Socio-Economic Disparity and Technology Use in the Urban Classrooms

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Abstract: Over the past fifteen years a considerable amount of research has been devoted to study of the socio-economic disparities in mathematic instruction, technology and its application in the mathematics classroom. With the call for curricular and instructional reform, educational institutions have embarked on the process to reform their educational practices to aid the urban student in their quest to obtain a quality mathematic and science based education with the integration of technology. The study performed was to reexamine the socio-economic disparities in technology application and to provide empirical evidence of whether these disparities continue to exist and their effects these factors have on student achievement in the mathematics classroom. The results of this study showed an overall positive relationship regarding the use of technology interventions within the mathematics classroom with levels of student achievement, showing a clear signs of continued disparities within mathematics classroom.

Educational institutions have called for instructional and curriculum reform that includes active engagement of students, quality assessments, and the increased and innovative use of technology applications to promote quality teaching and active student learning (U.S. Department of Education, 2001). This is especial true in the field of mathematics where organizations such as the National Council of Teachers of Mathematics (1989, 2000), Mathematical Science Board (MSEB, 1991), and Mathematics Association of America (1991) have stress that technology is essential in teaching and learning mathematics. The underlying assumption of these organizations and math educators alike is that technology will enable students to explore mathematics more in depth and will allow them to study topics that were previously impractical (Garofalo, 2000). However, in order for technology to have greatest impact on our educational system, all students must have access to technology. For that reason technology has the potential to narrow the achievement gap if equally distributed or widen the gap if only accessible to selected groups in the educational system (Kulik, 2002; Waxman, Connell, & Gray, 2002).

Over the past 15 years a considerable amount of research has been devoted to socio-economic disparity in technology availability and use in the mathematics classroom (Becker, 2001; Garofalo, 1999; Means, 2001; National Center for Educational Statistics,

1995; Manoucherhri, 1999; Owens and Waxman, 1993, 1994; U.S. Department of Education, 1995). There are some studies for example, that have found students from higher income families have been found to use computers in school and in their homes more frequently than students from lower-income families (Becker, 2001; Coley, Cradler and Engel, 1997). Minority students from urban schools have also been found to have less access to computers compared to Anglo-suburban students (Owens and Waxman, 1993, 1994). More recently, low SES schools are only about half as likely to have high speed internet compared to high SES schools (Advanced Telecommunications, 1997).

A second source of disparity in technology use is how technology is being used in the classroom. Previous studies for example, have found that low SES schools are more likely to use technology for drill and practice, whereas high SES school uses technology in innovative teaching strategies (Becker, 2001; Finneran, 2000). Furthermore, high SES students are more likely to use technology for school assignment, use e-mails, and use educational programs (Becker, 2001). Although these and other studies have established a pattern for technology disparities in the past, most of these studies rely on data collected in the 90's. Moreover, the last national report on the status of technology use entitled "Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology was published in 2000, however used data from the 1999 FRSS survey (National Center for Educational Statistics, 1999). Therefore, updated studies are needed that examine current data to determine where we are in the quest to narrow the achievement gap with the aid of technology. The purpose of the present study is to reexamine technology use and to provide evidence of whether or not disparity issues still exist using the latest national survey produced by the National Center for Educational Statistics (2002).

Methods

Data for this study were drawn from the base year survey of the Educational Longitudinal Survey of 2002 (ELS:02). The ELS data provides an excellent source to examine technology availability and use across SES levels. Tenth grade students were used in this study. The two sets of items were used availability and use of technology. To measure availability the following items were used: (a) how often uses calculators in math class; (b) how often uses graphing calculators in math class; and (c) how often uses computers in math class. The outcome measure for these items is a five point likert scale, ranging from "never" to "everyday or almost."

To measure use the following items were used: (a) how often uses computer to review math work; (b) how often uses computer to solve math problems; (c) How often uses computer for graphing in math; (d) how often uses computer to practice math drills; (e) how often uses computer to analyze data in math class; (f) how often uses computer to apply learning in math class; (g) how often uses computer to instruct One-on-one; and (h) how often uses computer to show new topics. The outcome measure for these items is also a five point likert scale, ranging from "never" to "everyday or almost." Also included on the survey was a measure of each SES level. To analysis the association between technology availability and use with students' SES status chi-square was used.

Results

Table 1, reports the results of the frequency of calculator and computer use in mathematics classrooms. The results indicated that students are using more calculators in the math classrooms compared to computers. Fifty eight percent of the students reported that they had used calculators every day in their math classroom compared to about 8% that indicated they were using computers on a daily basis. Thirty percent of the students reported using the graphing calculator on a daily basis. One-third of these students reported they never use the graphing calculator in their classroom. Sixty one percent of the students indicated they never use computers in their math classroom. Finally, 7.4% indicated that the students used computer on a daily basis.

Table 1
Overall Frequency
N=11,618

How often uses calculators in math class	6.2	Never
	12.0	Rarely
	5.7	Less than once a week
	18.0	Once or twice a week
	58.0	Everyday or almost
How often uses graphing calculator in math class	33.1	Never
	19.6	Rarely
	6.3	Less than once a week
	11.2	Once or twice a week
	29.8	Everyday or almost
How often uses computers in math class	60.7	Never
	20.2	Rarely
	5.7	Less than once a week
	5.8	Once or twice a week
	7.4	Everyday or almost

The results indicate that a positive significant association ($p<.001$) exists between calculator use and socio-economic levels. In this case, the lowest SES group reported using calculators on a daily basis the least. On the other hand students in the highest SES group reported using calculators on a daily basis more often. Forty eight percent of the lowest SES group reported using calculators on a daily basis compared to 68% of the high SES Group. There was also a significant positive association ($p < .001$) between daily use of graphing calculators and SES group membership. Twenty one percent of the students classified in the lowest SES reported using the graphing calculator on a daily basis compared to twice as many students (42%) classified in the highest SES group. The final comparison looked at computer usage across SES levels. The results also indicated a significant relationship ($p < .001$) between computer usage and SES levels. In this case students classified in the lowest SES group were more likely to use computers compared

to those students in the high SES group. The percentage of daily usage of computers for students in the lowest SES group compared to the highest SES group was 10% and 5% respectively.

The results from the study also report that the frequency of how computers are being used in math classrooms. The overall results indicate that the daily use of computers is very low. The highest percentage of daily use for computer use was to solve math problems (16.3%). The next two popular uses for computers in mathematics classrooms on a daily basis were for "applying learning in math class" and "to practice math drill". The percentages reported were 14% and 13% respectively. The daily use for computers provided "one-on-one instruction" reported a percentage of 7%.

In addition, the results indicated that the higher computer use was significantly associated with low SES classification. The most frequent use of computers on a daily basis for low SES students was to solve math problem. The reported daily percent for the lowest SES group was about 21%. The lowest classified SES group was more than two times more likely to use computers to review math work compared to the highest SES group. The percentages were 12.5% compared to 5.4% respectively. Seventeen percent of the students classified in the lowest SES reported using the computer on a daily basis to practice math drill compared to twice as many students (10%) classified in the highest SES group. Students classified in the lowest SES group reported about 17% of them were using the computer on a daily basis to apply learning in math drill class compared to twice as many students (9%) classified in the highest SES group. Ten percent of the students classified in the lowest SES group reported using the computer on a daily basis for one-on-one instructions compared to twice as many students (4.0%) classified in the highest SES group. Thirteen percent of the students classified in the lowest SES reported using the computer on a daily basis to practice math drill compared to twice as many students (7%) classified in the highest SES group.

Discussion

The use of technology in the math and science classroom has been a main focus in improving learning outcomes. Technology not only can provide visual learning in the classroom, it also opens the door to improve higher level thinking skills. The results of the present study indicate that 10th graders use more calculators on a daily basis compared to computers. Moreover, calculator use far outweighs the use of computers in today's math curriculum. This is also true for the use of the graphing calculator.

The results of the present study suggests that there are important differences in the use of technology in tenth grade mathematics classrooms associated with levels of SES status. Students from low SES families are less likely to use calculators on a daily basis compared to students from high SES families. This also includes the use of the graphing calculator on a daily basis. Low SES students also reported that they were more likely to use computers on a daily basis compared to high SES students. This may dispel previous findings that low SES students have a less opportunity to use computers compared to high SES students. However, the findings do raise a new issue of disparity in calculator use.

In addition, another important finding from this study deals with the students' overall use of computers. The results from the present study suggest that overall 10th

grade students do not use computers often in their mathematics class. This suggests that schools across the country need to do a much better job in integrating technology in the secondary school curriculum. Depending on its use, technology can be very useful in the mathematics classroom. In fact, operating a computer can be simple compared to designing a scientific experiment and solving challenging math problems, that is, as long as the student and the teacher have the tools. For those who don't, technology can become a diversion or a simple device for entertainment. Access to technological resources in the classroom is only part of the solution (Feldman, 2001). According to Feldman, research leads us to surmise that teachers who feel more prepared to use technology are more likely to use it in instructional activities (Feldman, 2001). If we want to help students from low SES backgrounds, our emphasis should be on providing more nourishing help, specifically, providing well-trained teachers and a rigorous curriculum that integrates the use of technology

Conclusion

Technology is often viewed as an enticing means of closing the achievement gap. However, this is not the reality. Statistics on the digital divide have shown are that the use of technology is often based on simple computer-to-student ratios that have little relevance in describing the quality of the technology experience of the use of the intervention in the classroom. With this in mind, the current accountability environment demands significant attention to the use of computer in schools and in the context of using the tools to enhance student achievement regardless of their socioeconomic status.

References

Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, Fall 1996, U.S. Department of Education, National Center for Education Statistics, February 1997.

Becker, H.J.. Who's wired and who's not: Children's Access to and use of computer technology. The future of Children and computer technology, 2000, 2(10, 44-75).

Feldman, Sandra. The Haves and Have Nots of the Digital Divide. The School Administrator, March 2000, (1-4).

Finneran, Kevin. Let Them Eat Pixels. Issues In Science and Technology. Spring 2000, (1-4)

Garofalo, J., Drier, H., Harper, S., Timmerman, M.A., Shockey, T. Promoting appropriate uses of technology in mathematics teacher preparation. Contemporary Issues in Technology and Teacher Education, 2000, 1(1), 66-88.

Huang, S.Y.L., & Waxman, H.C. Classroom observations of middle school students' technology use in mathematics. School Science and mathematics, 1996, (10, 28-34).