

Chapter 17

The Role of Situational Context in High School Teachers Use of Graphing Calculator in Mathematics Instruction

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ABSTRACT

By taking into consideration the significance of the socio-economic contexts, this research investigates teachers' perceptions of the role of graphing calculators, as mediating tools, to help facilitate mathematics instruction of students from two different SES backgrounds. The main source of data are in-depth semi-structured interviews with four teachers, two from each SES school. In general, the participants' perceptions of the role of the graphing calculator were dependent on the context within which it was used. Also, the participants played a crucial role in determining the nature of graphing calculator use with the low-SES school's participants appearing not to involve their students in lessons that capitalized on the powerful characteristics of graphing calculators. To tease out the role of the situation context, a four-component framework was conceptualized consisting of teacher, student, subject matter, and graphing calculator use. The components of the framework were taken to be continuously in interaction with one another implying that a change or perturbation in one of the components affected all the other components. The continuous interactions of the components of this framework suggest that equity issues in connection to the nature of graphing calculator use should be an ongoing process that is continuously locating strategies that will afford all students appropriate access and use of graphing calculators.

INTRODUCTION

The National Council of Teachers of Mathematics [NCTM] (2000) has, over the last thirty years, been in the forefront in advocating for reform in mathematics curriculum, instruction and assessment to improve the mathematics achievement of all students. Through its published *Standards* and its official policy

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statements, the NCTM has called for high expectations and strong support in order to ensure mathematics success for *every* child. Although the National Assessment of Educational Progress (NAEP) indicates that scores in mathematics and science have improved over the last 20 years, a closer examination of student data reveals a persistent performance disparity among at-risk students defined mainly by socioeconomic status (SES) and race (Lubienski, 2001; Struchens & Silver, 2000).

Race and socioeconomic status have long been associated with disparities in students' mathematics achievements. According to Lubienski (2001), the National Assessment of Educational Progress (NAEP) categorizes students' race as one of the following: White, African American, Hispanic, Asian/Pacific Islander, and American Indian (including Alaskan Native). In addition, NAEP classifies schools as high or low SES depending on the percentage of students eligible for free/reduced lunch. Since eligibility for free/reduced lunch is based directly on family income, this implies that majority of the students who attend high (low)-SES schools are those with high (low)-SES. Studies show that schools that enroll students of low-SES have a mean academic achievement that is significantly lower than that of schools with more affluent and high SES students (Strutchens & Silver, 2000). In addition, many researchers argue that there is a strong correlation between race and SES with a disproportionate number of low-SES students being minorities (Strutchens & Silver, 2000). Due to this conflation of race and SES, Strutchens and Silver (2000) posit that it is sometimes difficult to untangle the two variables to explain the variations in students' academic achievements. However, many have argued that compared to race, SES is a more important demographic factor to use as a basis for examining the differences in academic achievement (Lubienski, 2001; Struchens & Silver, 2000).

In addition, Krashen (2005) suggests that SES, per se, is not the cause of the discrepancy in the achievement of low-and high-SES students; rather it is the factors typically associated with SES that cause this. These factors, which are more likely to be associated with low-SES students than high-SES students, include low expectations of students, ill-prepared teachers, lack of coordination among school, parents and community on behalf of students, stereotyping, students' negative self-image and attitudes, race and identity issues, shortage of resources and less adequate facilities and biased curricula and pedagogy (Martin, 2000; Perry, Steel & Hilliard, 2003). It is worth noting that these factors do differentially affect the learning opportunities of low SES students. Several studies have shown that in order for students to achieve they must have appropriate learning opportunities (e.g., Tornroos, 2005). Appropriate learning opportunities refer to not only the chances presented to the students to study mathematical topics but also how those topics are taught, that is the quality of instruction afforded to the students to enhance the acquisition of the knowledge and skills of the topics covered (Tornroos, 2005).

The NCTM (2000, 2005) recommends the essentiality of ensuring that today's classrooms provide technology-supported learning opportunities for students to learn more sophisticated mathematical ideas. These opportunities among students include not only the physical presence of the technology in the classroom, but also the teacher's appropriate use of the technology in ways that encourage student engagement and learning, ultimately affecting their achievement (Abramovich, 2014). Thus, opportunity to learn is an important contributing factor in learning outcomes. Indeed, studies reveal that there exist a strong relationship between opportunity to learn and student performance and achievement in mathematics (e.g., Tornroos, 2005). For this reason, equity issues arise due to a differential opportunity to learn among the high SES and low SES students since, consistent with the aforementioned argument, this in turn leads to a differential gap in their academic achievement and performance. It is for this reason that Mickelson and Southworth (2005) argue that ensuring a closure of this achievement gap would require educational reforms that would ensure that all children have equal opportunities.

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