Science Learning with *Hero Elementary*: Accessible Blended Learning Resources to Reach All Students — Executive Summary

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As digital and blended-learning resources become more prevalent in formal and informal learning environments, there is a growing imperative to design learning resources that allow a diverse range of students access to their instructional content. In particular, there is a need for digital and blended resources that are accessible and engaging for three groups of students: those with disabilities, dual-language learners, and socioeconomically disadvantaged students. These groups are represented at notably high levels in today's classrooms. To address the need to reach diverse populations of student learners, designers of digital and blended science-learning resources are recognizing the value of (a) incorporating design features into their products that support equitable access to instructional content and (b) enabling educators to adapt resources to provide maximum access to the learning content for their students.

Hero Elementary, produced by Twin Cities PBS (TPT), is a multiplatform educational media initiative that supports science and literacy learning for children in grades K–2. The resources, bundled into playlists, include PBS Kids television episodes, digital and analog games, nonfiction e-readers, hands-on activities and scientific investigations, a digital science notebook, as well as educator professional development and resources. The 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.

This report describes a case study that examines the design and use of *Hero Elementary* science resources with K–2 elementary students representing a broad diversity of abilities and cultural identities. The report examines how these resources, designed with equity and accessibility in mind, can support science and literacy learning for students representing a range of backgrounds and identities.

Hero Elementary Learning Resources

Hero Elementary involves an engaging narrative — a school for young superheroes — where kids learn to master their superpowers, such as flying and teleportation, while exploring science. Its diverse group of characters includes Lucita Sky, AJ Gadgets, Sara Snap, and Benny Bubbles, along with their enthusiastic teacher, Mr. Sparks. The characters often use the "Superpowers of Science," practices based on the NGSS Science and Engineering Practices, to help them investigate, observe, make predictions, and figure out solutions to problems that occur in their community. Each *Hero Elementary* playlist is focused on a specific science topic aligned to grade-level standards. *Hero Elementary* playlists can be implemented in person or virtually. Educators learn how to adapt their use of resources to provide greater access to science content for their students. Early in their development process, TPT's resource design team developed design specifications and guidelines for the developers of *Hero Elementary* learning resources. The specifications guide *Hero Elementary* content creators to use an asset-based approach to support students with disabilities, dual-language learners, socioeconomically disadvantaged students, and other student groups that are historically

underrepresented in STEM. Collections of research that informed TPT's design documents included the NGSS, research on STEM identity development (Cook, 2014; Kane, 2012; Martin, 2012; McGee, 2015; Wilson, 2016), literacy for dual-language learners (National Academies of Sciences, Engineering, and Medicine, 2017), and Universal Design for Learning (CAST, 2011).

Study Methods

The equity and accessibility features of *Hero Elementary* resources are specifically designed to support all learners, allowing them to engage meaningfully with science and literacy content. The current case study focuses on two aspects of the resources: design and use. In addition, the case study examines similarities and differences in how *Hero Elementary* is used in in-person settings compared to virtual settings.

The study's guiding questions include:

1. *Do the design features of Hero Elementary support access to science learning for K–2 students, including those identified to have moderate cognitive disabilities, those who are dual-language learners, and those that are socioeconomically disadvantaged?*
2. *What adaptations do educators make to Hero Elementary that are intended to provide greater access to the content for their students? How do adaptations differ for different types of student populations, specifically those with moderate cognitive disabilities, dual-language learners, and those that are socioeconomically disadvantaged?*
3. *What are the similarities and differences in how Hero Elementary is implemented in person and virtually?*

Case studies employ a research approach that provides an in-depth understanding of complex phenomena in authentic settings. Descriptive case studies and are "especially good for . . . getting a rich picture and gaining analytical insights from it" (Thomas, 2011, p. 23). The study employed a holistic design (Yin, 2018), meaning researchers used a single unit of analysis. The study was conducted in four large afterschool programs serving a range of student populations that have been historically underrepresented in STEM, including students identified as having moderate cognitive disabilities, dual-language learners, and socioeconomically disadvantaged students. The programs are located in different regions of the U.S., including the nation's Southwest, West Coast, South, and Southeast regions. Administrators and educators across the four programs participated in the study (n=30). Data collection included administrator and educator interviews, written communication with educators, observations of educator planning meetings, and observations of classroom implementation of *Hero Elementary*. Qualitative analytic methods were used to analyze the data (Yin, 2018). The data, comprised of transcribed interviews and observation notes, were analyzed deductively using a set of external codes developed at the onset of the study based on the research questions, as well as a set of internal codes — that is, codes that emerged during analysis (Miles & Huberman, 1994). The analyses allowed for researchers to discern findings related to the study's guiding questions, including those related to *Hero Elementary*'s design features, adaptations made by educators, and similarities and differences in how *Hero Elementary* is implemented in person and virtually.

Findings

Data analysis resulted in findings related to implementation, the case study's guiding questions, and additional findings related to the study's guiding questions.

Implementation of *Hero Elementary*

All educators reported successful implementation of *Hero Elementary* to support science learning for their diverse groups of learners. Implementation often involved 30–40 minute sessions several times a week. For in-person implementation, students worked on activities individually or in small groups and pairs, working on all playlist activities while one or two educators moved about the room supporting them. Virtual

implementation often involved educators showing videos and conducting investigations via Zoom. Students completed other playlist activities on their own at home.

Hero Elementary Design Features Support Equitable Access to Science Content

Analysis of data from educator interviews and classroom observations produced findings suggesting that many of *Hero Elementary*'s design features supported engagement and learning for diverse groups of learners. Some beneficial features identified in the analysis include:

- Flexible learning environments and multiple modes for learning
- Use of technologies that allow for adaptations, including modifications and accommodations
- Developing STEM identities and connecting to cultural knowledge and experiences
- Learning experiences that connect to students' lives
- Framing science as literacy and providing language and literacy support
- Designing to include discussion and reflection

Typical quotes from educators include:

> *They like the diversity of the characters, like how AJ has autism.*
>
> *The activities encourage them to share their opinions and how to problem-solve situations.*

Educator Adaptations to *Hero Elementary* to Provide Equitable Access to Science Content

Findings also suggest that educators successfully adapted their use of *Hero Elementary* to facilitate students' access to the learning content, including for students with disabilities, dual-language learners, and those that are socioeconomically disadvantaged. Adaptations included:

- Connecting science to children's sense of place, including the physical, historical, and socio-cultural aspects of their local communities
- Empowering children to be active participants in science by connecting to the cultural knowledge and experiences of their families and communities
- Engaging children by using real-world, hands-on experiences
- Providing flexible learning experiences with multiple representations during learning activities
- Facilitating discussion and reflection about children's science experiences
- Supporting science learning by connecting to home and community partnerships

In interviews, educators provided numerous explanations and examples highlighting how they used these types of adaptations to engage their students in meaningful science learning activities. Examples include:

> *We would look at how we can bring in community. Because that was one of the big things [for us], the community.*
>
> *Those kids that learn better using different learning styles, it's all in there and you can scaffold that pretty easily because the lessons are pretty laid out. If you need to make it a little bit easier, there's ways to do that or to add a little bit more to it.*

Differences between In-Person and Virtual Implementation

Educators who had implemented the program both in person and virtually agreed that both methods supported students' science learning and engagement in science. Lack of devices in the home meant that students participating virtually had to use their tablets to communicate via Zoom during class time, limiting their ability to access other *Hero Elementary* activities. Educators reported that many students did not complete all the homework playlist activities that they were assigned to work on at home. However, virtual investigations and other group activities were particularly successful. Students used materials from home to participate in activities, and used Zoom's chat feature to note their predictions and reflections.

- The majority of educators who had implemented the program both in person and virtually said they preferred in-person implementation.

- Educators commented that having students together in a classroom allowed for individual, small-group, and whole-group instruction to take place.
- Educators frequently mentioned the difficulty of observing and providing individual support for students in the virtual environment.

Conclusion

This case study examined the design features of *Hero Elementary* science learning resources and the resources' use with students from a variety of backgrounds, strengths, and identities. The study provides rich examples of design strategies that can guide researchers, resource designers, and educators as they seek to create and use learning resources that can engage diverse learners in science and other content areas. In addition, the study provides evidence of how educator professional development focused on equity and accessibility prompted educators to use research-based practices to provide further access to the learning content with their students.

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