Science Learning with *Hero Elementary*: Blended Learning Resources to Reach Students Identified as Socioeconomically Disadvantaged

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About 24 percent of schools in the U.S. are designated as high poverty, that is, more than 75 percent of students are eligible for free or reduced-price lunch (U.S. Department of Education, 2020). This suggests that a high percentage (about 18%) of socioeconomically disadvantaged students are present in today's public-school classrooms. As the Next Generation Science Standards (NGSS) become more widely adopted, the need for NGSS-aligned learning resources for socioeconomically disadvantaged students is particularly acute. To address the needs of socioeconomically disadvantaged students, designers of digital and digital/non-digital blended science learning resources are incorporating features into their products that support equitable access to instructional content and provide flexibility for educators to adapt resources for students to better access the learning content. This case study examines the design features of *Hero Elementary* and their use with socioeconomically disadvantaged students. The study provides examples of design strategies useful in creating learning resources, and evidence of how professional development focused on equity and accessibility can both provide access to and engage socioeconomically disadvantaged students in science.

Hero Elementary, produced by Twin Cities PBS (TPT), is a multiplatform educational media initiative that includes a suite of digital and non-digital learning resources designed to support science and literacy learning for children in grades K–2. The engaging *Hero Elementary* narrative involves a school for young superheroes, where kids learn to master their superpowers—like flying and teleportation—while exploring science. The diverse group of characters includes Lucita Sky, AJ Gadgets, Sara Snap and Benny Bubbles, along with their enthusiastic teacher, Mr. Sparks (Figure 1). The characters use their "Superpowers of Science," based on the NGSS Science and Engineering Practices, to help them investigate, observe, make predictions, and find solutions to problems they encounter. The resources, bundled into "playlists", include PBS Kids television episodes, digital and analog games, non-fiction e-Readers, hands-on activities and scientific investigations, and a digital science notebook.

Figure 1. Hero Elementary's cast of characters.

Designing and Using Resources with Access in Mind

Early in the development process, TPT's resource design team conducted an extensive review of research to identify best practices in designing science learning resources for socioeconomically disadvantaged students. The team then created design specifications for the development of *Hero Elementary* learning resources to guide content creators to use an asset-based approach to support socioeconomically disadvantaged students and other student groups that are historically underrepresented in STEM. This led to the production of learning resources and educator training intended to provide support for access of socioeconomically disadvantaged students to science and literacy content, including resources and practices that present content in multiple representations, provide opportunities for hands-on exploration, include discussion and reflection about science, use discourse practices, provide language and literacy support, and connect academic content to home culture.

The Case Study

Hero Elementary resources are specifically designed to support socioeconomically disadvantaged students, allowing them to engage meaningfully with science and literacy content. The case study addressed two aspects of the resources: design and use. The study's guiding questions related to socioeconomically disadvantaged students included:

1. Do the design features of *Hero Elementary* support access to science learning for K–2 students identified as socioeconomically disadvantaged?
2. What adaptations do educators make to *Hero Elementary* resources to provide greater access to the content for their students identified as socioeconomically disadvantaged?

The descriptive case study was conducted in four large afterschool programs serving a range of student populations that have been historically underrepresented in STEM; nearly all students served across the sites were socioeconomically disadvantaged. Thirty administrators and educators participated in the study. Data collection included administrator and educator interviews, written communication with educators, and observations of educator planning meetings. Qualitative analytic methods were used to analyze the data. The analyses included data reduction and peer debriefing.

Findings

Data analysis produced findings related to the case study's guiding questions focused on students' experiences using *Hero Elementary* in their afterschool programs. A central goal of the *Hero Elementary* program is to increase science engagement for children from historically underrepresented communities in STEM. Overall, the findings suggest that *Hero Elementary* is effective in engaging socioeconomically disadvantaged students in science learning and in helping them to see science as an academic topic in which they can excel.

Building a STEM Identity

In interviews, educators commented on the relatability of *Hero Elementary* characters to their students and how the characters used the "Superpowers of Science" in ways that were accessible and familiar to their students. Educators also expressed those Hero Elementary provided opportunities for students to express their ideas and opinions regarding science phenomena.

> *"I think they like seeing the Hero Elementary [characters] who look like them. I think they like the fact that they're kids [the Hero Elementary characters] and they're at school. Because they are the Sparks Crew [Hero Elementary cast] and they're in school like them and they're little kids like them and they're still learning how to do stuff just like them."*

Science Connected to Sense of Place/Home Culture Connections

Educators encouraged students to share their own experiences related to the plotlines of the *Hero Elementary* characters and to share their opinions and hypotheses based on their lived experiences and the community around them. In addition to connections to the local context, educators particularly appreciated that *Hero Elementary* exposed their students to experiences and concepts outside of the realm of their everyday lives that they would not otherwise be able to experience, and to think about how their environment is connected to others.

> *"Maybe some of them, they don't have the opportunity to go visit other cities. Now that they have this opportunity to watch something on* Hero Elementary, *so they can start using their imagination. "How do you think it feels? How do you think it smells? How do you imagine that you're there?" Every single part is very important to make them feel connected to what we're talking about."*

Increased Science and Literacy Exposure and Reinforcement

The educators who were working with students identified primarily as socioeconomically disadvantaged reported that the resources were a "good fit" for their students because students could improve their literacy and engage in a variety of learning activities related to science topics, including hands-on and real-world experiences.

> *"I think it's a perfect fit for our program because it implements STEM, it engages the kids, and it has hands-on activities. And by them adding things that we can do virtually [digital games, digital science notebook, e-Readers], well, of course we use those. So, I think it's perfect for us. As far as the educational aspect of it, they are responding because they not only see it, they're getting an opportunity to get involved with it. Doing the experiment, it's just total involvement."*

Conclusion

The current case study examined the equity and accessibility design features of *Hero Elementary* science learning resources and the resources' use with students identified as socioeconomically disadvantaged. The study provides examples of design strategies that can guide 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 socioeconomically disadvantaged students.

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