Intentional Design for Diverse Learners

BirdBrain Technologies was founded in 2010 to promote gender equality and diversity in computer science and robotics. We believe all students, regardless of background, have a right to learn in deep and joyful ways and make personally meaningful creations.

You may not be surprised that with a degree in computer science you can expect to earn about 40% more than a person with a different college degree and about 3 times as much as a high school graduate over the course of your life. There's a clear advantage to this field, yet of the high school AP computer science test takers in 2020 only 31% were female and 22% were African American or Hispanic, which is a reasonable representation of the students who will pursue computer science degrees in college. (Source: Code.org)

Our products, the Finch Robot and Hummingbird Robotics Kit, were designed to cultivate creativity and engagement in STEAM topics for all students. Thinking outside of the stereotypical robotic look, the Finch Robot resembles a bird and was one of the very first hands-on tools available for computer science education. It offered a fun purpose to learn to code, like successfully navigating a maze! The Hummingbird Robotics Kit also broke stereotypes with its ability to transform craft materials like pipe cleaners and construction paper into artistic robotic creations! Students create robotic displays inspired by poems, interactive models of the human arm, and so much more. With gender-neutral packaging and an open-ended platform to create personally meaningful designs, the Hummingbird Kit attracts students of diverse interests and experiences, and we have research to prove it.

Hummingbird projects help close the gender gaps in confidence and engineering career perception.

The Hummingbird Robotics Kit is the end result of five years of National Science Foundation-backed research at Carnegie Mellon University. The research process that led to the Hummingbird Kit included design feedback from and the direct participation of 59 middle school girls from 2006 (42 girls) to 2008 (17 girls) [2, 3]. In a study [1] of 727 students (24 teachers, 66 classrooms, 2 school district, one rural, one suburban) in which responses were analyzed by gender, researchers found four statistically significant differences between girls and boys:

1. In student responses to open-ended questions, girls provided fewer negative responses to the question "What was the best thing you learned?" than boys (2.4% vs 7.6%).
2. In student responses to open ended questions, girls self-reported improved confidence in technology more often than boys (14.8% of girl responses vs 8.1% of boy responses)

3. In student responses to open-ended questions, girls were more likely to note that one reason they enjoyed the project was because it was multidisciplinary or creative (11.2% of girls vs 2.4% of boys).
4. In a measure of engineering career perceptions, both girls and boys improved on a standardized pre and post assessment. On the pre assessment, boys outperformed girls on this measure; on the post assessment, average scores for girls were no longer statistically different from those of boys. The researchers concluded that female students caught up to their male peers on this measure as a result of the creative robotics experience.

These changes were noted after 8 class periods (45 minutes/period) of Hummingbird-based creative robotics experiences. The projects were integrated into core curriculum, as such, student participants completed these projects as part of required courses.

References:

1. Jennifer Cross, Chris Bartley, Emily Hamner, and Illah Nourbakhsh, Student Outcomes from the Evaluation of a Transdisciplinary Middle School Robotics Program, In Proceedings of the 2017 IEEE Frontiers in Education Conference (FIE), 2017.
2. Tom Lauwers, Aligning Capabilities of Interactive Educational Tools to Learner Goals (Doctoral dissertation), Carnegie Mellon, 2010.
3. Emily Hamner, Tom Lauwers, Debra Bernstein, Kristen Stubbs, Kevin Crowley, and Illah Nourbakhsh, Robot Diaries Interim Project Report: Development of a Technology Program for Middle School Girls, tech. report CMU-RI-TR-08-25, Robotics Institute, Carnegie Mellon University, 2008.