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The Role of Computers in Mathematics Teaching and Learning

SUMMARY. Computers can be powerful aids to mathematics teaching and learning. Changes brought about by the availability of these tools and the demands of an increasingly technological society impact curricular content and pedagogy in mathematics education as well as the very nature of mathematical thinking and understanding. This article presents ways in which technology is changing mathematics education, guidelines for appropriate technology use in the mathematics classroom, the impact of computers on mathematics learning, common uses of computers in mathematics education, and issues and concerns related to technology use in mathematics. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: <getinfo@haworthpressinc.com> Website: <<http://www.HaworthPress.com>> E 2001 by The Haworth Press, Inc. All rights reserved.]*

KEYWORDS. Computers, technology, computer use, technology use, mathematics education, mathematics, teaching, learning

Computers play an increasingly significant role in mathematics teaching and learning, so much so that they are considered an important force behind the evolution of mathematics education. As Heid (1997) asserts, "The single most important catalyst for today's mathematics education reform movement

is the continuing exponential growth in personal access to powerful computing technology" (p. 5). This article presents ways technology is changing mathematics education, guidelines for appropriate technology use in the mathematics classroom, the impact of computers on mathematics learning, common uses of computers in mathematics education, and issues and concerns related to technology use in mathematics.

CHANGES IN MATHEMATICS TEACHING AND LEARNING

Van de Walle (1998) outlines three ways technology is changing the nature of mathematics education. The first is that some mathematics skills have decreased in importance. Time taken to perform tedious paper-and-pencil computations, such as long division or constructions such as graphical representations, can be put to better use in more reasoning- and interpretation-oriented endeavors. This approach mirrors ways technology is used in everyday life. Second is the pedagogical idea that mathematics can be taught more effectively using computers. For example, visual and contextual representations that might not otherwise be available can be included. And teachers can use computer-based simulations to provide students with opportunities to work on problem situations that are difficult to experience without technology. As stated in *Principles and Standards for School Mathematics*, "Students can learn more mathematics more deeply with the appropriate use of technology" (National Council of Teachers of Mathematics, 2000, p. 25). Third, some mathematics topics and skills are more accessible or can receive greater emphasis. Data analysis is a prime example. The Internet provides access to a plethora of information that—combined with data-analysis tools and computer-generated graphs and tables—allows children to gather, represent, analyze, and interpret data at earlier ages and in expanded ways. Adults also have the opportunity to gain insight into new mathematical methods. A discussion recently took place on a mathematics educators' listserv in which one participant shared a new technique for simplifying a radical under a radical, which he had just learned while using the algebra software *Maple* by Waterloo Maple. Motivated to investigate, he learned that the method had been around for centuries but is no longer taught in school. This led him and a friend to explore how the method worked.

These changes impact mathematics content and curriculum, instructional methodologies (including assessment), learning styles, and the nature of mathematical thinking and understandings (Connell & Abramovich, 1999; Heid, 1997; National Council of Teachers of Mathematics, 1998; Schwartz & Beichner, 1999). The National Council of Teachers of Mathematics (NCTM) (1998) contends, "When a curriculum is implemented, time and emphasis must be given to the use of technology to teach mathematics concepts, skills, and