters needed to be remade for content changes. The pilot run for the Contracted version of the kit was completed at the end of July. TMR will continue to monitor and assist on these products as needed.

##### Building on Patterns (BOP) Kindergarten (Modification)

The file for the weather cards met significant delay due to printing issues with the Roland® printer not producing a high enough relief for the model maker to produce a good mold pattern with. This was eventually worked out fully in March 2020. New printouts from the Roland will be provided to the model maker as of May 2020. A die for the hat and bow stencils has been finalized as of March 2020. Several ideas were discussed in starting in April 2020 regarding how to produce the 3 x 3 grid pattern. It was decided in May 2020 that we would use the router to make a part to assist the model maker in creating a mold casting. The routed part was completed in July 2020 and has been sent to the model shop to pour the pattern. Work on “mini specifications” to be used to manufacture prototypes for field testing is well underway. It was decided to give the production floor the specifications in small batches rather than the entire kit at one time so it would not clog the production floor. The mini specs for the student set of braille children’s books were turned over to production in September 2020. The mini specs for unit 6 of the student set of print children’s books were turned over to production in March 2021. The mini specs for the student storybooks were turned over to production in May 2021. The mini specs for the *Nice to Meet You* book were turned over to production in November 2021. The mini specs for the *Look It Up* book were turned over to production in June 2022. TMR will continue working to turn over the remainder of the mini specs for the prototype run of this product.

##### Braille Reading Materials for Adult Learners

Formerly Readers Digest for Adult Learners

This product was recently introduced and is currently waiting on input of a market-needed survey distributed in the APH News. Responses are due at the end of August and will be evaluated. TMR will continue to monitor the status of this product.

##### Building on Patterns (BOP) 2nd Grade: Teacher’s Material UEB

The PM is currently working with an outside graphic design company to update print files for each of the units. They are also working with Production to see what content needs to be updated to UEB. Once content is finalized, TMR will begin to develop specifications for this product and help guide the project as it continues through the New Product Development Process.

##### Chameleon™ 1 Year Extended Warranty

This product was made available for sale in November 2021.

##### Chameleon™ 2 Year Extended Warranty

This product was made available for sale in November 2021.

##### Cosmic Number Lines

This is an app that the PM is working on with the Technology Products group to develop. TMR will monitor this project as it is developed and hold the Passthrough meeting when it is ready to launch.

##### Crossings with No Traffic Control Modification (Revision)

A Gate 2: Product Design meeting was held in April 2022, and the changes to the kit were confirmed. Primary changes are removing the headphones and splitter from the kit and updating the flash drive with some new data (but it should remain nearly the same size). The new build for the flash drives is anticipated to be completed around the end of the 2022 calendar year. TMR will continue to monitor the progress of this product.

##### CVI Companion Guide EPUB

This product was made available for sale in March 2022.

##### CVI Companion Piece

TMR turned this product’s specifications over to Production in November of 2021. The product was made available for sale in March 2022.

CVI How I See  
This product has been placed on hold. TMR will develop product specifications once the product has been placed on the active timelines and more information has been received.

##### DC Supplement Adapter

Due to the custom design of the rechargeable batteries included with the adapter, APH had to buy the batteries in bulk so that the vendor could meet the minimum order requirement for the batteries. This resulted in having enough batteries for two full production runs. This was approved by all the parties, and the order was allowed to continue. The product experienced some delays during shipping due to port congestion, but eventually the shipment arrived to APH’s dock. There was visible damage to the pallet, and so a full inspection was conducted to assess the damage. Thankfully the damage was not significant, and only a few kits needed to have new boxes sent to us by the vendor. These affected units have been placed in quarantine until the boxes arrive. In the meantime, APH had enough inventory on hand to fly the airplane, and the product was made available for sale in July 2022.

##### Dots123

This is an app that the PM is working on with the Technology Product Research (TPR) group to develop. TMR will monitor this project as it is developed and hold the Passthrough meeting when it is ready to launch.

Emergent Numeracy for Preschool Students 3-5

*Five Speckled Frogs*:

In July 2021, it was discovered that the purchased dragonfly that was to be included in the kit was no longer available for sale. None of the alternatives that TMR identified were deemed acceptable. TMR met with the PM in August 2021 and determined that the best course of action was to make a raised dragonfly in-house. A vacuum-form pattern was completed, and samples created in November 2021. Plans were put in place to hold a Gate 5: Specifications meeting, but in January 2022, Purchasing informed TMR that the vendor we planned to get brown polyblend from for the Logs no longer had any in stock and had no plans to have any more stocked. TMR was unable to find an alternative vendor that offered brown plastic at an acceptable minimum order quantity. As an alternative solution, TMR proposed that we print brown ink onto white vinyl in-house. A sample Log created using this process was approved by the PM in early March. The Gate 5: Specifications meeting for this product was held in May 2022. TMR will be available to assist Production as this kit moves through the floor.

*My Very First Book of Shapes*

This project is currently on hold. Before it was put on hold, TMR worked with the PM to develop multiple components to adapt the printed version of this book for blind and near-blind readers. TMR has designed vacuum-form patterns to be used in conjunction with a cutting die to create the tactile pages for this flip-over style book. The model shop has designed a vacuum-form mold based on said pattern which was completed in August 2020. Along with the tactile pages, the product will include 20 manipulative shapes die cut from red and yellow polyblend material. TMR along with Model Shop and the PM have been working together to create a stabilizing sheet made from .030” vinyl to add rigidity and stability to the front and back covers of the book. We made 10 prototype copies of the book at speed to ensure that all patterns and tooling are within the acceptable margins of error to meet APH quality standards and sent those out for field-testing. This is when the project was put on hold. TMR will continue to work with the PM and monitor the progress of the project.

*The Doorbell Rang*

This product has been placed on hold. TMR will develop prototypes and product specifications once the product has been placed on the active timelines and more information has been received.

##### ENVISION Kit (Modernization)

The specifications were turned over to production in June 2022. Due to parts’ availability, a replacement for one of the monocular telescopes had to be sourced. We are awaiting samples to check their usability in the product and whether they will fit in the custom case that was designed with the original one in mind. The vendor for some of the parts has not given a final quote for the parts they are providing. Until they do, this project has been taken off the new products introduction report and placed on hold. TMR will continue to monitor the progress of this product through the production process.

##### EZ Track Calendar 2023

The files were proofed and approved in November 2021. They were placed on the sever in April 2022. The product specifications were turned over in April 2022 as well. It was decided that the original desired production quantity of 110 for both 1-07900-23 and 1-07901-23 were too high, and a new quantity for the 2023 calendars was agreed to be:

* 1-07900-23 – Qty. 40
* 1-07901-23 – Qty. 45 (5 additional units for direct sales)

##### Flip-Over Concept Book: Telling Time -Nemeth and Flip-Over Concept Book: Telling Time - UEB

Product specifications were turned over to Production in May 2021. After a successful pilot run, the remainder of the production was completed in August 2022, and the products should be made available for sale before the end of the fiscal year.

##### How to Recognize A Monster

This product was turned over via Passthrough meeting in March 2021, but because of a long lead time at the vendor and shipping delays at the ports, this product didn’t arrive to APH until January 2022. The product was officially made available for sale in February 2022.

##### Jerry Johns Basic Reading Inventory

The PM is currently working with Translation to create braille content for this book. They are also working with an outside graphic design firm on the content for the large print version of the book as well as the tactile graphics. TMR will continue to monitor the progress of this project as it continues through the development cycle.

##### Joy Player Cartridge (Modification)

(Completed 5/22)

This product was originally slated to be a physical cartridge that APH would have injection-molded and then the USB drive hardware installed inside. This idea was scrapped, and instead it was designed as a 3D printable adapter that customers can download for free and pair with their NLS cartridges. The files were officially made available in March 2022.

##### KeyMath™-3: Contracted UEB Supplement and KeyMath™-3: Uncontracted UEB Supplement

Specifications for the KeyMath-3 UEB Supplements were turned over in September 2021. In March 2022, after reviewing proofs created with plates on the rotary, it was determined by the PM we should switch the graphics to thermoform masters. Additionally, errors in content were discovered that would also need to be addressed. This necessitated creating said masters to replace the plates. Masters were made, but to avoid clogging up the floor, production of this product was put on hold until work on BRIGANCE® was completed. Work on KeyMath resumed in late August. TMR will continue to follow this product through its first run and assist Production as needed.

##### Keys to Code (Formerly Let’s Start Coding™)

Technology Product Research (TPR) contacted TMR in late July of 2022 to have prototypes of some of the schematics printed with raised braille on the Roland®. These were turned over in early August. TPR and TMR met periodically through the rest of that month to discuss specifications for future prototype prints. TMR will continue to assist and create prototypes as needed for this project.

##### Lots of Dots: Coloring the Garden, Lots of Dots: Counting 123, and Lots of Dots: Learning My ABCs

As of the end of the previous fiscal year, all three of the Lots of Dots products are available for sale.

##### Mantis™ 1 Year Extended Warranty

This product was made available for sale in November 2021.

##### Mantis™ 2 Year Extended Warranty

This product was made available for sale in November 2021.

##### Math Flash™ Online – Google® and Math Flash™ Online – Amazon®

This app was made available for sale for both quota and non-quota customers in February 2022.

##### Music Braille Wheel

Work on this product began in June 2021. This product is a quick reference guide consisting of two printed and embossed vinyl sheets riveted together in such a way that allows the top sheet to spin freely around the rivet. This product is in the prototype development stage. TMR will continue to work with the PM and monitor progress of the project.

##### Novel Effect

This product is in the early stages of development and will ultimately be a passthrough product for APH. TMR will continue to monitor the progress of this project and help facilitate it through the passthrough process once it is ready to launch.

##### O&M Grid Sheets

This product has been approved but is currently on hold until more project space clears up. TMR will continue to monitor the status of this project.

On the Way to Literacy Storybooks, Revised  
*The Caterpillar Book*

This product is produced for us from an outside vendor that takes purchased and manufactured materials from APH and assembles them into the books. TMR worked with the vendor to aid them in the first production run of the book. Upon receipt of the first run there were some books that had issues like missing pages or materials left off. TMR sorted through these books and coordinated with the vendor to repair them and return them to APH. The book was made available for sale in February 2022.

*Jellybean Jungle*

The original vendor that was going to sew the pockets fell through, so a new vendor was found to sew them for us. TMR has been working with the model shop to design the large amount of tooling required to produce this kit. A new brick pattern has been designed and printed on the Roland® wide format printer to greatly reduce the amount of labor for the model shop to produce the vacuum-form pattern for it. The PM approved a few small design changes regarding the jellybean platters and the monkey faces that will make them easier to produce while maintaining the same key features. A meeting with TMR and the PM was held in July 2022 to go over the product overview of the specifications. TMR will continue to monitor the progress of this product through development.

##### Paint-By-Numbers Safari: Endangered Creatures

This passthrough product was made available for sale in April 2022.

##### Paint Pot Palette, UEB

This passthrough product was made available for sale in November 2021.

##### Polly® (Formerly Annie™)

Although this product is intended to be fully developed by an outside vendor and processed as a Passthrough product, TMR has been more involved in the development by taking early prototypes of the unit and analyzing them for build quality and software operation and making suggestions to the vendor based on these observations. TMR also participated in training conducted by the vendor on level one repairs of the units. A production pilot of 50 units was conducted, and TMR aided in the testing of these units, noting issues that were communicated back to the vendor. Ultimately the pilot run failed due to too many issues, and TMR will continue to support the PM and the vendor in finding solutions to these issues.

##### Practice2Master Abacus

Development of this app has been completed. However, the PM is working with Information Technology and Customer Service to solve some minor issues that make it difficult for customers to purchase this app when it is launched. TMR will continue to monitor this product and help facilitate the Passthrough process once everything is ready to launch.

##### Quick Check Modification

This is a modernization of the old Quick Check product which had recently been obsoleted. The product is in the final design stages, and currently the print and braille tooling are being reviewed by the PM to see what edits need to be made. TMR will continue to monitor this project and turn over product specifications once all the tooling is complete and verified.

##### Rigby® UEB Update

Product specifications were turned over to Production at the end of FY 2021. There were four kits total and were the final kits to be produced in the entire Rigby UEB update series. The products were manufactured at APH without issues, and all four were made available for sale in June 2022.

##### Room with a View

Work is still being done to finalize the tooling on this product. Some of the print content is still being finalized by the PM while the Model Shop is putting the finishing touches on vacuum-form tooling and the corresponding print files for those tools. Product specifications have been created and are waiting on the finalization of tooling before they are turned over to Production in the Gate 5: Specifications meeting. There are 3D components to this product that require injection molding. Model Shop has met with the PM to come up with designs that are approved that can be injection-molded without the use of complicated and expensive molds. These parts were 3D printed and approved. A bid package will have to be distributed to potential vendors before awarding this job and having the parts made. This will be done ahead of the Gate 5: Specifications meeting. TMR will continue to finalize all the tooling for this project and turn it over to Production once it is ready.

##### Rules of Unified English Braille Modification

The Gate 2: Product Design meeting was held in May 2022. TMR worked with the PM to determine the best binding method for the print and braille version of the books based on the number of estimated pages the final product will be. It was determined that using three-ring binders will be best for this product. The PM is currently working on finalizing the PDFs for the print version, and then the braille version will be updated. TMR will continue to monitor the status of this product as it’s being developed for Production.

##### SALS (Submersible Audio Light Sensor)

This product was turned over to Production via the Passthrough process in July 2021, and the first order was placed. Due to global supply chain issues and global shipping issues, the first production units didn’t arrive to APH until June 2022. The pallet the units arrived on was visibly damaged, and a full inspection was done of all the units. There was no physical damage to any of the units, and they all passed the incoming inspection; however, three of the units had damage to the outer packaging box. These units were placed in quarantine, and the vendor is sending APH replacement boxes for these. There was a slight software issue that prevented the product from being released for sale once the units were done being inspected, but this has since been resolved. This product was made available for sale in September 2022.

##### SENSEable STRIPS: Stick-On Tactile Lines

Formerly Textured Graphic Art Tape

Technology Product Research (TPR) met with Operations Engineering and the PM throughout the Fall of 2021 to work out the optimal way to lay out the tooling of this product to make it as easy as possible to run on the floor. New vacuum-form patterns and dies were created for both the Line Path and Shape Strips, and the specifications were restructured. The pilot run began in early June 2022 and has gone smoothly with few issues. As of late July, the pilot is nearing completion. TPR will continue to assist Production as needed with the manufacturing of this product.

##### Sensing and Learning (Modification)

Formerly Sensory Learning Kit

The scope of this project changed from a collection of purchased components to a simple hard-copy book. The PM is working with an outside vendor to inquire about selling ePUB versions of the book as well as another vendor producing hard copies for APH to sell. This product was put on hold until some details could be sorted out between Finance and the outside vendors. TMR will continue to monitor the progress of this product.

##### Snap Circuits®, Jr. (Modernization)

TMR met with members of Technology Product Research (TPR) and the PM in February 2022 to discuss what would be changed in this modernization of the Snap Circuits Jr. kit. TMR noted that they would need example parts of the components that were going to be purchased and added to the kit separately. These were delivered in April. As of July, TMR has the specs written, the labeling guide drawn, and the tooling designed. The vendor will be contacted soon to have the tooling created along with proofs of the labels. Once TPR supplies the web address for the digital content, the insert will be designed and turned over to Transcription. Once all tooling is in place, a Gate 5: Specifications meeting will be held.

##### SPORTS COURTS

An approved production method for the X and O magnetic pieces has finally been agreed upon. This will be a modified production method using the tabletop thermoform machines to create smaller vacuum-form patterns that will allow Production to better control registration and quality. Product specifications are ready to turn over after the Model Shop has successfully run full copies of all the Production tooling materials. The vendor for the injection-molded pieces is also ready to start once they receive a purchase order. The Gate 5: Specifications meeting will be held before the end of the fiscal year.

##### Swirly Mats™ (Modernization)

This product is a modernization of a product that was previously discontinued. Work began on this product in June 2021. The product consists of CVI and FVA versions. Both versions have multiple plastic mats with colored and confetti fillings. Product specifications were turned over to production in July 2022. This product is expected to be available for sale in December of 2022. TMR will continue to work with the PM and monitor the progress of the project.

##### 3D Universal Core Communication Symbols

The 3D Universal Core Communication Symbols (3CUCS) redesigns started in January 2022. Existing files were used to create slightly modified models according to the specifications of the PM. The goal was to create a shape that that would have bumpy rows on the outside but still be able to injection mold. A hollow version of the 3CUCS was created in two parts, top and bottom, and would snap together after injection molding process. The first iteration was presented to the PM in January 2022. Feedback was received from outside consultant that the product was two thin and lacked the weight and feel of the solid original. Research was conducted into possible materials for injection molding to increase weight of the 3CUCS. After presenting different options for injectable materials to the PM, concerns were raised about shrinkage and child safety if the material were ingested. More research was conducted, and a child safe material with minimal shrinkage was found. In April 2022, samples of injectable materials were delivered by Infiniti Plastics and presented to PM. The PM suggested doing more research on silicone products like teething rings. In June, an alternative design for 3CUCS was discussed with PM, and plans for new design were set. Currently both alternative designs have been created and are waiting on PM review.

##### Tactile Chemical Bonding Kit

The Model Shop met with the PM and an outside consultant in early November 2021 to discuss the components and potential design of this kit. By the end of the month, preliminary prototypes were provided to the PM. The Model Shop and the PM worked back and forth for the next several months to refine the tooling design. A Gate 2: Product Design meeting was held in April 2022. After this meeting, Production approached TMR with the proposal of creating the print and braille for the tile pieces with the flatbed Roland® rather than creating embossed labels. The Model Shop gave the Graphics department print files in June to test on the flatbed. The samples were received and reviewed by the PM, and it was determined by both the PM and Model Shop that this is not a viable production method for this product. This helps guide TMR on how best to proceed with the design of the production of this kit. Prototypes are being developed, and once feedback is received, product specs will be written, tooling will be finalized, and a Gate 5: Specifications meeting will be held.

##### Tactile Point Symbol Slate

Brainstorming and design work for this product began in January 2022. In February 2022, elements were defined/determined including width and depth of grooves for tooling of point symbols. The current depth and width of the wide and narrow lines on the Line Slate were used to dictate depth in width of the Tactile Point Symbol Slate (TPSS). Experiments with arrangements of larger shapes on the TPSS followed. The existing Line Slate file was again used as a template for creating the TPSS layout. In March 2022, a design layout was determined, and 3D Modeling of a prototype begun. A 3D digital model was created and rendered for approval in April 2022. The first prototype was printed on a 3D printer and given to the PM for review in May 2022. Feedback on shapes, placement, and groove depths as well as suggested changes were made by the PM after review and testing of TPSS. Changes were implemented, and TPSS was reduced in size to fit and print more efficiently on 3D printer bed. This was a temporary adjustment for the purpose of saving time while getting copies ready for field testing. In June 2022, it was decided by the PM that the TPSS needed to be at full size for field testing. Currently the best possible placement is being worked on for the 3D printer so that most efficient arrangement can be achieved. The TPSS should be ready for field testing in September 2022.

##### Tactile Theme Pack: In My Yard

The kit is primarily a collection of purchased items, and the biggest hurdle was finding reliable vendors for some of the materials. Vendors were located, and the specifications were drafted. A specification turnover meeting was being scheduled when it was learned that nearly two thirds of the materials were coming from a vendor that just went out of business. This required researching new vendors and rewriting the specifications. New vendors were sourced for all the parts, and specifications were updated. Due to this and availability concerns, we decided that the purchased parts should have generic descriptions in the specifications and parts lists to avoid having to do an Engineering Change Request for every time we have to source a new part for the product. The specifications were turned over to production in September 2021. During the pilot run, we decided to change to a slightly larger box for subsequent runs. The original box was adequate for the pilot, but nearly all of the purchased parts are subject to changes at any time, and those changes could easily result in bigger parts that might not fit well. This product was made available for sale as of July 2022.

##### Tactile Thermometer Demonstration Modification

This product has been approved but has been placed on hold until work is completed on other projects. TMR will continue to monitor the status of this project and work with the PM to update the tooling when the hold is lifted.

##### Wilson Reading System® 4

TMR worked on revising the print of the Magnetic Tiles in January 2022. A master for creating a new pattern was printed on the Roland® at this time as well. In July, the Model Shop had enough time to begin working on the new vacuum-form pattern for the Tiles. Also in July, TMR began writing Braille Orders and turning over files to Transcription as they were passed along by the PM. TMR will continue to work with the PM on the project and develop new specs as time allows.

## Other Technical and Manufacturing Research Projects

### Plant Safety

The TMR area is the lead area for safety programs in the basement floor near the front of the plant. The areas covered by TMR include: The Technology Group, TMR, model shop, the electronics shop, the basement restrooms, the vacuum-forming area, the Roland® and 3D-printing area, and the dark room/film developing area. TMR continued to conduct monthly safety meetings throughout the year and monthly safety inspections of all departments in this section of the plant. All paperwork and recordkeeping are being maintained and turned in monthly in a timely fashion. No safety incidents have been reported in any department in the area. TMR has the longest running record of consistent record keeping in the safety program. Not one meeting has been missed nor has one report not been filed on time in the 18-year history of the safety program. TMR is the only area that has this uninterrupted record of holding meetings, making inspections, and filing the proper paperwork in the entire safety program.

### Product Repairs

Any electronic devices that come in for repair that are more detailed than swapping a board come to TMR for repair. Devices that TMR repaired this year include Joy Players, Book Port Pluses, Book Port DTs, Power Selects, ColorTests, and LED Mini-Lite Boxes. TMR improved upon this system by asking for and getting access to the repairs database so notes could be entered directly rather than passed to somebody else who enters the details. With this database access, TMR is also able to directly contact the customer for more information when necessary.

TMR has also used repair opportunities to evaluate electronic products and how we might better produce them to avoid potential quality issues. The Electronics Engineer has been working to redesign the printed circuit boards on both the LED Lightbox and the LED Mini to better facilitate production of these boards and offer a higher quality product for the end user.

### Special Projects

TMR and Model Shop have been working with Production to improve the flow of all the Production processes on the floor. This requires redesign of tooling and rethinking how we set up products to be manufactured at APH. The results will net APH products that can be produced more quickly and with a higher degree of quality. We are also researching new production methods that will continue to expand the capabilities of what APH can manufacture.

# APPENDICES

###### Appendix A Agencies Participating in Research (14)

Coppell Independent School District, Coppell, TX

Emporia State University, Emporia, KS

Independence Science, LLC, West Lafayette, IN

Kentucky School for the Blind, Louisville, KY

Lillie Jackson Early Childhood Center, Lewisville, TX

Massey University, New Zealand

Perkins School for the Blind, Watertown, MA

PlayAbility Toys™, LLC, Tucson, AZ

Precision Circuit, Columbus, IN

Provincial Resource Centre for the Visually Impaired, Vancouver, British Columbia, Canada

Technologie HumanWare Canada, Inc., Drummondville, QC, Canada

Texas School for the Blind and Visually Impaired, Austin, TX

ViewPlus Technologies, Inc., Corvallis, OR

Wittich Vision Impairment Research Lab, Université de Montréal, Montreal, Quebec Canada

###### Appendix B Consultants (34)

Blaylock, Luanne, Educational Vision Specialist, Pulaski County Special School District, Retired, Little Rock, AR [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Buhler, Kristen, MSEd, MM Choral Conducting, Teacher of Students with Visual Impairments, Columbia Regional Inclusive Services, Portland, OR [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Chambers, Stacey, MEd, TVI, APH Scholar, Coppell Independent School District, TX [Sensing and Learning]

Croft, Jo Ellen, MEd, Certified Orientation and Mobility Specialist, Educational Vision Consultant, Educational Services for the Visually Impaired, Retired, Little Rock, AR [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Davidson, Whitney Blair, MS, Educational Aide, Lillie Jackson Early Childhood Center, Lewisville, TX [Adapted Biology Lab Manual]

Dilworth, Kate, MS Special Education, Teacher of Students with Visual Impairments, Certified Orientation and Mobility Specialist, Columbia Regional Inclusive Services, Portland, OR [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Filicetti, Mary, MEd Early Childhood Special Education, Teacher of Students with Visual Impairments, Certified Orientation and Mobility Specialist, Fairfax County Public Schools, Fairfax, VA [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Flatres, Andrew, Product Manager, Technologies HumanWare, Inc., Drummondville, QC, Canada [PageBlaster™, Mantis™, Chameleon™]

Gardner, Dan, CEO, ViewPlus, Technologies, Inc., Corvallis, OR [PixBlaster™]

Haegele, Justin A., PhD, Certified Adapted Physical Educator, Assistant Professor, Department of Human Movement Sciences, Old Dominion University, Norfolk, VA [SPORTS COURTS]

Jones, Ryan, Vice President of Software, Freedom Scientific, Clearwater, FL [Freedom Scientific Education Edition]

Legault, Maryse, Quality Assurance, Technologies HumanWare Inc., Drummondville, QC, Canada [Mantis™, Chameleon™]

Lepore, Monica, EdD, Certified Adapted Physical Educator, Professor, Department of Kinesiology, Coordinator of Adapted Physical Activity Programs, West Chester University, West Chester, PA [SPORTS COURTS]

Lepore-Stevens, Maria, MA, Certified Adapted Physical Educator, Certified Orientation and Mobility Specialist, West Chester University, West Chester, PA [SPORTS COURTS]

Lieberman, Lauren, PhD, Distinguished Service Professor, SUNY Brockport, NY [Physical Education and Health Special Projects and Needs, Physical Education, Recreation, and Health Website, SPORTS COURTS]

Lopez, Joyce, Product Developer, PlayAbility Toys™, Tucson, AZ [Paint Pot Palette UEB]

Martin, Erika, PhD, Biology Lab Coordinator, Emporia State University, Emporia, KS [Adapted Biology Lab Manual]

Martiniello, Natalina, PhD, CVRT, Research Associate, Wittich Vision Impairment

Research Lab, University of Montreal, Montreal, Quebec, Canada [Braille Reading Materials for Adult Learners]

Neybert, Ashley, BS, Independence Science, LLC, Purdue Research Park, West Lafayette, IN [Submersible Audible Light Sensor]

Parker, David, Technical Support Analyst, ViewPlus Technologies, Inc., Corvallis, OR [PixBlaster™]

Read, Izetta, BA, Teacher of Students with Visual Impairments, Santa Barbara County Education Office, Santa Maria, CA [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Smith, Millie, MEd, TVI Consultant, Plano, TX [*Sensing and Learning*]

Stockhausen, Adam, MA, Kentucky School for the Blind, Louisville, KY [Tactile Chemical Bonding Kit]

Sullivan-O'Brien, Susan, MEd, TVI Consultant, Naples, FL [Astro Adventure Ball and App]

Supalo, Ron, Project Manager, Independence Science, LLC., West Lafayette, IN [Submersible Audio Light Sensor]

Sticken, Jenna, MSEd, Teacher of the Visually Impaired, Certified Orientation and Mobility Specialist, Indian Prairie School District #204, Naperville, IL [SPORTS COURTS]

LC, Purdue Research Park, West Lafayette, IN [Submersible Audio Light Sensor]

Swain, Mark, Owner, Precision Circuit, LLC, Columbus, IN [Submersible Audio Light Sensor]

Swenson, Anna, MEd, Teacher of the Visually Impaired, Fairfax Co. Public Schools, Retired, Ashburn, VA [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

Tellis-Ackley, Anna, Teacher of the Visually Impaired, PA [Music Braille Wheel]

Waggener, Lloyd, Marketing, ViewPlus Technologies, Inc., Corvallis, OR [PixBlaster™]

Wood, Mike, Marketing, Freedom Scientific, Clearwater, FL [Freedom Scientific Education Edition]

Williams, Greg, PhD, Director of Products and Training, Independence Science, LLC, Purdue Research Park, West Lafayette, IN [Submersible Audio Light Sensor]

Wingell, Robin, MA, Special Education, Teacher of Students with Visual Impairments, Santa Barbara County Education Office, Santa Maria, CA [Building on Patterns Second Edition, Prekindergarten and Kindergarten]

###### Appendix C Field Evaluators / Expert Reviewers (18)

Astro Adventure Ball and App

Anonymous, PhD, lecturer, Institute of Education, Massey University, Auckland, NZ

McCarthy, Tessa, PhD, assistant professor, University of Pittsburgh, PA

Sheline, Diane, MEd, TVI, independent consultant, Strategy to See, Canyon Lake, TX

Joy Player Cartridge Holder

Glaab, Matthew, volunteer 3D Printing, Madison Center Wyandotte, MI

O’Brien, Susan, braille/tactile graphics coordinator and technology applications teacher, Texas School for the Blind and Visually Impaired, Austin, TX

Sennott, Betsey, AT/instructional materials specialist, teacher, Perkins School for the Blind, Watertown, MA

Practice2Master Abacus

Anonymous, teacher of the visually impaired, New Mexico School for the Blind and Visually Impaired, Alamogordo, NM

Anonymous, teacher of the visually impaired, Cimarron Elementary-Middle School, Cimarron, NM

Elliott, Linnea, teacher of the visually impaired, Walker County Schools, Jasper, AL

Grosselfinger, Byron, teacher of the visually impaired, certified orientation and mobility specialist, Berks County Intermediate Unit 14, Reading, PA

Heise, Yoko, teacher of the visually impaired

James, Kristin, teacher of the visually impaired, Central Susquehanna Intermediate Unit, Milton, PA

Ludwig-Miller, Tammy, teacher of the visually impaired, Sullivan County Boces, Liberty, NY

Mason, Amy, teacher of the visually impaired, certified orientation and mobility specialist, Gateway Regional School District, Huntington, MA

Robinson, Denise, teacher of the visually impaired, assistive technology specialist, TechVision, LLC, Bristol, TN

Smith, Brittany, teacher of the visually impaired, New Caney Independent School District, New Caney, TX

Tellis-Ackley, Anna, teacher of the visually impaired, Wilson School District, West Lawn, PA

Whitworth, Louise, teacher of the visually impaired, Jefferson City School District, Jefferson City, MOAppendix D  
Presentations and Workshops 2022

Best, K., Dudycha, B., & Martin, J. (2022, July 21). *Code Jumper: Computer science, careers, and the expanded core curriculum* [Conference session]. Association for the Education and Rehabilitation of the Blind and Visually Impaired International Conference, St. Louis, MO.

Bishop, R. (2021, October). *Learning through play: Fun and engaging ways to learn* *UEB* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Bishop, R. (2021, October). *Early Braille Trade Books video tutorial* [Virtual]. Portland State University, Portland, OR.

Bishop, R. (2022, February). *Paper choices from APH* [Virtual].Ex Officio Trustees, American Printing House for the Blind, Louisville, KY.

Bishop, R. (2022, May). *Math Symbol Reference Booklets* [Virtual]. Department of Education Review Panel, Louisville, KY.

Bishop, R. (2022, May). *Reach and Match Alphabet Tiles* [Virtual]. Department of Education Review Panel, Louisville, KY.

Bishop, R. (2022, August). *Braille legacy products II* [Presentation].American Printing House for the Blind, Louisville, KY.

Bishop, R., Freeman, W., & Poppe, K. J. (2021, October). *Learning through play: Using embossers to create fun student activities* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Bishop, R., Freeman, W., & Poppe, K. J. (2022, April). *Using embossers to create fun student activities* [Virtual]. California Transcribers and Educators for the Blind and Visually Impaired Conference, online.

Bishop, R. & Senft-Graves, C.(2021, October). *Legacy APH products are learning UEB: Product showcase* [Virtual].153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Brown, S. (Host) & Freeman, W. (Co-interviewee). (2022, January 13). High-tech braille devices (No. 44) [Audio podcast episode]. In *Change makers: A podcast from APH*. American Printing House. <https://podcasts.apple.com/us/podcast/high-tech-braille-devices/id1504698784?i=1000547795754>

Brown, S. (Host), Pierce, T., & Zierer, L. (Co-interviewees). (2022, March 24). National arts and craft month (No. 49) [Audio podcast episode]. In *Change makers: A podcast from APH.* American Printing House. <https://www.buzzsprout.com/354881/10215781-national-arts-and-craft-month>

Brown, S. (Host) & Poppe, K. J. (Co-interviewee). (2021, November 24). Tactile graphics (No. 42) [Audio podcast episode]. In *Change makers*: *A podcast from APH*. American Printing House. <https://podcasts.apple.com/us/podcast/tactile-graphics/id1504698784?i=1000542962795>

Brown, S. (Host) & Senft-Graves, C. (Co-Interviewee). (2021, November 11). National family literacy month (No. 41) [Audio podcast episode]. In *Change makers: A podcast from APH*. American Printing House. <https://www.buzzsprout.com/354881/9497419-national-family-literacy-month>

DeJute, K., & Freeman, W. (2022, February). *How braille works electronically* [Webinar]. APH Webinar, Louisville, KY.

Dudycha, B. (2022, May 9). *Jump into Code Jumper* [Conference session]. National Coding Symposium, online.

Dudycha, B., & Lowell, R. (2022, May 17). *Yes, I can! Tap into your student's passion through coding and ECC* [Webinar]. APH webinar, Louisville, KY. [https://www.youtube.com/watch?v=PHft-zEuVoI](https://www.youtube.com/watch?v=PHft-zEuVoI%20)

Freeman, W. (2021, October). *APH braille tech news* [Virtual]. National Federation of the Blind, Des Moines, IA.

Freeman, W. (2021, October). *Learning through play: Fun with braille displays* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Freeman, W. (2021, October). *Learning about APH’s Braille Trail - Braille tech from early literacy onward* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Freeman, W. (2021, October). *Expert tips for using braille tech* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Freeman, W., Sullivan J. (2021, October). *CA School for the Blind: Mantis and Chameleon introduction* [Webinar]. APH Webinar, Fremont, CA.

Freeman, W. (2021, November). *Major changes in BrailleBlaster V2* [Webinar]. NBA Webinar, Rochester, NY.

Freeman, W., Flatres, A., Tucci, P., & Bishop, R. (2021, November). *Blast off to more* *braille with PageBlaster* [Webinar]. American Printing House for the Blind and HumanWare, Louisville, KY.

Freeman, W., & Hart, S. (2021, November). *PixBlaster and TGIL overview* [Webinar]. APH Webinar, Philadelphia, PA.

Freeman, W. & Bishop, R. (2021, November). *Innovations in braille literacy for adults*. [Virtual]. Association of Vision Rehabilitation Therapists (AVRT) Annual Training Virtual Conference, online.

Freeman, W., (2021, December). *Using braille commands with VoiceOver: “Apple”-ly your braille skills to the Mantis and Chameleon* [Webinar]. APH Webinar, Louisville, KY.

Freeman, W., (2022, January). *Braille is a breeze with BrailleBlaster* [Webinar]. APH Webinar, Louisville, KY.

Freeman, W., (2022, January). *Introducing BrailleBlaster from the American Printing House for the Blind* [Virtual]. Scottish Sensory Center, Edinburgh, Scotland.

Freeman, W., & Stilson, G. (2022, January). *eBRF: Creating dynamic braille with a new standard*. [Conference session]. ATIA 2022, Orlando, FL.

Freeman, W. (2022, February). *Using embossers to make STEM content* [Webinar]. AER Webinar, Louisville, KY.

Freeman, W., & Stilson, G. (2022, March). *eBRF summit* [Presentation]. CSUN Conference, Anaheim, CA.

Freeman, W. (2022, April). *Talk the talk: Benefits of text to speech on braille displays* [Webinar]. APH Access Academy Webinar, Louisville, KY.

Freeman, W., Flatres, A., & Bishop, R. (2022, April). *More than braille with PageBlaster* [Webinar].APH Access Academy. American Printing House for the Blind, Louisville, KY.

Freeman, W. (2022, May). *Guest lecturer* [Virtual]. San Francisco State University, San Francisco, CA.

Freeman, W. (2022, July). *Magnifier and braille display overview* [Virtual]. ACB Conference, Omaha, NE.

Freeman, W. (2022, July). *NFB committee for the advancement and promotion of braille: eBRF overview* [Conference session]. NFB, New Orleans, LA.

Freeman, W. (2022, July). *NFB computer science division: eBRF overview*. [Conference session]. NFB, New Orleans, LA.

Freeman, W. (2022, July). *Navigation and dynamic content in a new eBRF*. [Conference session]. AER International, St. Louis, MO.

Freeman, W. (2022, September). *Chameleon 20 basics using text-to-speech* [Webinar].APH Access Academy Webinar, Louisville, KY.

Hodge, J. (2021, October 18). *Roll the dice: Selection and random with Code Jumper* [Webinar]. APH webinar, Louisville, KY. <https://www.youtube.com/watch?v=7mtkGeS28qw>

Hodge, J., Zhou, L., Kirwan, L., & Sullivan, J. (2022, April). *Math product presentation* [Virtual]. Scottish Sensory Center, Edinburgh University, Edinburgh, United Kingdom.

Hoffmann, R. (2021, October). S*TEM learning: Build-A-Cell and adapted science measuring tools* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2021, October). *Learning some STEM and a little bit of O&M* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2021, October, November, December). *Health is meaningful living* [Webinar panelist]. APH Hive, Louisville, KY.

Hoffmann, R. (2022, January). *Health Education Tactile Graphics, Step-By-Step, 2nd edition, and Accessible Code & Go Mouse* [Demonstration]. Ex Officio Trustees. American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2022, January). *Cost analysis of spinner overlays for the light box* [Virtual]. Product Manager Training, American Printing House for the Blind, Louisville, KY.

Hoffmann, R., Perry, K. & Kirwan, L. (2022, February). *Fun inclusive STEM coding* [Presentation]. IdeaFestival Bowling Green 2022, Western Kentucky University, Bowling Green, KY.

Hoffmann, R., Kirwan, L., & Sullivan, J. (2022, February). *STEM product presentation* [Virtual]. Scottish Sensory Center, Edinburgh University, Edinburgh, United Kingdom.

Hoffmann, R. (2022, March). *Science product gap analysis and roadmap* [Presentation]. Educational Product Advisory Board, American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2022, April). *Health and science products from APH* [Presentation]. New Ex Officio Training, American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2022, June). *Health Education Tactile Graphics and Accessible Code & Go Mouse* [Presentation]. Building on Patterns Meeting, American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2022, August). *Legacy presentation II* [Presentation]. American Printing House for the Blind, Louisville, KY.

Hoffmann, R. (2022 September). *APH presents the Submersible Audio Light Sensor (SALS); A device that fosters inclusion in science* [Virtual]. ISLAND Conference 2022, Princeton University, Princeton, New Jersey.

Lowell, R. (2022, February 15). *Play along with Code Jumper* [Webinar]. American Printing House for the Blind, Louisville, KY.

Mosen, J. (Host), Stilson, G., & Freeman, W. (Interviewees). (2022, April 30) Elon Musk is buying Twitter, have you ever served on a jury, and APHs braille revolution (No. 176) [Audio podcast episode]. In *Mosen at large.* Jonathon Mosen. <https://podcasts.apple.com/au/podcast/elon-musk-is-buying-twitter-have-you-ever-served-on/id973360653?i=1000559201681>

Pierce, T. (2021, October). *Something old, something new, something borrowed, and no one’s blue* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Pierce, T. (2022, March). *New products* [Presentation]. Educational Product Advisory Board, American Printing House for the Blind, Louisville, KY.

Pierce, T. (2022, April). *APH environmental control units* [Virtual]. EOT Meeting, American Printing House for the Blind, Louisville, KY.

Pierce, T. (2022, April). *Barraga Visual Efficiency Program* [Presentation]. New Ex Officio Training, American Printing House for the Blind, Louisville, KY.

Pierce, T. (2022, May). *Barraga Visual Efficiency Program* [Virtual]. Department of Education Review Panel, Louisville, KY.

Pierce, T. (2022, August). *Legacy presentation II-Physical education* [Presentation]. American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2021, October). *Ideas to flip over! Brainstorm future Flip-Over Concept Books* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2021, October). *Learning smART: Learning concepts through art* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2021, October). *On the road to tactile understanding: 3D to 2D representations* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2021, November). *In-house tactile methods for product design* [Virtual]. Training session for APH Educational Product Innovation staff, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2021, December). *Tactile literacy skills: A review of APH products* [Virtual]. Scottish Sensory Center, Edinburgh University, Edinburgh, United Kingdom.

Poppe, K. J. (2022, January). *Relevant classic: Color-by-Texture Marking Mats* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, February). *Tactile literacy products* [Virtual exhibit]. Texas Focus Conference, Texas School for the Blind and Visually Impaired, Austin, TX.

Poppe, K. J. (2022, February). *Relevant classic: Picture Maker and accessory kits* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, March). *Polling all current kit users! Open focus group for Picture Maker Kit* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, March). *Relevant classic: Setting the Stage for Tactile Understanding* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, March). *Product manager roundtable: Tactile literacy products* [Presentation]. EPAC/ESAC Joint Advisory Meeting, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, April)*. Relevant classic: StackUps: Spatial Reasoning Using Cubes and Isometric Drawings* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, July). *Learning smART: Learning concepts through art* [Conference session]. AER Biennial International Conference, St. Louis, MO.

Poppe, K. J. (2022, August). *Tactile literacy legacy products: Sales updates and forecasts for FY22* [In-person/virtual presentation]. APH Executive Committee and Division Managers, American Printing House for the Blind, Louisville, KY.

Poppe, K. J. (2022, August). *Upcoming field test opportunity: Tactile Point Symbol Slate* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Senft-Graves, C., Bishop, R., & McClure-Rogers, D. (2022, March). *APH braille literacy products roadmap* [Presentation]. Educational Product Advisory Board, American Printing House for the Blind, Louisville, KY.

Sullivan, J. (2022, March 31). *Yes! I can code* [Conference session]. Texas Association for Education and Rehabilitation of the Blind and Visually Impaired Chapter Conference, Round Rock, TX.

Sullivan, J., & Senft-Graves, C. (2021, November). *Connecting with APH & CNIB: Benefiting braille literacy & more* [Virtual]. CNIB Foundation 2021 Connecting the Dots Educator Series Conference, Toronto, Ontario, Canada.

Stilson, G., & Freeman, W. (2021, October). *Learning through innovation: How the DTD and eBRF will change the education landscape* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Stilson, G., & Freeman, W. (2022, March) *Braille dots serving 21st century needs* [Conference session]. CSUN Conference, Anaheim, CA.

Taylor, J. (2021, October). *Learning magnified: Hands on with Juno Handheld Magnifier* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Taylor, J., Wood, M., & Stilson, G. (2021, October). *Do you know Juno* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Taylor, J., & Fulwiler, B. (2021, November). *Magnifiers & telescopes 101: Envision* [Virtual]. AVRT Annual Conference, Louisville, KY.

Taylor, J. (2022, February). *Low vision products* [Virtual exhibit]. Texas Focus Conference, Texas School for the Blind and Visually Impaired, Austin, TX.

Taylor, J. (2022, March). *Envision Kit: Coming soon!* [Virtual]. EOT Virtual Meeting, American Printing House for the Blind, Louisville, KY.

Taylor, J. & Freeman, W. (2022, March). *Low vision and braille roadmaps* [Presentation]. EPAC/ESAC Joint Advisory Meeting, American Printing House for the Blind, Louisville, KY.

Taylor, J., & Wood, M. (2022, March). *Juno tips and tricks: Unboxing* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Taylor, J., & Wood, M. (2022, May). *Juno tips and tricks: Menus* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Taylor, J., & Wood, M. (2022, August). *Juno tips and tricks: Camera* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Taylor, J., & Wood, M. (202,2 September). *Juno tips and tricks: OCR* [Webinar]. Access Academy, American Printing House for the Blind, Louisville, KY.

Torpey, N., Torpey. P (Hosts), Stilson, G., & Freeman, W. (Interviewees). (2022, July 13) Graphical braille display and eBRF (No. 2228)[Audio podcast episode]. In *Eyes on success*. Eyes on Success with hosts Peter and Nancy Torpey. <https://tunein.com/podcasts/Podcasts/Eyes-On-Success-Radio-Show--Podcast-p1124475/?topicId=173496363>

Zhou, L. (2021, October). *Learning by the number: Using APH’s math products in the classroom* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Zhou, L. (2021, October). *Learning fractions using APH math products* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

Zhou, L., Kirwan, L., & Sullivan, J. (2022, January). *Math manipulatives from APH that scream, practice with me!* [Virtual]. CNIB Teacher Training Series, Toronto, Ontario, Canada.

Zhou, L. (2022, March). *Tactile Algebra Tiles* [Virtual demonstration]. Ex Officio Trustees. American Printing House for the Blind, Louisville, KY.

Zhou, L., & Kirwan, L. (2022, July). *Teaching math to the blind: Graphing in classrooms* [Conference session]. AER Biennial International Conference, St. Louis, MO.

Zhou, L. (2022, August). *Math legacy products presentation II* [Presentation]. American Printing House for the Blind, Louisville, KY.

Zierer, L. (2021, October). *Learn to the beat of your own music* [Virtual]. 153rd Annual Meeting of Ex Officio Trustees of the American Printing House for the Blind, Louisville, KY.

###### Appendix E Product Status Tables and Charts Fiscal Year 2022

The following tables and bar charts show projects that are in active development, on hold, and completed. The data in each bar chart reflects that in its associated table.

**Table 1**

*Products Launched in Fiscal Year 2022*

| Product Name | Date of Airplane | Product Manager |
| --- | --- | --- |
| Animal Recipes | 11/04/21 | Donna McClure-Rogers |
| Paint Pot Palette | 11/15/21 | Rachel Bishop |
| Lots of Dots Counting 123 | 11/15/21 | Tristan Pierce |
| Lots of Dots Coloring Garden | 11/15/21 | Tristan Pierce |
| Braille Datebook Calendar Tabs '22 | 11/16/21 | Andrew Moulton |
| Braille Datebook Calendar 2022 | 11/16/21 | Andrew Moulton |
| Mantis 1 year | 11/22/21 | William Freeman |
| Mantis 2 year | 11/22/21 | William Freeman |
| Chameleon 1 year | 11/22/21 | William Freeman |
| Chameleon 2 year | 11/22/21 | William Freeman |
| How To Recognize A Monster | 01/21/22 | Suzette Wright |
| OTWL: The Caterpillar | 02/08/22 | Suzette Wright |
| Math Flash for Android Devices - Quota | 02/24/22 | Li Zhou |
| Math Flash for Android Devices - Non-Quota | 02/24/22 | Li Zhou |
| CVI Companion Guide EPUB | 03/04/22 | Donna McClure-Rogers |
| Paint by Number Endangered Species | 04/21/22 | Tristan Pierce |
| Joy Player Cartridge | 05/04/22 | Tristan Pierce |
| Guideline and Games for Teaching Efficient Braille Reading, 2nd Edition | 05/09/22 | N/A |
| Guideline and Games for Teaching Efficient Braille Reading, 2nd Edition | 05/09/22 | N/A |
| CVI Companion Guide Kit | 05/09/22 | Donna McClure-Rogers |
| Rigby Nonfict Kit 4 UEB Contr | 06/15/22 | Rachel Bishop |
| Rigby Nonfict Kit 4 UEB Uncon | 06/15/22 | Rachel Bishop |
| Rigby Nonfict Kit 5 UEB Contr | 06/15/22 | Rachel Bishop |
| Rigby Nonfict Kit 5 UEB Uncon | 06/15/22 | Rachel Bishop |
| Tactile Theme Pack: In My Yard | 07/26/22 | Suzette Wright |
| DC Supplemental Adapter | 07/21/22 | Tristan Pierce |
| Submersible Audio Light Sensor | 08/31/22 | Rosanne Hoffman |
| PageBlaster 1 Year Warranty | 08/31/22 | William Freeman |
| Flip-Over Concept Books: Telling Time: Nemeth | 08/31/22 | Karen Poppe |
| Flip-Over Concept Books: Telling Time: UEB | 08/31/22 | Karen Poppe |
| EZ Track Calendar 2023 | 08/31/22 | Laura Zierer |
| Insert EZ Track Calendar 2023 | 08/31/22 | Laura Zierer |
| Insights Calendar 2023 | 09/06/22 | Laura Zierer |
| Insights Custom Calendar 2023 | 09/06/22 | Laura Zierer |
| Braille Datebook Calendar Tabs 2023 | 09/20/22 | Laura Zierer |
| Braille Datebook Calendar Kit 2023 | 09/20/22 | Laura Zierer |
| Practice 2 Master Abacus Non-quota Apple Store | 09/23/22 | Li Zhou |
| Practice 2 Master Abacus Quota Apple Store | 09/23/22 | Li Zhou |
| Practice 2 Master Abacus Non-quota Google Play Store | 09/23/22 | Li Zhou |
| Practice 2 Master Abacus Quota Google Play Store | 09/23/22 | Li Zhou |
| Brigance CIBS II Uncontracted Braille | 09/27/22 | Lauralyn Randles |
| Brigance CIBS II Contracted Braille | 09/27/22 | Lauralyn Randles |
| Brigance CIBS II Print Edition | 09/27/22 | Lauralyn Randles |

**Table 2**

Active Project Categories

|  |  |
| --- | --- |
| Product Category | Active |
| Braille Literacy | 7 |
| Communication Modes | 4 |
| Early Childhood | 5 |
| Fine Arts | 1 |
| Mathematics | 4 |
| Multiple Disabilities | 1 |
| Orientation & Mobility | 2 |
| Recreation/PE | 1 |
| Science & Health | 4 |
| Tactile Literacy | 2 |
| Technology & Electronics (Assistive) | 15 |
| Tests & Assessments | 3 |

**Chart 2**

Active Project Categories

**Table 3**

On-Hold Project Categories

| Category | Hold |
| --- | --- |
| Braille Literacy | 1 |
| Career Education & Transition | 1 |
| Communication Modes | 3 |
| Cortical Visual Impairment | 3 |
| Early Childhood | 4 |
| Low Vision | 1 |
| Mathematics | 1 |
| Orientation & Mobility | 1 |
| Science & Health | 4 |
| Technology & Electronics (Assistive) | 5 |
|  |  |

**Chart 3**

On-Hold Project Categories

**Table 4**

*Completed Project Categories*

|  |  |
| --- | --- |
| Category | Complete |
| Communication Modes | 3 |
| Daily Living | 1 |
| Early Childhood | 4 |
| Fine Arts | 2 |
| Mathematics | 3 |
| Technology & Electronics (Assistive) | 6 |

**Chart 4**

*Completed Projects*

**Chart 5**

Compilation of Project Categories

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Arduino® is a registered trademark of Arduino.

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Mantis™ is a trademark of American Printing House for the Blind, Inc.

MathType™ is a trademark of Design Science.

Math Flash™ is a trademark of American Printing House for the Blind, Inc.

MATT Connect™ is a trademark of American Printing House for the Blind, Inc.

Microsoft® is a registered trademark of Microsoft Corporation.

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Paint-by-Number Safari™ is a trademark of American Printing House for the Blind, Inc.

PermaBraille™ is a trademark of American Printing House for the Blind, Inc.

PixBlaster™is a trademark of American Printing House for the Blind, Inc.

PlayAbility Toys™ is a trademark of Josephine Baldacchino Lopez.

Polly® is a registered trademark of American Printing House for the Blind, Inc.

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Puffy® Paint is a registered trademark of Paisley Crafts, LLC.

Rigby® is a registered trademark of Houghton Mifflin Harcourt.

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Wilson Reading System® is a registered trademark of Wilson Language Training Corporation.

Windows® is a registered trademark of Microsoft Corporation.

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