

CD 173: Curriculum for Young Children: Math, Science and Technology

Tuesdays 4:30-7pm, Fall 2011

Eliot-Pearson Department of Child Development

Curriculum Lab

<http://ase.tufts.edu/devtech/courses.html>

Prof. Marina Bers

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Office hours: Mondays 9-10 am and by appointment

Course Description

This course explores how to create and implement curriculum for young children, with a focus in the use of technology to teach math and science, and the development of technological fluency. The underlying philosophy of this course is that people learn better when engaged in making and designing their own meaningful projects; therefore, we will become designers of curriculum and technological tools and we will test it out in a pilot project in an early childhood classroom. We will observe how children play and learn with technology and we will learn how to use on-line tools to document their learning experience. This course has three pillars: design of innovative curriculum and technological environments, observation and evaluation of technology-rich curriculum in the classroom, and documentation of the experience using new technologies.

Course Requirements

- **Readings.** All students are expected to do the readings, and to participate in discussions of the readings in class. Prof. Bers book, “**Blocks to Robots: learning with technology in the Early Childhood Classroom**” will be used. Most of the other readings are linked from the syllabus.
- **Class presentations.** Class time will be organized as discussions, not lectures. To help get discussions started, each session a student will be asked to summarize the readings and describe one question or issue that he or she found particularly provocative in that week's reading.
- **Design studio.** Students will work individually and in teams to experience different educational software, design interactive projects and test them out in the classroom. These experiences are aimed at connecting the readings and the theory with hands-on practice.
- **Empowering ideas paper (Due September 20):** Students will choose a "powerful idea" in the areas of math, science or technology, that empowered them to think in new ways when they were young. They will write a three page report describing what is the powerful idea, a personal recount of how they first encountered it, the struggles to grasp it and the tools, people and related ideas that helped them understand it. They will also specify if and how it relates to the MA curriculum frameworks and the core curriculum.
- **Curriculum proposal presentation (Due November 1):** Students will choose a "powerful idea" in the areas of math, science or technology and design Scratch-based curricular module or set of activities that helps students to explore and understand it. They will present it in class and will engage in peer-review of the proposal
- **Final project:** For the final project students will implement the curricular proposal in a classroom or with a small group of children. Students will report

results from their final project during a final presentation on **December 6**. The final paper should be approx. 15 pages and is due on **Dec 12**.

Tentative Schedule

Day 1 (Sept 6): Introduction and course overview

Papert, S. (1999). [*Papert on Piaget*](#). Time Magazine, special issue on "The Century's Greatest Minds," page105, March 29.

Videos

Design studio (5:30-7) with Amanda Sullivan: WeDo robotics projects building a classroom garden

Day 2 (Sept 13): Powerful ideas; empowering ideas

Duckworth, E. (1972). [*The Having of Wonderful Ideas*](#). Harvard Educational Review, vol. 42, no. 2, pp. 217-231.

Papert, S. (1980). [*The Gears of My Childhood*](#), *Forward to Mindstorms: Children, Computers, and Powerful Ideas Basic Books* (pp. xviii-xxi).

Bers, M (2008) "Blocks to Robots: learning with technology in the Early Childhood Classroom" NY: Teacher's College Press (introduction & chapter 1)

Design studio lead by students: Working with the frameworks and standards

- [NCTM standards](#) (National Council of Teachers of Mathematics [website](#))
- National Science Education [Standards](#)
- [Benchmarks for Science Literacy](#) ([American Association for the Advancement of Science](#)'s website)
- [Pre-school and Kindergarten core curriculum frameworks](#)

- [ITEA standards for Technological Literacy](#)

Day 3 (Sept 20): Learning by doing, learning by designing

Resnick, M., Bruckman, A., & Martin, F. (1996). [Pianos Not Stereos: Creating Computational Construction Kits](#). *Interactions*, vol. 3, no. 6, pp. 41-50.

Bers, M (2008) “Blocks to Robots: learning with technology in the Early Childhood Classroom” NY: Teacher’s College Press (chapter 2)

Papert (1999) [What Is Logo? And Who Needs It?'](#), Introduction: Essay from Logo Philosophy and Implementation (Logo Computer Systems)

Design studio: Students will make a Logo project. Microworlds Logo tutorial (see [LCSI website](#))

Assignment due: “Empowering ideas” paper.

Day 4 (September 27): Young children and computer programming

Resnick, M. (2007). [All I Really Need to Know \(About Creative Thinking\) I Learned \(By Studying How Children Learn\) in Kindergarten](#). Proceedings of the SIGCHI Conference on Creativity and Cognition, Washington, D.C.

Resnick et al [Scratch: Programming for All](#) Communications of the ACM (CACM)

Design studio (5:30-7) with Louise Flannery: Scratch <http://scratch.mit.edu/>

Day 5 (October 4): Scratch day

Developing Scratch modules

5:30-7 Design studio: Working with Scratch with Louise Flannery

Day 6 (October 11) Robotics in early childhood

Bers, M (2008) “Blocks to Robots: learning with technology in the Early Childhood Classroom” NY: Teacher’s College Press (chapters 3 and 4, as well as all four vignettes in the book and interview with Terry Green)

Bers, M. & Urrea, C (2000) [Technological Prayers: Parents and Children Exploring Robotics and Values. In Robots for Kids: Exploring New Technologies for Learning Experiences.](#) Edited by A. Druin & J. Hendler. NY: Morgan Kaufman, pp 194-217

Bers, M. & Horn, M. (In Press). [Tangible programming in early childhood: Revisiting developmental assumptions through new technologies.](#) In I. R. Berson & M. J. Berson (Eds), *High-tech tots: Childhood in a digital world.* Greenwich, CT: Information Age Publishing.

Design studio 5:30-7: Tangible K robotics with Louise and Safoura

Day 7 (Oct 18): Robotics day

Working with the WeDo robotics curriculum (led by Amanda Sullivan)

Day 8 (October 25): Math in early childhood

Brizuela, B. (1997). [Inventions and conventions: A story about capital numbers.](#) *For the Learning of Mathematics*, 17, 1 (2-6).

Brizuela, B. M. & Alvarado, M. (2010). [First graders work on additive problems with the use of different notational tools.](#) *Revista IRICE*, 21, (37-43).

Brizuela, B. M. & Lara-Roth, S. (2002). [Additive relations and function tables.](#) *Journal of Mathematical Behavior*, 20, 309-319.

Earnest, D & Balti, A. A. (2008). [Instructional strategies for teaching algebra in elementary school: Findings from a research-practice collaboration](#). *Teaching Children Mathematics*, May, 518-522.

Guest speaker 4:30-6pm: Prof. Barbara Brizuela

Day 9 (November 1): Learning about math with technology

Kafai, Y. B., Franke, M., Ching, C., & Shih, J. (1998). Game design as an interactive learning environment fostering students' and teachers' mathematical inquiry. *International Journal of Computers for Mathematical Learning*, 3(2), 149–184. [PDF](#).

Andee Rubin (2005) [Math that Matters](#). Threshold. Spring 2005.

Assignment due: presentations of curriculum proposal and peer-review

Day 10 (November 8): No class. Substitute schedule

Day 11 (November 15): Scratch classroom modules

Students will play and test each other's Scratch classroom modules and provide feedback on assessments.

Day 12 (November 22) Science in the classroom

[Landy & Forman \(1999\) Chapter 6: Research on early science education In *The early Childhood Curriculum: Current Findings in Theory and Practice*. \(Ed. By Carol Seefeldt\) NY: Teachers College Press](#)

[Chille, C & Britain, L \(1997\) "Chapter 2: A Constructivist Curriculum Model for Science" \(pp21-31\)](#)

["Chapter 5: How can I make it move?" \(pp75-104\) In The Young Child as Scientist: A Constructivist Approach to Early Childhood Science Education.](#)

[Kilmer,S. & Hofman,L "Chapter 5: Transforming Science Curriculum" \(pp43-63\) In Reaching Potentials: Transforming Early Childhood Curriculum and Assessment Vol. 2 \(Edited by S. Bredekamp & T.Rosegrant\) Washington, DC: NAYEC.](#)

Guest speaker: Museum of Science Boston. “Engineering is Elementary” curriculum

Day 13 (November 29) Little scientists

Papers to be sent by guest speaker

Guest speaker:

Merredith Portsmore, PhD Research Assistant Professor, CEEO

Day 14 (December 6): Presentation of final projects