Checkout STEM

Expanding Access to STEM-Literacy Experiences

SARA NELSON, CONSTANCE BEECHER, AND JERRI HEID

"I wanted to thank the individuals or individual who came up with the idea for the STEM kits . . . I am a nanny of three boys aged eight to thirteen years old, and all three enjoy working with the problem-solving skills, engineering, science, and other learning opportunities that the kits offer. Thanks so much for making education exciting and fun!"

As the above email illustrates, the response to Checkout STEM (Science, Technology, Engineering, and Math) at the Ames (Iowa) Public Library has been wonderful.

Checkout STEM is a program that works to support the development of STEM and literacy skills through learning events that are engaging and responsive. Each kit includes two carefully chosen children's books, developmentally appropriate play materials, and a research-based activity guide focused around a STEM topic such as coding. We have been pleased, and a little surprised, by the amount of community interest in Checkout STEM. However, given the prevalence of STEM books and toys on the market today, it makes sense that the community would be excited and engaged by these kits.

Closing the STEM-Literacy Gap

Research by Morgan, Farkas, Hillemeier, and Maczuga[1] notes an increasing and persistent STEM achievement and participation gap. As educators, this gap was troubling to us so we began to brainstorm ways to help close it. Stevens, Bransford, and Stevens[2] state that over the course of a year, 80 percent of a child's waking hours are spent outside of school or formal education. Thus, institutions such as the public library can play an important role in developing STEM knowledge and attitudes of children. We decided a good first step would be to create and increase access to high quality STEM-literacy learning experiences for children, especially books and materials that could be checked out at the public library.

These brainstorming sessions in spring 2017 were the start of Checkout STEM, with the goal of expanding access to research-based STEM and literacy experiences for K-3 children and their caregivers. To help meet this goal, Ames Public Library and Iowa State University began a unique partnership. We felt that, by working together, we could leverage our strengths and work to close the STEM-literacy gap through the development of an innovative, engaging, and sustainable program.

Development of Checkout STEM

To begin, we sat down to create a plan for the development of the kits and divided up tasks. The library would choose the books and STEM play materials while the university would work on developing and writing the activity guides. As a



Sara Nelson *is a Postdoctoral Research Associate at Iowa State University supporting both literacy and science education.* ***Constance C. Beecher*** *is an Assistant Professor at the School of Education at Iowa State University. She is an Early Intervention researcher and educator, with an emphasis on language and literacy development.* ***Jerri Heid*** *started her career in the small northwest Iowa library community of Cherokee twenty years ago, then on to the metro area at the Clive Public Library and now at the Ames Public Library.*

group, we worked to create a strong implementation road map to help ensure that this collaboration would be a success.

For the activity guides, we first focused on the development of a learning framework. The Experiential Learning Model based on work from Kolb[3] was chosen due to its strong connection to informal education. This learning model encourages children to first DO an activity, REFLECT on the activity, and then APPLY knowledge learned to other life experiences.

To reflect this learning model, each activity guide first encourages reading a fiction book to help focus the experience around a problem or theme. This is then followed by a variety of hands-on STEM experiences or play (DO). Last, children and their caregivers are encouraged to discuss the experience and learn more about the topic by reading a nonfiction text (REFLECT/APPLY).

The kits needed to be attractive and easy to transport, and we finally settled on plastic bins. Each kit contains two books (one fiction, one nonfiction), materials for STEM play, and a thematic activity guide. The books were chosen based on the following criteria: vibrant language or text, engaging illustrations or photos, correct STEM concepts, and developmentally appropriate concepts and format. Play materials were chosen based on ability to illustrate STEM concepts, sturdiness, ease of availability, and developmentally appropriate format. We were fortunate to receive a grant from the Ames Public Library Friends Foundation to support the development of the kits. In general, grants of about $2,000 to $3,000 are a great fit for starting up this program.

After the books and play materials were chosen, we created one-page activity guides. It took us much longer than anticipated to write one-page documents; we found it tricky to be clear yet concise. University students enrolled in early childhood science methods assisted with the writing. It was a great authentic learning experience for them, and many shared it was a highlight of their semester.

Check Out Process

Before the kits were made available to the public, we finalized our check-out process. The kits are stored in a cabinet by the youth services desk. To check out a kit, children take a tag with the kit name from the Checkout STEM display. Our current seven kits are Bee and Me, Curious Coding, Fabulous Five Senses, Super Slinky, Building Bridges, Humpty Dumpty, and Magic Eye. Each kit can be checked out for three weeks.

Humpty Dumpty kit materials.

Staff then check out a kit to the child and hang the tag inside the cabinet. We ask that these kits be returned inside the library. The kits don't fit through the drop box, and this allows staff to check for any missing or damaged pieces. In addition, videos promoting Checkout STEM and the process for checking them out were created for the library's YouTube channel. For an example, visit https://youtu.be/CLnEtizE7BE.

Feedback and Future Plans

Feedback on these kits has been positive. The kits have now been piloted in six additional libraries across the state with support from an Iowa State University Extension and Outreach grant. This has allowed us to see that they can be successful in both urban and rural public libraries. Based upon circulation data, the most popular kits are Curious Coding, Building Bridges, and Bee & Me.

We do plan to create additional kits. Topics are sometimes spurred by the discovery of an excellent book or by requests from children or caregivers. We are also looking to focus on the creation of Checkout STEAM (STEM + the Arts) kits to include art books and materials.

We'd also like to design kits that complement library programs, such as a program on rockets or force and motion. Our end goal is to create programs and materials that create connections among school, library, and home learning while working to close the STEM-literacy gap. &

All of our activity guides are available free online at www.extension.iastate.edu/humansciences/checkoutstem.

References

1. Paul Morgan, George Farkas, Marianne Hillemeier, and Steve Maczuga, "Science Achievement Gaps Begin Very Early, Persist, and Are Largely Explained by Modifiable Factors," *Educational Researcher* 45, no. 1 (2016): 18-35.
2. Reed Stevens, John Bransford, and Anne Stevens, "The LIFE Centre Lifelong and Lifewide Learning Diagram," *Learning in Formal and Informal Environments*, 2005, accessed September 4, 2018, http://life-slc.org/about/citationdetails.html.
3. David Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Hoboken, NJ: Pearson FT Pr., 2014).