Computers in Mathematics Education: A "Not Really for the Researcher" Review of Recent Unique Findings

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There is a great deal of research on the use of computers in mathematics education. Finding many reviews of research with similar conclusions and using similar resources, a review of some of the less common research conclusions would be useful and interesting to mathematics educators.

Although the research results presented here must be viewed with caution, mathematics teachers should keep them in mind as they use computers in their classrooms. For this review a publication date of 1986 or later was used; in theory, this limited the research to approximately 1985 or later.

Hativa and Schorer's (1989) findings from a 2-year study of 99 disadvantaged and 112 advantaged mathematics students in grades three through six points to a widening gap between advantaged and disadvantaged, between high- and low-aptitude students, and between boys and girls. That is, those who benefit most from computer-based drill-and-practice in arithmetic are the advantaged, high-achieving students.

Bahr and Rieth (1989) and Moore (1988) investigated the use of the computer with special learners in mathematics. Bahr and Rieth (1989) used instructional games and drill-and-practice software with junior and senior high school learning-disabled mathematics students. Student performance using the computer was always the same or better than the non-computer base line condition. They concluded that computers could contribute to the education of the learning-disabled student but should not replace teacher-based instruction. Moore (1988) evaluated teacher affect and computer assisted instruction (CAI) on 117 seventh- and eighth-grade students in the lowest remedial mathematics classes. She found the most effective combination to be a positive teacher who uses CAI. Even though CAI is helpful for increasing low-ability mathematics student achievement, it is doubtful that computers can overcome teachers' affect or the influence of a poor teacher.

Three studies, along more traditional lines, examined the relationship of computer anxiety, mathematics anxiety, and/or sex differences. Hadfield, Oakley, Maddux, Cleborne, and Hart (1989) found that Logo instruction did not have a significant effect on the mathematics anxiety of 59 eighth-grade general mathematics students. Gressard and Loyd (1987) investigated the effects of mathematics anxiety and sex differences on computer attitudes. Their study suggested that," . . . math anxiety may be a small but important factor in the high computer anxiety and low computer confidence and/or liking of some junior high, high school, and college students" (p. 134). Another finding of interest was that there was no significant difference between males and females regarding computer anxiety. Collis (1987) examined sex differences in association with student attitudes toward mathematics and computers. She found from her study of 1,818 eighth- and twelfth-grade students that female students were more likely than male students to associate negative attitudes toward mathematics with negative opinions about computer use. Her results did not support the assumption that providing computer experience in a mathematics class improves female student attitudes toward either computers or mathematics.

Three recent studies examined the relationship between mathematical problem solving and computer programming. Blume and Schoen (1988) examined the mathematical problem solving performance of eighth-grade programmers and nonprogrammers. They found that programmers used systematic trial more frequently and checked for and corrected more errors in their potential solutions than did nonprogrammers. They suggested that an explanation of differences may be the transfer of processes used in computer programming to solving mathematical problems; however, programmers and nonprogrammers did not differ in their use of planning processes, frequency, or effectiveness of use of variables and equations or number of correct responses. Similarly, McCoy and Burton (1988) concluded from their study of the relationship of computer programming and secondary mathematics that, "after programming instruction, both Ability to Use Mathematics Variables and Mathematical Problem Solving Ability scores were significantly improved" (p. 165). A third study by McCoy and Dodi (1989) also found that experience with computer programming increased problem-solving achievement in mathematics.

Damarin, Dziak, Stull, and Whiteman (1988) investigated the effect of computer instruction in estimation on 108 high school mathematics students. Their sample included two ninth-grade general math classes, two tenth-grade algebra I classes, and one twelfth-grade geometry and trigonometry class. They found significant increases in students' abilities to solve estimation problems as a result of using computer based instructional materials. These increases occurred in all grades and all courses.

In a study of personality characteristics of 49 ninth-grade

students who were successful with computers, Lutz, Durham, and Coble (1988) found that successful computer users appear to be much like students successful in any academic area. They suggest that these might be students who are self-assured, independent, and intelligent.

Johnson, Johnson, and Stanne's (1986) study of 74 eighth-grade students showed that computer-assisted cooperative instruction promoted greater achievement, more successful problem solving, and more task-related student-to-student interaction while increasing the perceived status of female students. They suggested that teachers who wish to maximize achievement when using computer assisted learning, should structure lessons cooperatively rather than competitively or individually.

Conclusions and Summary

The following conclusions and summary are based on the research findings and deserve serious consideration. The reader is cautioned, however, that they are based on very limited data and should be accepted as highly tentative. In fact, the reader would be best advised to view them as suggestions for further investigation.

1. Computer-assisted lessons should require students to work cooperatively rather than competitively or individually.
2. The commonly referred to sex bias regarding the use of computers in mathematics may be disappearing or perhaps never existed. This is contrary to past studies/opinions which have tended to support the belief that males are more successful with computers and mathematics than females.
3. The use of computers in elementary mathematics classes may widen the gap between advantages and disadvantaged and high- and low-aptitude students.
4. Students who use computers successfully are probably going to be the same ones who are successful in other areas--the self-assured, independent, and intelligent.
5. Although computers are not a panacea, it does appear that they should be one of the tools used to improve students' problem solving skills.
6. A positive teacher using computers appears to be the best teaching combination with the lowest remedial mathematics students; however, use of the computer will not overcome the affect of a teacher.

The classroom teacher should keep in mind that in spite of all the good that can result from the use of computers, there can also be negative outcomes and that computers will not do their job for them.

A Final Observation

The computer appears to be a successful teaching tool when it is used by good teachers using appropriate teaching methods. It will make a good teacher better; it will not make a poor teacher an excellent teacher. Someone once said, "Teachers who are afraid they will be replaced by a computer probably should be" (Anonymous).

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