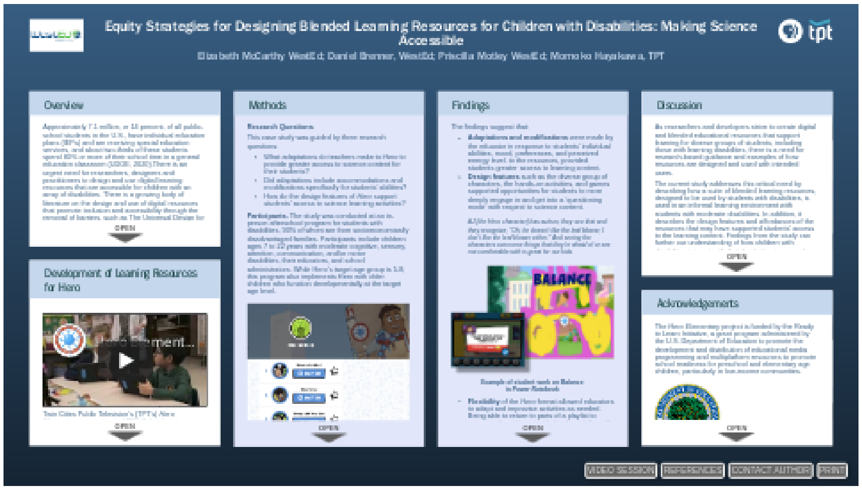
Equity Strategies for Designing Blended Learning Resources for Children with Disabilities: Making Science Accessible



Elizabeth McCarthy, WestEd; Daniel Brenner, WestEd; Priscilla Motley, WestEd;
Momoko Hayakawa, TPT

PRESENTED AT:

SRCD Society for Research in Child Development 2021 *Virtual* BIENNIAL MEETING

APRIL 7-9, 2021

OVERVIEW

Approximately 7.1 million, or 14 percent, of all public-school students in the U.S., have individual education plans (IEPs) and are receiving special education services, and about two-thirds of these students spend 80% or more of their school time in a general education classroom (UDOE, 2020).There is an urgent need for researchers, designers and practitioners to design and use digital learning resources that are accessible for children with an array of disabilities. There is a growing body of literature on the design and use of digital resources that promote inclusion and accessibility through the removal of barriers, such as The Universal Design for Learning and Computer Assisted Instruction Frameworks (CAST, 2011; Cheng & Lai, 2019; Lee, Miller & Janusyk, 2015; Panagopoulou, et al., 2018,Weng, Maeda & Bouck, 2014).The current paper describes a case study focused on the implementation of learning resources designed to allow children with disabilities to access science content, and for educators to adapt activities to provide children better access.

DEVELOPMENT OF LEARNING RESOURCES FOR HERO

[VIDEO] https://www.youtube.com/embed/tuZy4suwhRE?rel=0&fs=1&modestbranding=1&rel=0&showinfo=0

Trailer for *Hero Elementary*

Twin Cities Public Television's (TPT's) *Hero Elementary* is an animated PBS Kids television series and suite of digital and non-digital learning resources designed to support science and literacy learning for children in grades K–2 in formal and informal learning environments. The *Hero Elementary (Hero)* science resources examined in the study, include television episodes, digital and analog games, non-fiction eBooks, hands-on activities, a digital science notebook, and educator resources, all connected by an engaging narrative involving a diverse group of children. Resources are organized in "playlists" based on science topics.

The cast of *Hero Elementary*

TPT developed key documents to guide

1. the equitable and accessible design of *Hero* learning resources and
2. educators use of the resources in ways that promote equity and accessibility.

The Transformative Transmedia Framework for Early STEM Learners (Ellington, et al., 2021) and *Hero's Equity Strategies* documents summarize research-based best practices in the design and use of learning resources for students with moderate cognitive disabilities. These documents guide *Hero* designers and educators.

The goal of the *Hero Elementary* project is to achieve equity in science education and school readiness for children in grades K-2 across the nation. Our educational approach is based on research on effective teaching strategies to reach all learners in science. These equity focused strategies include:

1. Connect science to children's "sense of place"—the physical, historical and socio-cultural aspects of their local community.

Early science learning helps children understand the world around them. In the primary years, this is best accomplished when children engage in their immediate surroundings and investigate everyday natural phenomena. Providing opportunities for developmentally appropriate exploration of their surroundings helps children understand how things work and offers an important foundation for future science learning.

2. **Empower children to be doers of science by connecting to the cultural knowledge and experiences of their families and communities.**

Children come from different cultural and linguistic backgrounds and have a rich knowledge of their cultural and linguistic practices. When children are given opportunities to leverage these practices in developing scientific knowledge and practice, they engage in scientific reasoning. Provide opportunities to incorporate children's cultural and linguistic experiences into science learning.

3. Engage children's curiosity through real-world, hands-on experiences.

Science learning for young children need to be concrete and tangible. When engaging with scientific content, children learn better through physical interactions with the concepts. Providing hands-on experiences in realistic contexts supports children's understanding and expands their knowledge of a scientific idea by applying it in their lives. Real-world science is creative and fun!

4. Provide flexible learning experiences with multiple representations to engage all children.

All children learn differently from one another. Provide different means of interaction for students to understand the content. Include resources such as science related literature, hands-on activities, realia (real objects or events), Venn diagrams, and concept maps. Depending on children's background knowledge, provide resources to bridge their understanding of new ideas. For example, provide vocabulary support for English learners and adaptive materials for children with learning differences.

5. Facilitate discussion and reflection about science experiences.

Encourage children to develop science language and terms. Set high expectations for them about the importance and value of science knowledge. Offer opportunities for children to practice science language to describe, explain, and predict science phenomena.

6. Support science learning by connecting to home and community partnerships.

Partner with home and community resources in meaningful ways. Have families participate in classroom events. Include role models from students' communities, especially those who use STEM in everyday life. Engage community knowledge and resources to support children's science learning.

TPT's *Equity Strategies*

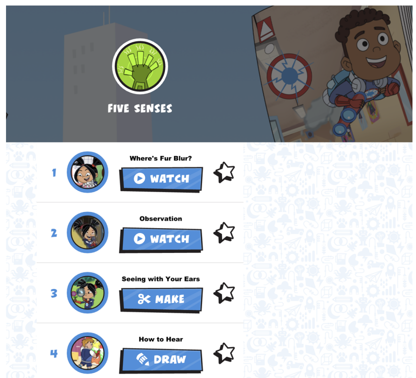
METHODS

Research Questions

This case study was guided by three research questions:

- What adaptations do teachers make to *Hero* to provide greater access to science content for their students?
- Did adaptations include accommodations and modifications specifically for students' abilities?
- How do the design features of *Hero* support students' access to science learning activities?

Participants. The study was conducted at an in-person afterschool program for students with disabilities, 90% of whom are from socioeconomically disadvantaged families. Participants include children ages 7 to 22 years with moderate cognitive, sensory, attention, communication, and/or motor disabilities, their educators, and school administrators. While Hero's target age group is 5-8, this program also implements Hero with older children who function developmentally at the target age level.



Activities from *Hero* Five Senses Playlist

Data Collected. Data collection occurred during two separate interventions, one in winter 2020 and one in late fall 2020.

<u>Fiirst round of data collection</u>. This involved a two-day visit to the school. The site visit included observations over a two-day period of three students with varying abilities and preferences using Hero, and interviews with their educator.

<u>Second round of data collection</u>. This was implemented virtually during where two new staff were responsible for the administration of the program. Virtual classroom observations were conducted via two zoom sessions, one with an older group of 12 students (aged 15-22), and one with a younger group of three students (aged 5-10).

Data analyzed included: pre-observation interviews with several administrators, a program coordinator, and both educators, the in-person and virtual classroom observations, and post-observation interviews with the educators.

Analysis. Qualitative analytic methods were used to analyze the data (Charmaz, 2007). The data, comprised of transcribed pre- and post-observation interviews and classroom observations were analyzed deductively by three researchers using a set of codes based on related literature.

Each document was coded by at least two researchers. Based on results of the first coding, the agreement between coders was approximately 80%. A code book was created based on TPT's design frameworks, the study's guiding questions, and additional codes that emerged during analysis (Miles and Huberman, 1994).

Using a process described by Yin (2018) researchers conducted a data reduction process whereby key findings from the coding process were documented in analytic memos. Data reduction continued, including additional sessions of peer debriefing, producing the key findings of the study.

FINDINGS

The findings suggest that:

- **Adaptations and modifications** were made by the educator in response to students' individual abilities, mood, preferences, and perceived energy level. to the resources, provided students greater access to learning content.
- **Design features** such as the diverse group of characters, the hands-on activities, and games supported opportunities for students to more deeply engage in and get into a 'questioning mode' with respect to science content.

  AJ [the Hero character] has autism, they see that and they recognize, "Oh, he doesn't like the leaf blower, I don't like the leaf blower either." And seeing the characters overcome things that they're afraid of or are not comfortable with is great for our kids.

Example of student work on Balance
in *Power Notebook*

- **Flexibility** of the *Hero* format allowed educators to adapt and improvise activities as needed. Being able to return to parts of a playlist to review and revisit content helped to reinforce the learning; educators were better able to elicit responses from students to questions about the content on the second exposure.

  We were eating lunch today and someone had poured the water out and said, 'Oh, you got liquid all over the table.' And I was replied, 'Why didn't you just say water?' And he answered, 'We learned liquid yesterday.'

- **Multiple representations** and formats of the science content allowed students to choose activities most suited to their abilities and learning styles.
- **SMART board**, introduced strategically in the classrrom initially to engage students taking advantage of their large motor skills, allowed for a smoother transition of students to tablet devices.
- **Multiple aides** in the class, allowed the educator to better support students one-on-one and provide intensive scaffolding on playlist tasks.
- **Framing lessons** around things students could relate to directly in their own lives was an effective strategy used by the educators.

DISCUSSION

As researchers and developers strive to create digital and blended educational resources that support learning for diverse groups of students, including those with learning disabilities, there is a need for research-based guidance and examples of how resources are designed and used with intended users.

The current study addresses this critical need by describing how a suite of blended learning resources, designed to be used by students with disabilities, is used in an informal learning environment with students with moderate disabilities. In addition, it describes the design features and affordances of the resources that may have supported students' access to the learning content. Findings from the study can further our understanding of how children with disabilities interact with digital activities in general, and provide insight into how digital activities can be designed or adapted to be even more inclusive and accessible.

Hero features designed to promote access to science learning can be used successfully to engage students with moderate cognitive disabilities. The findings suggest that educators' adaptations to the resources, including accommodations and modifications, provided students greater access to learning content. In addition, the design features of the resources supported opportunities for students to more deeply engage in the science content. Analysis showed that educators made adaptations to Hero in response to students' individual abilities, mood, preferences, and perceived energy level. This generally meant that children worked as a class on different playlist tasks, rather than in pairs or in a smaller group. By having some children work with an aide, the teacher could better lead the class, as well as help students one-on-one and provide intensive scaffolding on playlist tasks.

ACKNOWLEDGEMENTS

The *Hero Elementary* project is funded by the Ready to Learn Initiative, a grant program administered by the U.S. Department of Education to promote the development and distribution of educational media programming and multiplatform resources to promote school readiness for preschool and elementary age children, particularly in low-income communities.

REFERENCES

CAST, Center for Applied Special Technology (2011) Universal Design for Learning Guidelines version 2.0, Wakefield, MA. Retrieved from http://www.udlcenter.org/aboutudl/udlguidelines/downloads

Cheng, S. C., & Lai, C. L. (2019). Facilitating learning for students with special needs: a review of technology-supported special education studies. Journal of Computers in Education, 1-23.

Goodrick, D. (2014). Comparative Case Studies: Methodological Briefs - Impact Evaluation No. 9.

Lee, O., Miller, E. & Janusyk, R. (2015). NGSS for All Students. NSTA Press.

Maher, C., Hadfield, M., Hutchings, M., & de Eyto, A. (2018). Ensuring rigor in qualitative data analysis. International Journal of Qualitative Methods, 17(1), 1-13.

Panagopoulou, M. S., Tsihouridis, C., Panagopoulou, A. S., Verevi, A., Papalexopoulos, P., & Vavougios, D. (2018). Science Education Adaptations for Non-Textbook Instruction to Students With Learning and Other Disabilities: A Chronological. US-China Education Review, 8(4), 135-144.

Weng, P.-L., Maeda, Y., & Bouck, E. C. (2014). Effectiveness of Cognitive Skills-Based Computer-Assisted Instruction for Students With Disabilities: A Synthesis. Remedial and Special Education, 35(3), 167-180. https://doi.org/10.1177/0741932513514858

Yin, R. K. (2003). Case study research: Design and methods (3rd ed.). Thousand Oaks, CA: Sage.