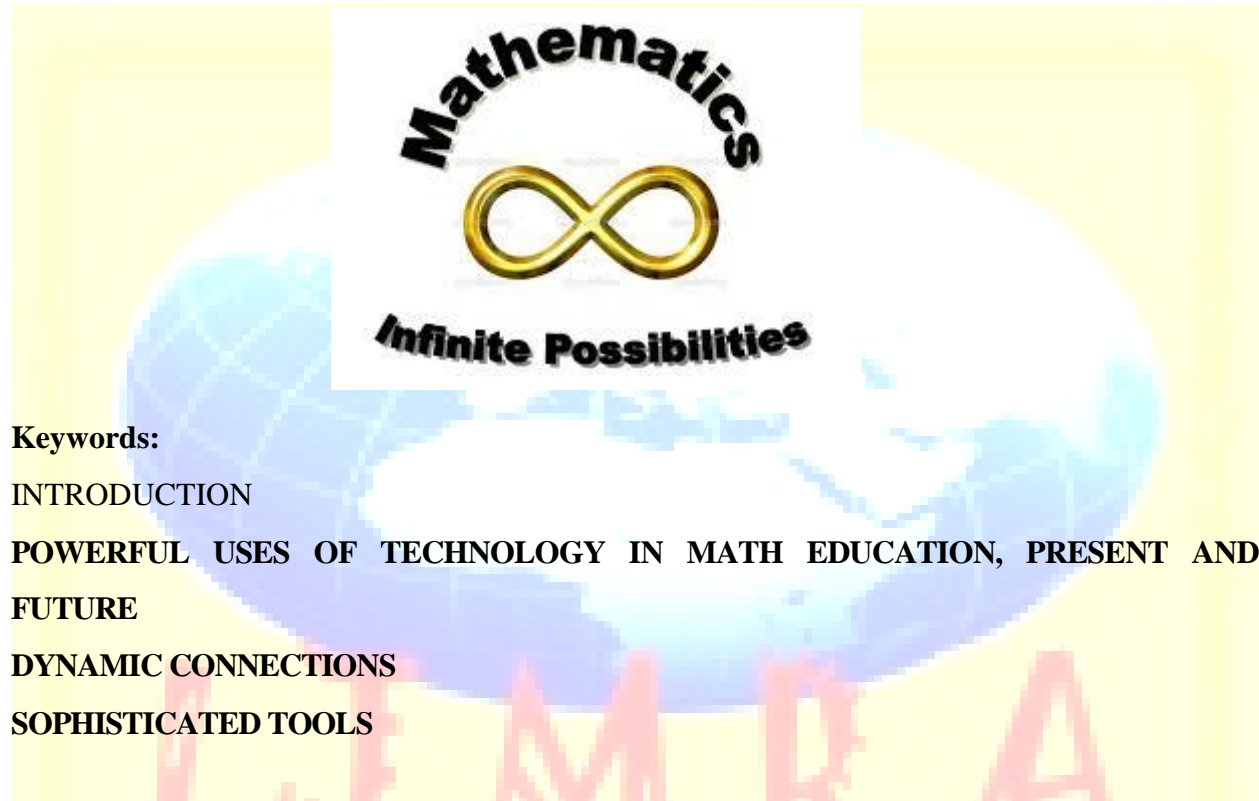


**TECHNOLOGY MEETS MATH EDUCATION:
VISUALIZING A PRACTICAL FUTURE**

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- INTRODUCTION
- POWERFUL USES OF TECHNOLOGY IN MATH EDUCATION, PRESENT AND FUTURE
- DYNAMIC CONNECTIONS
- SOPHISTICATED TOOLS

Due to the popularity of electronic gadgets and its emergence as the dominant technology in the world of education both inside schools and out—and that significant changes in the way we teach and learn will result from their presence. I want to temper our expectations with a practical view of where schools and classrooms are now and how much they might change in the next decade. But I firmly believe that simultaneously considering both the vast potential of technology and the current realities of schools can lead us to creative solutions to problems we might not otherwise have considered. In this situation, practicality and therefore necessity, may indeed be the mother of invention. The question which has emerged for many educators, seeks to

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establish, 'What are the effects of the technology on teaching and learning?

The pairing of mathematics and technology has a long history. This paper insists that, rather than looking at math education from the perspective of the computer, we must look at computers from the perspective of mathematics education. The primary tenet of this paper is that the role of technology in math education must be in service of goals we hold for student's mathematical knowledge and expertise.

As we can see that the present and future roles of technology in math education are both powerful and problematic; we need to paint a picture that takes advantage of the potential of technology without falling into the technology = computation trap. There are indeed many significant opportunities that go far beyond this impoverished image and I will describe several below. But it is important to note before jumping into descriptions of several compelling uses of technology in math education, that the existence of these opportunities does not guarantee that they will be used effectively—or at all. The effects of technology on education and on society in general are emphatically sociotechnical, that is, the technology has an effect only through people's uses and attitudes, in this case, in particular, through pedagogical philosophy. *Technology in a vacuum is just that—technology in a vacuum.*

The seeds of most of the potential future uses of technology in math education are present in today's possibilities, although we are just beginning to learn how to take advantage of them. In the following sections, I will discuss several categories of technology use, noting the present situation and future possibilities. The structure of the rest of this paper will be:

1. Descriptions of five powerful uses of technology in math education, present and future;
2. A consideration of the factors that are necessary to fulfill this potential;
3. Some concerns about the integration of technology into math education;
4. A brief closing restatement of the dilemma

POWERFUL USES OF TECHNOLOGY IN MATH EDUCATION, PRESENT AND FUTURE

As a way of organizing the ways in which technology may have substantial and significant effects on mathematics education, I have chosen five types of opportunities afforded by computers, calculators, the Internet/Web, and associated input and output devices.

DYNAMIC CONNECTIONS

Mathematics is most often thought of as an "abstract" topic, populated by symbols and invisible concepts. For many students, this lack of a visual representation makes it difficult to make connections between a mathematical expression and the situation to which it refers. Technology can help here; computers, in spite of their early image as calculating machines, are decidedly visual and provide a medium in which visual representations can be made dynamic. Students do not have to be stuck with a description in words and symbols OR with a diagram in a book that that can't be examined or explored.



SOPHISTICATED TOOLS

Many authors have noted the growing importance of numeracy in our lives; few jobs are immune from a need for mathematical sense-making. As a result, many workplaces now provide workers with an integrated tool set (spreadsheet, calculator, graphing calculator, graphing/data analysis tools) and expect that they will have the expertise to use them effectively. Part of the responsibility of math education is to "keep up" with these developments in order to prepare

students for the work world. Having such a set of tools widely available to students also has the potential to significantly change the curriculum—to give students access to mathematical topics and insights by removing computational barriers to inquiry. There are portal for mathematics educators and as a kind of social center for the mathematics education community.

On-line professional development.

Mathematical communities for students

Possibility of home-school connections

Availability of data

The Web will only get larger, with faster connections and more information. We can anticipate that as the amount of material on the Web increases, the difficulty of sifting through all the resources will increase as well. In addition, many of the powerful uses of the Web require human infrastructure as a foundation—organizing a coordinated data collection activity or a math competition must begin with personal contact that can then make the best use of the Web's capabilities. Getting schools connected to the Internet has been a major policy goal for the past several years; now that we've come a long way toward achieving that goal, it's time to look more critically at the possible uses we might make of these electronic connections.