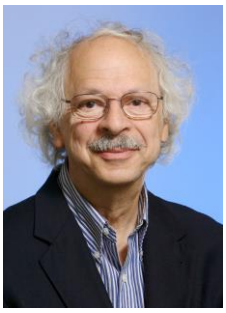

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Teaching children to be problem posers and puzzle-creators in mathematics

Seymour Papert's 1972 paper "Teaching Children to be Mathematicians Versus Teaching About Mathematics" started with the summary statement "The important difference between the work of a child in an elementary mathematics class and that of a mathematician is not in the subject matter…but in the fact that the mathematician is creatively engaged…." Along with "creative," a key term that Papert kept coming back to is project, not problem. Of course, a problem of sufficient size can be a project, but the focus on sustained engagement was central. A mathematical playground with enough attractive enough destinations in it would draw children naturally to pose their own tasks and projects as they universally do in their other personal and group playgrounds and learn to act and think like mathematicians. They would even acquire some of the conventionally-taught content through that play. Physical construction was always available, and appealed to such thinkers as Dewey, but computer programming, newly available to school, suggested a more flexible medium and a model for the ideal playground.

A fact about playgrounds is that children choose challenge. Puzzles tap some of the same personally-chosen challenge that a programming-centric playground offers. Children are naturally drawn to intellectual challenges in the form of riddles ones they learn and ones they make up and puzzles; adults are so attracted to puzzles that books of them are sold even in supermarkets. So what's the difference between (real) puzzles and school problems? What's useful about creating a puzzle or posing a problem? How might puzzles and problem posing support mathematical learning? And what's constructionist about this? This plenary will try to respond to these questions, invite some of your own responses, let you solve and create some puzzles, and explore how programming and puzzling can support mathematics even in an age of rigid content constraints.

About speaker

Paul Goldenberg, distinguished scholar, has been at EDC for over 30 years. He's taught from Grade 2 (self-contained) through middle school and high school mathematics and computer science through graduate school mathematics and psychology for education. Before EDC, he worked at the MIT Logo Laboratory with Seymour Papert and at Bolt Beranek and Newman with Wallace Feurzeig. At EDC, he designs, crafts, and researches curriculum and learning materials for K–12 learners and teachers, aimed at taking advantage of and building on their natural curiosity about, and interest in, mathematics—or rekindling that interest if necessary.

He, Al Cuoco, and June Mark have championed the use of mathematical habits of mind now aggregated within the Common Core State Standards for Mathematical Practice as organizers of curriculum since their initial paper written in the early 1990s. His curricula, including *Transition to Algebra* (lead author June Mark), and *Think Math!*, are used in classrooms throughout the United States. He is principle author of *Making Sense of Algebra*, a new professional book for teachers co-authored with June Mark, Cindy Carter, and others, centered on algebraic habits of mind (including puzzling through problems!), *Developing Essential Understanding of Geometry and Measurement for PreK–Grade2*, coauthored with Douglas Clements, and *Exploring Language with Logo* co-authored with Wally Feurzeig and part of an MIT Press series he initiated and edited that included volumes authored by Al Cuoco, Jim Clayson and others.

With co-PIs June Mark and Brian Harvey, Paul helps lead EDC's initiatives to expand access to high-quality computer science education through a National Science Foundation funded project to develop a high school advanced placement course emphasizing programming and social issues of computing, and taught now to over 2500 students per year in New York City alone.

See Paul's blog-posts about early math.