Science Learning with *Hero Elementary*: Blended Learning Resources to Reach Students with Disabilities

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Approximately 7.1 million, or 14 percent, of all public-school students in the U.S. have Individualized Education Programs (IEPs) and are receiving special education services. As the Next Generation Science Standards (NGSS) become more widely adopted, the need for NGSS-aligned learning resources for students with disabilities is particularly acute. To address the needs of students with disabilities, 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 learning content. This case study examines the design features of *Hero Elementary* and their use with students with disabilities. The study provides examples of research-based design strategies for creating learning resources, and evidence of how professional development focused on equity and accessibility can both provide access to and engage students with disabilities 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 for designing science learning resources for students with disabilities. 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 students with disabilities 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 students with disabilities to access 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 students with disabilities, 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 students with disabilities included:

1. Do the design features of *Hero Elementary* support access to science learning for K–2 students with moderate cognitive disabilities?
2. What adaptations do educators make to *Hero Elementary* resources to provide greater access to the content for their students with moderate cognitive disabilities?

The descriptive case study was conducted in an afterschool program that provides individualized learning opportunities for students with disabilities across a large metropolitan area in the Southeastern United States. Six administrators and educators participated in the study. All of the students participating in the program had a developmental, learning, and/or physical disability, such as autism, Down syndrome, or cerebral palsy. While *Hero Elementary's* target age group is 5–8, this program also implemented *Hero Elementary* with older children who functioned developmentally at the target age level. 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 data analysis highlight how the equity and accessibility design features of *Hero Elementary* serve students with disabilities and the variety of ways that educators modified and adapted *Hero Elementary* to support their students with disabilities in their afterschool program. Educators agreed that the flexible design of *Hero Elementary*, and the professional development they received, facilitated adaptations they made during instruction that resulted in student learning. Overall, the findings detailed below suggest that *Hero Elementary* features, designed to promote access to science learning, can be used successfully to engage students with moderate cognitive disabilities.

Facilitating Accommodations and Modifications

Nearly all of the educators mentioned making adaptations to *Hero Elementary's* science investigations and other hands-on activities to provide students with disabilities greater access to science content. These included:

- using an interactive whiteboard to view the videos together, review segments during class discussions, and facilitate full participation for students experiencing challenges with small-motor skills needed to manipulate a tablet and with remaining focused while working independently;
- making adaptations to science investigations and other hands-on activities to provide greater access to science content, such as replacing materials in a lesson with objects to which the students could better relate;
- having students participate in group discussions rather than working individually or in in pairs; and
- providing simplified directions for completing tasks one step at a time while modeling the activity for the students.

> *"Using the interactive whiteboard really helped a lot of the kids to understand what it was that they needed to do and it's really been a good thing as far as for them all to be involved in a group discussion … Because some of them need some one-on-one assistance to follow the directions of the tablet. So being able to use the interactive whiteboard to help transition them into the tablet, it is a lot easier to tell them."*

Flexible Learning Environment and Experiences

Educators appreciated the flexibility allowed by the program to choose activities that would meet their students where they were and that they believed students would find the most engaging. Educators also found that given the learning styles and capacities of their students with moderate cognitive disabilities, the interactivity of the hands-on activities and games provided greater engagement and access to the science content. Examples of ways that educators modified the program to meet the needs of their students included:

- using repetition to maximize exposure to scientific concepts and questions included in every lesson;
- implementing multiple activities related to each science topic to reinforce the science content;
- introducing the e-Readers as a whole-group activity to help drive lively discussions that all students, even those with attentional difficulties, were able to focus on, asking leading questions before clicking to the next page; and
- provideing students with a model of what to draw when using the digital science notebook.

> *"...not all of them are good at writing or holding the pencil. And so being able to use their finger, it helps them with the wrist motion of writing. So as long as they're following along, and using the same color, if I'm drawing a red apple, like, "Oh, you draw something." And then sometimes they draw, it's scribbles, but they will point to it and say, "That's my apple." So, they know what they're trying to do."*

Building STEM Identities and Connecting to Cultural Knowledge and Experiences

One educator shared that *Hero Elementary* makes science more relatable for students with disabilities. She said that being able to watch the videos and see relatable characters making sense of science phenomena in familiar contexts supports learning for students with disabilities.

> *"Like AJ [a Hero Elementary character], he has autism and it's very well known in the show that he has autism like, "Oh, I don't like loud things. I don't like when things are a certain way," or stuff like that. And so being able to watch that and see, and them getting over their fears and us acknowledging it, I think it just overall, it makes science easier for us to teach to them just because it's adaptable to their needs."*

> *"Seeing the characters overcome things that they're afraid of or things that they're not comfortable with is great for our kids. Anytime they can see that and see an example of somebody like them. They see this guy [AJ], and [Lucita Sky], she can fly but she's afraid of heights. There's several different instances where you see her overcoming that fear. So for them to see that, that's a great thing."*

STEM as Literacy: Language and Vocabulary

Many students with disabilities were observed using science vocabulary when communicating. One educator mentioned that she had observed some of her students transfer *Hero Elementary's* science knowledge to other situations. Examples of ways educators facilitated literacy learning included:

- adjusting their language to provide more simplified instructions and explanations to students;
- employing less advanced vocabulary to better match what students required to understand concepts and facilitate meaningful inquiry dialogue, and
- framing lessons around things students could relate to in their own lives such as using breathing to calm down.

> *"Actually today, ... we were eating lunch, ... and someone had poured the water out and he was like, 'Oh, you got liquid all over the table.' And I was like, 'Why didn't you just say water?' And he was like, 'We learned liquid yesterday.'"*

> *"[I asked the students] 'Well, can I hold a liquid in my hand?' They were like, 'You can't hold water.' And so, I was pretty proud of that."*

One of the educators shared that it was sometimes challenging for students with disabilities to grasp implied messages in the videos without direct connections to the lessons.

> *"So, the use of subliminal messages may not be the best way of teaching these students. For example, when the characters walked into the movie theater during one video, they were like, 'Oh my gosh, everything looks silly.' If they directly said like, 'Oh, it all looks melted,' that might be beneficial."*

Conclusion

The current case study examined the equity and accessibility design features of *Hero Elementary* science learning resources and the resources' use with students with disabilities. 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 students with moderate cognitive disabilities in science and literacy. 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 with disabilities.

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