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Teaching Mathematics with Technology: Reflecting on Our Progress and Looking Ahead

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Teaching mathematics with technology:
Reflecting on our progress and looking ahead

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The use of technology in middle grades mathematics classrooms has changed mathematics teaching and learning. Mathematical tools, including calculators and computers, have revolutionized mathematics instruction, helping students make connections between mathematics and real-world phenomena (NCTM, 1989). As we begin the 21st Century, we can reflect on the many advances technology has provided, and ponder what possibilities the future might hold for our classroom teaching in the middle grades.

Research has shown many advantages of the use of technology in the mathematics classroom. Technology can individualize instruction, allowing students to work at their own pace to solve mathematics problems. On the other hand, technology may encourage students to work collaboratively in addressing multiple dimensions of a complex problem solving task. Its imperative style can provide nonjudgmental and informative feedback when problem solving breakdowns occur. Technology potentially encourages students' personal constructions of mathematical concepts by assisting them in managing their thinking processes. It allows the teacher to act as a facilitator instead of a "dispenser of knowledge." Technology enables complex and realistic problem situations to be created in meaningful contexts which present teachers with opportunities to integrate mathematics to real world applications. Finally, it has the potential for improving student attitudes about mathematics.

Technology use in Grades K-12 is essential as students and teachers live and work in the 21st Century. The use of calculators and computers are an integral part of not only mathematics instruction, but students' and teachers' daily lives. Calculators should be available to all students. Tactile feedback of graphics should be available for demonstration by the teacher, as well as for individual student and group mathematical explorations. Students need opportunities to learn to use appropriate mathematical tools for specific problem situations. Teachers can promote the creation of mathematical representations such as models, pictures, diagrams, tables, and graphs. The usefulness of technology is appropriate in various problem solving situations in which students develop procedures and learn to interpret the results of computations performed with these tools.

A number of research reports on the use of technology in middle grades mathematics classrooms and professional development opportunities for the acquisition of technology skills have increased significantly in the last 30 years, the integration of technology into today's middle grades mathematics programs does not reflect this rapid increase. Reports indicate that teachers in middle grades used calculators in their mathematics classes at least once a week (Weiss, 1994) and only 20% of eighth-grade teachers had a computer in their classroom (National Education Goals Panel, 1994). Additionally, teachers in grade 8 report that they are "not very prepared" or "not at all prepared" for using computers (55%) and calculators (8%) (Lindquist, 1997). A number of factors contribute to technology use in our nation's mathematics classrooms including: the cost of these technologies, the lack of available resources for implementation, and the lack of professional development for teachers who want to learn to use these tools. In fact, many students arrive in middle school with far greater experience and expertise in the use of technology than their teachers possess.

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Web Sites all over the world. Email allows students and teachers to engage in dialogue with other classrooms around the world of mathematics. These technologies give students and teachers access to the ideas and innovations of scientists and mathematicians they might never have the opportunity to meet. The Internet is a middle school classroom that is available 24 hours a day, and 7 days a week. The teachers are the students and the students are the teachers, and communication is two-way. Middle school students can engage in discussions and the development and sharing of their ideas and innovations with other classrooms, teachers, and mathematicians who can add to the mathematical ideas being developed. Online collaborative web pages that link information for teachers and students can be found at www.unc.edu/depts/cmtp/programs/mgmmlinks.html for the Cognition and Technology Group at Vanderbilt University, and the Middle Grades Teachers Project web page created summer 1999. A web page of mathematics teaching links for middle grades teachers can be found at www.math.com. Teachers and students have become developers of technology, finding ways to effectively use these tools to engage in the teaching and learning of mathematics. By allowing students to explore both two-dimensional and three-dimensional geometric figures on the computer screen, students can develop and create mathematical ideas and to describe the relationships they discover. Logi is also used with the computer to draw angles and create geometric figures as students investigate and try various conjectures. Information is given to the computer and a "turtle" draws the programmed commands. Other computer applications that have been successful in mathematics classrooms include spreadsheet, databases, and statistics packages. Students can use spreadsheets to get immediate feedback while using trial and error to solve a problem. Students begin by seeing the trial and error and error in systematicity in order to solve problems efficiently using a spreadsheet. Students begin to see the power of mathematical relationships as they see the spreadsheet. A database can be used to compile large amounts of data as a systematic way about the students themselves or other gathered information sets. Main categories in the database called "fields" are manipulated and analyzed allowing students to make interpretations and conjectures about the information (see Browning & Channell, 1992). Finally, statistics packages allow students to manipulate large amounts of "messy" real-world number, numerical information and to create a variety of graphs to interpret mathematical problems. Students can see the different solutions that result when various graphs are used to report the data (see Parker & Widmer, 1992b).

CALCULATORS IN THE MATHEMATICS CLASSROOM

The calculator has transformed many middle grades classrooms, where the emphasis was on computation, to classrooms where students are actively involved in problem solving. In 1984, NCTM (1989) recommends the use of the calculator at all grade levels. The use of calculators in the classroom allows students to manipulate large amounts of "messy" real-world numerical information and to create a variety of graphs to interpret mathematical problems. Students can see the different solutions that result when various graphs are used to report the data (see Parker & Widmer, 1992b).

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REFERENCES