Chapter 8
Supporting Mathematics for Young Children through Technology

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ABSTRACT

We owe a debt to our children. We have failed to prepare our students for global competiveness, especially in mathematics. As educators, we need to think about how we can support all learners at all levels, but perhaps we should begin in the early childhood years and concentrate on mathematics. This chapter is about technology in mathematics in the early childhood years. We write this because we believe that technology can be appropriately used in mathematics in the early years. We note however, that technology, like teacher quality, has profound and systemic problems with equity. We also acknowledge that technology for technology's sake is not appropriate, particularly during the early years. We are taking responsibility for our debt, as we outline use of the National Association for the Education of Young Children (NAEYC) standards in conjunction with the National Council of Teachers of Mathematics (NCTM) as a framework for mathematics in the early years. We view technology as one means of supporting those standards.

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INTRODUCTION: THE STATE OF MATHEMATICS EDUCATION IN THE USA

International comparisons of students in mathematics indicate that the United States is lagging behind many countries. *Trends in International Mathematics and Science Study 2003* (TIMSS 2003) and the *Program for International Student Assessment* 2003 (PISA 2003) suggested needs for improvement in mathematics education. The TIMSS 2003 reported U. S. eighth graders performed above the international average in all of the mathematics content areas. However when we look carefully at the data, the eighth graders in the US are within a group of nine countries whose averages are not measurably different from one another. Unfortunately, all of these nine countries are in the second performance tier. Moreover, in 6 of the 15 countries that participated in international assessments, fourth graders demonstrated improved performance--the United States was not among those countries (Gonzales, Guzmán, et al., 2004). These reports remind educators there needs to be more reform in mathematics education. If reform is to succeed the greatest efforts should be focused on young children since this is where formal schooling begins. While there are concerted efforts to address literacy in early childhood education, little attention is paid to mathematics in the early years (National Research Council, (NRC) 2009). Until such time as that reform occurs we can expect to see less than successful outcomes in the later years.

Objectives

After reading this chapter the reader should have a better understanding of how technology can support mathematics learning in early childhood environments. This should include:

- Teaching to address issues of socio-cultural environments
- Mathematics standards for young children
- Technology integration

BACKGROUND

If we are to prepare children for a global society we must also understand how children learn and how technology can be used to prepare young children in mathematics. Technology and mathematics education, along with science education, are main concerns as these are the fields that drive economic innovation globally. Like mathematics and science education, technology education is rapidly moving toward a more collaborative, problem based approach to learning that is based on learning theory and the use of authentic situations and problems (Black & Atkins, 1996). In fact, the learning promoted by technology is the same learning needed for success in our global society (Greenfield, et al., Shaffer & Gee, 2008). Technology engages young learners in authentic tasks that mirror the way professionals identify and solve problems (Shaffer & Gee, 2008). Use of technology allows young learners to use the same or similar tools as those used by professionals in the world of work (Edelson, Gordin, & Pea, 1997).

Supporting Mathematical Learning

Essential to successful problem solving in mathematics is conceptual understanding. Conceptual understanding is demonstrated by an integrated and functional grasp of mathematical ideas (Bruner, Goodnow, & Austin, 1956). Students who understand concepts know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which is it useful. They organize their knowledge into a coherent whole, which enables them to learn new ideas by connecting those ideas to what they already know. It is essential for future success that this learning begins in the early childhood years (NRC, 2009).