

## Technology in Teaching and Learning Mathematics

A Position of the National Council of Teachers of Mathematics

**Question:** What is the role of technology in the teaching and learning of mathematics?

### NCTM Position

It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students.

Technological tools include those that are both content specific and content neutral. In mathematics education, content-specific technologies include computer algebra systems; dynamic geometry environments; interactive applets; handheld computation, data collection, and analysis devices; and computer-based applications. These technologies support students in exploring and identifying mathematical concepts and relationships. Content-neutral technologies include communication and collaboration tools and Web-based digital media, and these technologies increase students' access to information, ideas, and interactions that can support and enhance sense making, which is central to the process of taking ownership of knowledge. Findings from a number of studies have shown that the strategic use of technological tools can support both the learning of mathematical procedures and skills as well as the development of advanced mathematical proficiencies, such as problem solving, reasoning, and justifying (e.g., Gadanidis & Geiger, 2010; Kastberg & Leatham, 2005; Nelson, Christopher, & Mims, 2009; Pierce & Stacey, 2010; Roschelle, et al., 2009, 2010; Suh & Moyer, 2007).

In a balanced mathematics program, the strategic use of technology strengthens mathematics teaching and learning (Dick & Hollebrands, 2011). Simply having access to technology is not sufficient. The teacher and the curriculum play critical roles in mediating the use of technological tools (King-Sears, 2009; Roschelle, et al., 2010; Suh, 2010). Teachers and curriculum developers must be knowledgeable decision makers, skilled in determining when and how technology can enhance students' learning appropriately and effectively (ISTE, 2008). All schools and mathematics programs should provide students and teachers with access to instructional technology—including classroom hardware, handheld and lab-based devices with mathematical software and applications, and Web-based resources—together with adequate training to ensure its effective use.

Programs in teacher education and professional development must continually update practitioners' knowledge of technology and its application to support learning. This work with practitioners should include the development of mathematics lessons that take

advantage of technology-rich environments and the integration of digital tools in daily instruction, instilling an appreciation for the power of technology and its potential impact on students' understanding and use of mathematics (Nelson, Christopher, & Mims, 2009; Pierce & Stacey, 2010). In addition to enriching students' experiences as learners of mathematics, use of these tools maximizes the possibilities afforded by students' increasing knowledge about and comfort with technology-driven means of communication and information retrieval (Gadanidis & Geiger, 2010; Project Tomorrow, 2011).

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