STEM Curiosity Academy

Building the Engineers of Tomorrow

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Using squishy circuits, participants learned that circuits must be closed in order to help electricity flow and light the LED.

"Thank you for the experience of a lifetime," wrote one parent in a survey about the STEM Curiosity Academy. What could make a parent so excited about a library program? A research-based, play-filled program for children entering kindergarten, STEM Curiosity Academy offers children an experience they cannot get at home, and your library can create it, too.

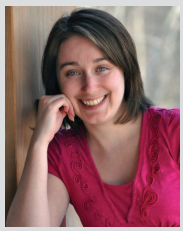
STEM Curiosity Academy grew out of a newspaper article to become a community-wide collaboration between Hood College in Frederick, MD, Frederick County (MD) Public Libraries (FCPL), and the Frederick County Judy Center, which serves children ages 0–5 in Title 1 schools.[1]

In July 2013, Dr. Marisel Torres-Crespo and her students created the first STEM Summer Camp at the Onica Prall Child Development Lab School on the campus of Hood College. When FCPL librarians saw the article, they reached out to learn more and see whether the curriculum could be adapted for library use. Seeing the potential to share the benefits of STEM (Science, Technology, Engineering, and Math) learning as well as training librarians to teach STEM, Torres-Crespo agreed to share her curriculum and train both librarians and staff at the Judy Center. After some adaptation and a new name, the STEM Curiosity Academy successfully introduced STEM concepts to more than one hundred rising kindergarteners in 2014 and 2015.

From STEM Summer Camp to Curiosity Academy

STEM education is an approach to teaching and learning that integrates content and skills of science, technology, engineering, and mathematics. STEM is not a set of activities; it is a mindset of teaching and learning.

Years ago, when this program was developed, the emphasis was in STEM at the college level and also in K-12. That was mainly due to the lack of students interested in STEM-related fields and the decline in scientific innovation in the US.[2] But why not expose four-year-olds to STEM-related activities, to encourage both boys and girls to consider STEM fields as a future profession? The basic concepts of STEM are collaboration, curiosity, exploration, creativity, and critical thinking, skills that are always in demand. They also happen to be intrinsic in young



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The STEM Curiosity Academy offered many opportunities for young engineers to build unique structures.

Proud of their engineering designs!

children.[3] Based on these premises, the original STEM Summer Camp was born.

Research in early brain development denotes that preschool programs provide the best place to start focusing on STEM.[4] It also underlines that practice is essential to make the learning process permanent. And the best way to do that is through play, which is consistent with the importance of preschool children adopting an active role instead of assuming a receptive one.[5]

Four-year-old children are the perfect age because of their growing interest in everything, including science and exploration. However, they are not developmentally ready to sit and behave for long periods of time, so if we wanted preschoolers to learn about STEM, specifically engineering, we needed to create a curriculum in which the learning activities were accomplished through active play.[6] Karen Wohlwend and Kylie Peppler clearly state how allowing preschoolers to be engaged, not only in "hands on activities" but in "minds on experience," will help them to have a meaningful understanding of the concepts.[7] Based on all this, we knew what our preschoolers needed the most: STEM opportunities in which they learn through hands-on and playful activities.

The teachers' role is essential—to provide learning experiences that encourage preschoolers' natural imagination and curiosity (with a prepared teacher guiding the experience).[8] Through that, children developed a valuable tool for life—they will always want to learn more.

With this foundation, Torres-Crespo worked with student teachers to develop an age- and developmentally-appropriate, two-week STEM curriculum for preschoolers with emphasis on engineering. Each day, participants were presented with problems they needed to solve together. The day was divided in different periods of time to give them the opportunity to complete all the steps.

To make the experience more realistic, the preschoolers and the teachers wore engineering lab coats, safety hats, and safety goggles. At that point they were playing make believe—they were engineers—and they took that job very seriously. Based on the pre- and post-tests, children's interviews, and parents' evaluations, it was clear that kids gained greater knowledge with a broad range of play and concrete activities. The camp changed positively the way the participants approached STEM subjects.

Early childhood and STEM education are crucial in children's development and shouldn't be exclusive for a small group of children. Through professional collaboration, Torres-Crespo's original STEM Summer Camp became STEM Curiosity Academy available for free at community locations to impact many more preschoolers, exposing them to STEM learning activities and preparing them for kindergarten.

Funding

Funding for the project was a community effort in the greatest sense of the word. The Academy's focus on school readiness in STEM for at-risk children, especially those served by the Judy Center or those without access to preschool, allowed FCPL Grants Coordinator Marie Slaby and then Children's Services Supervisor Janet Vogel to pitch the project to FCPL's community partners as an excellent investment in the county's future.

Most of our funding came through community grants from the United Way of Frederick County, the Community Foundation of Frederick County, and PNC Bank, as well as fundraising by the Fort Detrick Alliance, which supports STEM education in Frederick County. Each community partner, FCPL, Hood College, and the Judy Center provided funding in addition to staff salaries for the project.

Finally, as word spread about the project, small donations came in from community supporters, including Frederick County Public Schools' teacher of the year and the Asian American Center. By demonstrating the importance of students entering school ready to learn STEM concepts, we were able to convince organizations like the Fort Detrick Alliance that their money was well spent on preschoolers, even though they traditionally

focused only on middle and high school students. As these students are introduced to positive, engaging, and interactive STEM experiences at an early age, they are more likely to continue that interest later in life.[9]

Marketing and Promotion

Promoting the STEM Curiosity Academy at FCPL was more challenging than we first anticipated. The Judy Center had a targeted list of families with children of the appropriate age for the program, but FCPL was attempting to reach children not served by our partners in early childhood education, such as those in Head Start and FCPS pre-kindergarten. As a result, we had to rethink our methods. We posted fliers in low-income apartment complexes and relied on our partners to target families that they knew who might benefit but were not receiving service. In addition, we utilized the library's traditional channels of social media, in-library fliers, and word of mouth to fill out the rosters. We used an online and paper application process to screen and give priority to children who did not attend any daycare or preschool.

Attendance

Nearly 50 percent of the children at the first library academy had no prior care or school experience, although later academies had a lower percentage of such children due to factors that may have included library service area demographics, lack of transportation, and lack of concentrated apartment facilities for publicizing the academies.

Look what I made!

We also learned an important lesson—many of the families of children not enrolled in formal care or school settings send their children to a neighbor or friend for care, and they were unable to get the child to a program each day. As a result, when the library offers the program in the future, it will be as part of a standalone series rather than a required two-week session, although the Judy Center will continue to offer it "camp style" for two weeks in the summer.

Execution

Presented over the course of ten days, each day of the STEM Curiosity Academy highlighted a particular STEM field or topic using picturebooks and activities, in addition to exposing children to a corresponding vocabulary word and STEM profession of the day.

Given the special nature of this program, Torres-Crespo trained a small group of FCPL staff members to present the Academy at all four libraries. This group was supplemented by additional staff members, who both observed and trained at each session. In the morning, staff would arrive early to gather the materials necessary for that day's lesson, prepare each activity, and set up the room. Depending on the complexity of the day's lesson and activities, this process would take fifteen to forty-five minutes.

Each morning, children entered the room, immediately put on their engineering hats and coats, and began their day by building with wooden and cardboard blocks. Following this time for free-play engineering, we welcomed the children to the center of the room, where we introduced the day's theme, read our chosen story, and shared our word and profession of the day.

Afterwards, we introduced our activity or experiment and got down to work! During this time, we not only answered questions children had, but also asked them questions, using the scientific method to hypothesize what they expected would happen and to make observations. We wrote our thoughts in our daily journal, revisiting it following the conclusion of our activity or experiment and examining whether or not our hypotheses were realized. At the end of each day, we sent children home with a newsletter to share with their parents, which discussed the topic and lessons we learned, the activity or challenge completed, and our word and profession of the day.

When presented at FCPL locations, the STEM Curiosity Academy was offered as a two-hour program. However, when presented at the Judy Center, the STEM Curiosity Academy was made available as a half-day camp, offered over the span of two weeks. Held in a classroom at a local public school during summer vacation, this program allowed us to better introduce children to the kindergarten setting, including routine and behavioral expectations; furthermore, the additional time allotted allowed for us to offer extra activities that supported the STEM Curiosity Academy curriculum and to provide food, both as activities materials (i.e. in the building of marshmallow and toothpick structures) and as a mid-morning snack for the longer program.

Results

The STEM Curiosity Academy required some logistical hurdles, but in the end, staff, children, and parents were thrilled with the results. Children who had no prior experience in a group or classroom setting learned to work together and formed friendships. For some, this was the first time their parents could see them interacting with typically developing peers; one parent observed this and decided to have her child tested for a disability. We do not know the outcome, but if early intervention allowed a child to get help as a result of our program before entering kindergarten, that is just one reason why we offered the Academy.

In addition, pre- and post-tests as well as parent surveys indicated that children had learned from the event. Following the program, they demonstrated vocabulary, such as "engineer" and "structure," as well as how to use a ruler and magnifying glass. Parents have reported children continuing to talk about the experience months later, including one who noted, "My son and several STEM Curiosity Academy friends are now in the same kindergarten class. The teacher says that they are very inquisitive and have set the tone for the entire class." Another child regularly shows her branch librarian the ASL signs for "engineer" and "prediction" she learned at the Academy.

For library staff, the STEM Curiosity Academy exposed them to new programming techniques. Some were less comfortable with STEM and reported being more confident using it in a program after following the curriculum. Others learned new techniques and considered it one of their favorite library programs.

For a sample lesson from Day 1 of STEM Curiosity Academy you can try in your library, visit http://bit.ly/FCPLstemacademy. Happy learning!

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