# Chapter 10
# Mathematics Learning through the Use of Technology

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## ABSTRACT

*Technology can capture young children's attention, motivate them, and help them construct early mathematics concepts in meaningful ways. This chapter examines the nature of children's mathematics learning and how technology can support learning on three levels: (a) a teacher information resource; (b) teaching support; and (c) the learning process for children. It provides a description of how technology tools, when connected to sound inquiry-based pedagogy and formative assessment, can facilitate learning in today's increasingly technological world. Considerations for future research as well as a list of relevant, practical resources for teachers to experiment with in their own classrooms are included.*

## INTRODUCTION: CHARTER SCHOOL VIGNETTE

On a busy October day at Southern Avenue Elementary Charter School, Ms. Shepard's kindergarten children place an electronic popcorn popper at the end of a long roll of butcher paper taped to the floor. They measure the kernels in a measuring cup and pour them into the machine. Trying to bridle their excitement, they discuss their estimations concerning how far the popcorn will land after shooting out of the popping device. The "pop" button is pushed. Much conversation and collaborative problem solving quickly follow as the children observe that the popcorn does not follow their anticipated trajectory but instead pops randomly in all directions. They vote to move the popping machine to the middle of the paper. They furnish additional paper on the sides and then focus on measuring the distances of the popcorn and machine using their hands as tools of measurement. Together, they also count the

popcorn. Ms. Shepard documents the children's learning by taking pictures with her digital camera and recording their words on her laptop computer. All the while, she guides the children to think about and discuss their original hypotheses compared with the actual data collected and the differences in measurements. She also facilitates a conversation about how many kernels actually popped compared to the cup of kernels placed in the machine. The documentation will later serve as a foundation for thinking, learning and teaching as students and teachers revisit the experiment. For now, each child moves to a table to enjoy the edible manipulative while placing a mark on paper for every ten pieces eaten and reflecting on the experience in their journals.

A quick glance around the classroom reveals multiple applications of technology (besides the popcorn popper) that this creative teacher uses to facilitate her young students' development of early math skills. Learning is constructed within the context of inter-disciplinary, fun and meaningful activities that promote higher-order thinking skills. There are estimation jars sorted with differing colored popcorn kernels on a shelf with nearby corresponding printed-out bar graph. In one area of the room, kernels have been carefully placed in squares of a one-hundreds chart, and a nearby computer screen invites a pair of children to work on a similar interactive virtual manipulative hundreds chart. Ms. Shepard has also retrieved popcorn images printed from ClipArt and displays ordinal numbers and kindergarten-level math vocabulary words on them. A completed pie chart shows "Our Favorite Ways to Eat Popcorn" (i.e., with butter, with salt, with butter and salt, plain). The walls and shelves also hold child-created poems (typed with the help of older peers) from Word processing programs, popcorn songs and literature derived from the Internet. The words of children's theories in response to a question posed by the teacher are also evident: Why does popcorn pop? Next to the early theories are text and photos from http://www.tellmewhyfacts.com that supply the answer. (In short, when heated, pressure builds up from the steam of a small amount of water that exists inside the kernel). Finally, a hardcopy of a list of relevant hyperlinks that children can access to play popcorn-themed learning games is embedded on a popcorn themed bulletin board that depicts a web of disciplines and associated standards for learning.

The above vignette illustrates integrated learning opportunities for young children in mathematics, science and literacy supported by the use of technology. This activity uses technology in two ways, as a teacher information resource and as learning process tools for children to support exploration and conceptual development of mathematical skills and thinking. The use of multiple forms of data, graphing, counting and tallies and real materials allow children to think about multiple representations and communication, both important concepts in mathematics. The recording of this investigation through digital media provides data storage for future comparisons of similar investigations so children can identify patterns to make inferences from multiple observations and repeating conceptual activities to support learning. The use of real 3-dimensional objects and the transfer to 2-dimensional representatives through computer games and photos is another important element of mathematical thinking. The active exploration combined with the children's dialogue about the investigation included predictions, comparisons, actual data analysis and planning for adjustment of conditions support the ideas of Vygotsky (1978) through active discourse and social interaction. This teacher prepared a mathematically concept rich environment through the use of technology. Technology as a resource and a learning process tool is changing the educational environments in the field of early mathematics in the United States.

The world of mathematics can be an exciting exploration for the young child when combined with technology in a supportive mathematics rich learning environment. Hasselbring and Glaser

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