

The Use of Technology in the Learning and Teaching of Mathematics, Position Paper

National Council of Teachers of Mathematics

Technology is changing the ways in which mathematics is used and is driving the creation of new fields of mathematical study. Consequently, the content of mathematics programs and the methods by which mathematics is taught and learning assessed are changing. The ability of teachers to use the tools of technology to develop, enhance and expand students' understanding of mathematics is crucial. These tools include computers, appropriate calculators (scientific, graphing, programmable and so on), video-disks, CD-ROM, telecommunications networks by which to access and share real-time data, and other emerging educational technologies. Exploration of the perspectives these tools provide on a wide variety of topics is required by teachers.

It is the position of the National Council of Teachers of Mathematics that the use of the tools of technology is integral to the learning and teaching of mathematics. Continual improvement is needed in mathematics curricula, instructional and assessment methods, access to hardware and software, and teacher education.

- Although the nature of mathematics and societal needs are forces that drive the curriculum, the opportunities that technology presents must be reflected in the content of school mathematics. Curricular revisions allow for the de-emphasis of topics that are no longer important, the addition of topics that have acquired new importance and the retention of topics that remain important. In the implementation of revised curricula, time and emphasis are to be allocated to the topics according to their importance in an age of increased access to technology. Instructional materials that capitalize on the power of technology must be given a high priority in their development and implementation. The thoughtful and creative use of technology can greatly improve both the quality of the curriculum and the quality of students' learning.
- Teachers should plan for students' use of technology in both learning and doing mathematics. A development of ideas is to be made with the transition from concrete experiences to abstract

mathematical ideas, focusing on the exploration and discovery of new mathematical concepts and problem-solving processes. Students are to learn how to use technology as a tool for processing information, visualizing and solving problems, exploring and testing conjectures, accessing data and verifying their solutions. Students' ability to recognize when and how to use technology effectively is dependent on their continued study of appropriate mathematics content. In a mathematics setting, technology must be an instructional tool that is integrated into daily teaching practices, including the assessment of what students know and are able to do. In a mathematics class, technology ought not be the object of instruction.

- Every student is to have access to a calculator appropriate to his or her level. Every classroom where mathematics is taught should have at least one computer for demonstrations, data acquisition and other student use at all times. Every school mathematics program should provide additional computers and other types of technology for individual, small-group and whole-class use. The involvement of teachers by school systems to develop a comprehensive plan for the ongoing acquisition, maintenance and upgrading of computers and other emerging technology for use at all grade levels is imperative. As new technology develops, school systems must be ready to adapt to the changes and constantly upgrade the hardware, software and curriculum to ensure that the mathematics program remains relevant and current.
- All professional development programs for teachers of mathematics are to include opportunities for prospective and practicing teachers to learn mathematics in technology-rich environments and to study the use of current and emerging technologies. The preparation of teachers of mathematics requires the ability to design technology-integrated classroom and laboratory lessons that promote interaction among the students, technology and the teacher. The selection, evaluation and use of technology for a variety of activities such as

simulation, the generation and analysis of data, problem-solving, graphical analysis and geometric constructions depends on the teacher. Therefore, the availability of ongoing in-service programs is necessary to help teachers take full advantage of the unique power of technology as a tool for mathematics classrooms.

The National Council of Teachers of Mathematics recommends the appropriate use of technology to

enhance mathematics programs at all levels. Keeping pace with the advances in technology is a necessity for the entire mathematics community, particularly teachers who are responsible for designing day-to-day instructional experiences for students.

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Jones Collected One Dollar

"While we're waiting for the others," said Jones to Brown, "let's do something with these dice."

"Okay," said Brown. "What do you suggest?"

"We'll each throw two dice," said Jones, "and multiply together the numbers which turn up. For example, if you throw a 6 and a 3, your product is 18. Then the one with the lower product pays the other \$1 per point on the difference. One's maximum gain would thus be \$35."

"Suits me," said Brown. "If we get the same product, we both throw again?"

"That's right."

Jones threw first. His throw produced a 4 and a 3.

"Ha," he said. "That's not too bad. There are 19 chances in 36 that you get a lower product, and only 13 chances that you get a higher one . . . Like to pay me a dollar to call the whole thing off?"

"I think I'd better," said Brown. "You're not pulling my leg about the odds?"

"Indeed I'm not," said Jones.

So Brown paid \$1. Was he well advised to do so?