Kindergarten Robotics

Learning about programming and robotics in early childhood

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Background

Young children are surrounded by technology, from their electronic toothbrushes to their parents' new iPad. Everyday children encounter technologies that "know" what is happening in their world, such as automatic paper towel dispensers that "know" when your hands are waving in front or cell phones that "know" how to take pictures or play music. However, very little, if anything, is taught to young children about these technologies (Bers, 2008).

There is a lack of curriculum, technologies, and pedagogical approaches for introducing concepts of new digital technologies, engineering, and computer programming in early childhood.

Our research focuses on teaching and learning robotics (which integrates both engineering and programming aspects) in developmentally appropriate ways (Bers & Horn, 2010).

TangibleK Project

The TangibleK project is an interdisciplinary, NSF-funded project to investigate the use of innovative new technology in early elementary school. To explore what is developmentally appropriate for young children in light of novel human-computer interaction techniques, our team developed an innovate programming environment called CHERP (Creative Hybrid Environment for Robotic Programming).

How CHERP Works

Objective

To evaluate the change in children's ideas about robots before and after participating in a robotics program.

Participants

• 31 young children (mean age 5.5, sd = 0.5) • 68% male, 32% female • 71% Kindergarten, 29% PreK

Robotics Yes/No Statements	PreTest Correct	%	PostTest Correct	%	% Change	Paired Sample T Test	*p*
1. Robots are machines.	28	90.3%	25	80.6%	-10.7%	t = 1.139	p < .30
2. All robots are made of the same materials.**	18	58.1%	28	90.3%	55.6%	t = 3.321	p < .00
3. All robots have moving parts. *	19	61.3%	26	83.9%	36.8%	t = 2.244	p < .04
4. Robots can think by themselves.	18	58.1%	18	58.1%	0.0%	t = 0.000	p = 1.00
5. All robots look alike. *	27	87.1%	31	100.0%	14.8%	t = 2.108	p < .05
6. Robots must be able to move around the room.	11	35.5%	10	32.3%	-9.1%	t = 0.329	p < .75
7. All robots are operated using remote controls.	10	32.3%	14	45.2%	40.0%	t = 1.072	p < .30
8. People tell robots how to behave using a list of instructions called a program.**	19	61.3%	30	96.8%	57.9%	t = 4.062	p < .00
9. Some robots can tell what is going on around them. *	17	54.8%	25	80.6%	47.1%	t = 2.278	p < .03
10. Robots are alive.	22	71.0%	25	80.6%	13.6%	t = 1.000	p < .35

Method

Participants were presented with ten yes/no statements regarding their ideas of robotics before and after exposure to an educational robotics program, TangibleK. Children attended 4 sessions lasting 1.5 hours each over the course of, on average, 18 days. Background, pre-exposure questionnaires to understand if, when, and how the child was exposed to programming and robotics concepts were also collected from both the participants and their parents.

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Discussion

Prior to the intervention, most children in our sample understood that "robots are machines," "not all robots look alike," and "robots are not alive." The children in our sample struggled more with the concept of motor control.

We found significant changes in children's ideas about the physical appearance of robots and children also gained understanding of sensors and moving parts.

Interestingly, we found children's responses remained constant, overall, for children answering Yes to "robots can think by themselves," however, a majority of children report robots are not alive. We hypothesize this contradiction may be due to media portrayals of robots.

The largest significant change seen was when asking the child if robots are controlled by programs. All but one of our participants understood this concept at the end of the program, a promising sign in terms of teaching young children about computer programming as early as kindergarten.

Future Directions

• Further explore children's ideas of robots and other digital technologies in their worlds.

• Ask more specific interview questions about prior exposure to technology and robotics.

References

Bers, M. (2008). Blocks to Robots: Learning with technology in the Early Childhood Classroom, NY: Teachers College Press.

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