Recent related publications

Bers, M.U. (2010). The TangibleK Robotics Program: Applied Computational Thinking for Young Children. *Early Childhood Research and Practice, 12*(2).

Kazakoff, E.R., & Bers, M.U. (2010). Computer programming in kindergarten: The role of sequencing. *Proceedings of the ICERI 2010 International Conference of Education, Research and Innovation*, 15-17 November 2010, Spain: Madrid. (Virtual Presentation available online)

Bers, M.U., and Horn, M.S. (2010). Tangible programming in early childhood: Revisiting Developmental assumptions through new technologies. In I. R. Berson & M. J. Berson (Eds.), *Hightech tots: Childhood in a digital world*. Greenwich, CT: Information Age Publishing.

Horn, M., Bers, M., & Jacob, R. (2009). Tangible programming in education: A research approach. Presented at *CHI'09*, April 2009, Boston, MA.

Bers, M. (2008). *Blocks to Robots: Learning with Technology in the Early Childhood Classroom*. New York: Teachers College Press.

Horn, M.S. and Jacob, R.J.K. Designing tangible programming languages for classroom use. First International Conference on Tangible and Embedded Interaction. *ACM Press*, 2007.

You can find these publications online @ http://ase.tufts.edu/DevTech/publications

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"We are surrounded by technology… However, in the early grades children we learn very little about this…What is unique to our man-made world today is that atoms are not enough. Bits are as important. Computers and electronics are as much part of our world as gears and mechanical structures…We go to the bathroom to wash our hands and the faucets "know" when to start dispensing water…The elevator "knows" when someone's little hands are in between the doors and shouldn't close ... Even our cars "know" where we want to go ... We live in a world in which bits and atoms are increasingly becoming integrated…However, we continue teaching to our children about atoms and bits as two separate realms of experience. In the early schooling experiences, we teach them about polar bears and cacti, which are probably further from their everyday experience than smart faucets and cellular phones."

~Bers, Blocks to Robots (2008)

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Tufts UNIVERSITY

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TangibleK

Robotics, Programming & Powerful Ideas in Kindergarten Classrooms

http://ase.tufts.edu/devtech/tangibleK

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What is TangibleK?

TangibleK is an NSF-funded collaboration between the Child Development and Computer Science departments at Tufts University to explore the use of tangible programming languages for making robots in Kindergarten classrooms.

We are investigating how new programming languages that are developmentally appropriate can engage young children in learning powerful ideas that will help them understand our technological world.

At the heart of this proposal is the claim that, for a variety of reasons, modern graphical user interfaces (GUI) alone are ill-suited for use in early childhood. Instead, this project builds on the emerging tangible user interface (TUI) technology to create a hybrid tangible-graphical programming language for young children called CHERP.

Rather than using just a mouse and a keyboard to write programs to control robots, children can instead construct programs by using connectable wooden blocks. A camera takes a picture of the labeled blocks and the program is then downloaded into a robotic artifact constructed by the child using a LEGO based robotic construction kits.

This approach creates a unique opportunity to understand and separate the intellectual act of computer programming from the confounding factors of modern GUIs and complex mechanical constructions. In turn, it provides a means to better understand the developmental capabilities of young children with respect to computer programming and robotics.

What You Need

- Willingness to learn with your students
- Taking risks in supportive learning environment that might look noisy and chaotic as children engage in building and programming robotic projects
- Commitment to gather consent forms from parents of the students and complete assessment forms
- Dedicate 20 hours of classroom time to our TangibleK curriculum (timing and scheduling is flexible and can be done over the period of several months or a few weeks)
- Comfort with researchers conducting observations in your classroom
- Participation in a training session (scheduled at your convenience)
- A computer for every 4 students (more is better!)
- Recycled & craft materials for enhancing the robot designs

What You Don't Need

- To be an engineer, computer scientist, or robotics expert!

What We Provide

- A pilot-tested technological curriculum that fits with Federal and State (MA) Frameworks (and children love it!)
- Training on the TangibleK program, programming concepts, and robotics
- Programming software, Tangible programming blocks
- Robotics building kits
- Assistance & support from researchers

Developmentally-Appropriate Robotics Curriculum

A fundamental goal of the project, along with the development of new technology, is to test and develop age-appropriate curriculum for use in the Kindergarten classrooms to meet the demands of Federal and State Curriculum Frameworks. Children will explore powerful ideas from robotics and computer programming to expand and support their ongoing classroom learning. For example, in the "Community" curriculum, which correspond to the Massachusetts PreK-K Social Studies Frameworks of "Living, Learning, and Working Together," children build and program peoples, places, and things found in their own communities. The curriculum can be easily adapted for your class! (Check out the Mi Ani video on our website!)

Research

The overarching goal of the TangibleK project is to expand our definition of literacy in the 21st century to include computer programming and robotics in the early years. In particular, we have three primary research objectives for this project:

1. To provide research-based evidence of young children's capacity to understand computer programming and robotics concepts.

2. To develop and test robotics curriculum units, appropriate for kindergarten children.

3. To describe how (and whether) the innovative tangible interfaces facilitate children's learning across multiple domains.