Students Design Sensory Toy for Children with Autism

Flashing lights, sounds, and a ricocheting ball. It's not a game on a New Jersey boardwalk, but a toy with a positive purpose. Kevin Heaney, Rowena Lee, and Stephanie Miller, three Mechanical Engineering students at Stevens Institute of Technology, are using their Senior Design project to create a toy for children with autism that will aid in children's development through play therapy.

The team collaborated with teachers at Academy Learning Center, a Monroe Township school that provides specialized, classroom based instruction, based on the principles of Applied Behavior Analysis for students with autism or autistic-like behavior. Their design won over both the instructors and the children attending the school.

"I was very impressed with the team's ability to observe the interaction of the kids with autism with toys," says Dr. Erik Solberg, Principal of Academy Learning Center. "What they made was quite popular, incorporating light, movement, and sound. It was attractive and interesting for children with autism, and it was unique."

"It really raised the level of interaction," Stephanie explains. "Children that normally didn't talk were talking and taking turns. Even though the toy did not promote talking directly, it did have a positive effect on the children."

"It was very rewarding to see the kids playing and responding to this toy," Kevin adds.

The umbrella term autism denotes a spectrum of developmental brain disorders affecting about 1 in 110 children in the United States, according to a 2006 report by the Department of Health and Human Services, Centers for Disease Control and Prevention. Symptoms include heightened sensitivity to sensory information, difficulty communicating or interacting socially, unusual attachment to objects, and repetitive body movement. The exact cause of autism is unknown, but treatment such as play therapy has been shown effective. Knowing this, the Stevens senior design team set out to create an interactive toy that would appeal to and benefit children with autism.

The toy takes the form of a "plinko" game, in which a child drops or shoots a ball into a box filled with protruding pegs. These pegs light up as the ball bounces off of them. When the ball exits out the bottom, the toy makes a sound. The design seeks to avoid "stimming," the term given to the repetitive movements of self-stimulation, or stereotypy, of people with autism. The game had to be cohesive, with interwoven sensations and movement. "Sometimes a child with autism will focus on a single sensation," Kevin says. "A child might only touch a button for the sensation of the button, not because of the toy's response."

"We didn't want children to stim off of individual components," adds Rowena. "The lights and sounds ensured that the entire toy would be interactive. This way the child will experience the entire toy, rather than just a part of it."

The team worked with Academy Learning Center teachers to create a feasible, effective design based on cause and effect. "The teachers recognized that some designs would pose a difficulty for some of the children and warned us," Rowena says. "Our toy could not require any fine motor skills." The final design offers two levels of difficulty in order to engage children with different abilities. In the first, a child picks up the ball and drops it in from the top. In the second, a child brings the ball to the top with a scoop.

"Throughout the entire design process, from the initial brainstorming and research stages through the prototype building and multiple rounds of user-testing, I was extremely impressed," says Professor Frank Fisher, the team's faculty advisor and Associate Professor of Mechanical Engineering. "I've learned quite a bit by following the group as they progress in their project, and seeing how each element of their design specifically addresses the needs of children with autism."

The design comes from intensive research into autism, its treatments, and toy design. Rowena gave the team an advantage with the design, having worked through Stevens co-op program at Fisher Price in toy research and development, meeting the needs and design specifications of both the offices in Hong Kong and New York City. The product adheres to ASTM standards and is designed so that it could be mass produced with an injection molding process.

In addition to graduating with a solid product with demonstrated effectiveness, all three team members will enter a job after graduation: Rowena at L'Oreal, Kevin at PSEG, and Stephanie at Exxon Mobil. All three team members will graduate with both a Bachelor's of Engineering Degree in Mechanical Engineering and a Master's of Engineering degree in Mechanical Engineering with a focus on Design and Production.

For this senior design project, the engineering was as important as the societal impact. Students identified a critical need, researched problems and potential solutions, and arrived at a design that was effective and changes the world for the better. "We are bridging the gap between technical and social," Stephanie says. "It's great to have the children respond to the toy."

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