Science Learning with *Hero Elementary*: Differences in Implementation In-Person and Virtually

Betsy McCarthy, PhD, Daniel Brenner, PhD, Claire Morgan, MA
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As the Next Generation Science Standards (NGSS) become more widely adopted, the need for NGSS-aligned learning resources for diverse learners is particularly acute. To address the need to reach diverse populations of student learners, designers of digital and 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. In addition, developers are producing resources that provide educators flexibility to implement these learning resources in their "in-person" classrooms, or virtually, via distance learning. This case study examines the design features of *Hero Elementary* and their implementation in-person and virtually. The study provides examples of design strategies useful in creating learning resources to reach diverse groups of learners. In addition, the study describes how *Hero Elementary* was implemented by participating educators in-person and virtually via distance learning during the Covid-19 pandemic.

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. *Hero Elementary* can be implemented in-person, virtually, or as a hybrid program, with some activities occurring in the classroom and others via distance learning.

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 for designing science learning resources for diverse learners. The team then developed design specifications for the development of *Hero Elementary* learning resources to guide content creators to use an asset-based approach to support student groups that are historically underrepresented in STEM. This led to the production of learning resources and educator training intended to provide support for diverse groups of student learners to access science and literacy content, including resources and practices that present learning 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 students' home culture.

The Case Study

Hero Elementary resources are specifically designed to support diverse student learners, allowing them to engage meaningfully with science and literacy content in both in-person and virtual settings. The case study addressed two aspects of the resources: their design and their use. In addition, the case study examined similarities and differences in how *Hero Elementary* was used and adapted in afterschool settings, both in-person and in virtual settings.

The descriptive case study was conducted in four large afterschool programs serving a range of student populations that have been historically underrepresented in STEM. The guiding question for the research focused on in-person and distance learning was, *What are the similarities and differences in how* Hero Elementary *is implemented in person and virtually?*

During the spring of 2020, with the onset of the COVID-19 pandemic, two afterschool programs that were implementing *Hero Elementary* in-person had to adapt programming to allow for virtual implementation. Many educators in the study had implemented *Hero Elementary* in-person before schools were closed. Therefore, they could reflect on the differences between implementing *Hero Elementary* virtually and in-person. Other educators included in the data collection and analysis had only implemented *Hero Elementary* either in-person or virtually.

Twenty-five 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

Findings from the data analysis indicate that educators were able to successfully implement *Hero Elementary* in-person and virtually. Although implementation looked quite different in each of the two methods of implementation, both produced, for the most part, lively and productive learning environments. Findings suggest that in both implementation modes, *Hero Elementary's* design features promoted student access to the learning content and that educators were able to adapt resources to address the needs of their students.

Differences in Implementation of *Hero Elementary* Learning Resources

The most striking differences between in-person and virtual implementation of *Hero Elementary* involved the way students interacted with *Hero Elementary*'s learning resources, and the role educators played in these interactions. For typical in-person implementation:

- Educators conducted 40-minute sessions 2-3 times per week.
- Educators used the majority of learning resources, including the episodes, science investigations, and other hands-on activities, digital science notebook, and e-Readers, in whole or small groups or in student pairs, with digital games often played individually or in pairs.
- Educators moved about the classroom, checking on student progress, discussing and reflecting on the science learning aspects of the activities, answering questions, and supporting students who might be struggling.

For typical virtual implementation:

- Educators implemented 30–60-minute sessions 1-3 times per week.
- Educators reduced the number of activities used in each playlist, instead utilizing Zoom to share their screen with students and focus on the television episode or the science investigation.

- Students were encouraged to complete other playlist activities at home on their own time. Educators asked students about their progress during Zoom sessions or via phone calls and sent email and text reminders to students to encourage them to complete playlist activities.
- The majority of participating students had difficulty logging into their *Hero Elementary* account from home due to a lack of internet access, lack of device, or lack of adult or sibling support.
- During virtual Zoom sessions with their class, students had to use their tablets to access Zoom, so could not simultaneously access *Hero Elementary*.
- Several educators welcomed siblings and older students from their afterschool program to join virtual *Hero Elementary* sessions. Older students could support younger ones in using *Hero Elementary* virtually, and older students sitting in on Zoom sessions frequently praised and encouraged younger students as they made predictions and discussed possible outcomes and results.

Similarities Between In-Person and Virtual Implementation

Educators and administrators agreed that both methods of implementation supported students learning and engagement in science. In addition, findings suggest that the equity and access design features of *Hero Elementary* were evident in students use in both modes of implementation.

> *"I think when they get in the older grades, they might think back, 'Oh, I remember seeing that in Hero Elementary'."*

> *"You have a diverse group of characters that you can talk about within the lesson, and they can see, and it talks about [their world]. They can see themselves in the characters… they acknowledge it and see it."*

Adaptations to Conduct Successful Science Investigations Virtually

Educators used different strategies to implement science investigations virtually and in-person but were able to successfully conduct the investigations in both environments with robust student engagement. Adaptations made by educators for virtual implementation of investigations included:

- using the recorded science investigation demonstration videos during Zoom sessions and using the "advance" and "pause" features to discuss and reflect with their students;
- prompting students to try aspects of the investigation with the materials they had on-hand at home and reporting their results to the group;
- asking adult family members to implement steps of the activity that might not be safe for children to do on their own; and
- showing and discussing the video of the investigation with students without doing any of the "hands-on" steps.

> *"We had them run and do a scavenger hunt and find the materials that they actually had at home. And if it was something they didn't have, they just had to look at someone else's screen to see whether it was waterproof or whether it would absorb the water. We had to change up to make it work, to still be able to do the experiment and still have the kids be able to do something hands-on."*

Incentives to Boost Participation and Engagement in Virtual Learning

Educators mentioned that, unlike in-person afterschool sessions, students attending virtually sometimes forgot to, or chose not to, attend. As one educator commented, "They may or may not show up." Nearly all educators implementing *Hero Elementary* virtually mentioned offered incentives including:

- goodie bags for students and their parents to pick up on-site for those students who had fully participated in *Hero Elementary* meetings that week and completed playlist activities at home; and

- prizes for students for participating and demonstrating their science knowledge in games incorporated into Zoom sessions to test students' science learning related to *Hero Elementary* activities.

Reduced Opportunities for Engagement and Participation in the Virtual Format

Educators who implemented *Hero Elementary* both in-person and virtually noted some disadvantages related to engaging students in the virtual format, including:

- fewer possibilities to connect science concepts that students were encountering in *Hero Elementary* to phenomena in their local environment; and
- reduced ability to support students one-on-one when they were struggling; in particular, educators were not able to give the targeted support they normally would provide in-person to their students with disabilities and English learners.

> "*They all participate [in-person and virtually], but in person, you could reach out individually more if you notice that one student needed more attention."*

> *"A girl, she's in one of our special ed classes, I don't know if she's getting on [*Hero Elementary*], because I really don't think she can do it on her own and I don't know if her parents are that good at the technology that we have nowadays.*

One site that served only students with disabilities continued to only meet in person for their afterschool programing including *Hero Elementary* as educators were unable to provide adequate individualized support for students in a virtual setting.

Educators' Reflections on Differences between In-Person and Virtual Implementation

Most educators indicated that they preferred in-person implementation when compared to virtual implementation. However, despite their challenges with virtual implementation, educators frequently mentioned that the flexibility and engaging qualities of *Hero Elementary* contributed to the success of their virtual lessons.

> *"What's so encouraging is that these kids continue to come on [*Hero Elementary*] virtual learning to participate after being in [virtual] school continuously [throughout the school day]. They're enjoying it and they love it. That means whatever we put into them [the lessons] is productive. If not, then they wouldn't continue to return."*

All educators who had used both methods preferred in-person implementation. Educators noted that:

- in-person implementation in a classroom allowed for individual, small group, and whole group instruction to take place;
- virtual implementation made it more difficult to observe and provide individual support for students; and
- a particular positive energy and enthusiasm often arose when students were working together in-person as a group,

> "*It was easier to do it face-to-face because they're here and you can just pass out the materials and show them, this is how it goes. You wouldn't have to do as much [group instruction] either, because they could be on their individual path, like if one person was farther along than the other."*

Conclusion

The current case study examined the use of *Hero Elementary* in in-person and virtual afterschool environments. In addition, it examined the equity and accessibility design features of *Hero Elementary* science learning resources and the resources' use with diverse student learners. The findings suggest that *Hero Elementary* supported engagement and learning in science in both the in-person and virtual implementation modes with diverse groups of K-2 students. 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.

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