

Critical Mathematics Pedagogy: Transforming Teachers' Practices

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Abstract

This study reports the effects of a graduate-level mathematics education course that focused on critical theory and teaching for social justice on the pedagogical philosophies and practices of three mathematics teachers (middle, high school, and 2-year college). The study employed Freirian participatory research methodology; in fact, the participants were not only co-researchers, but also co-authors of the study. Data collection included reflective essays, journals, and “storytelling”; data analysis was a combination of textual analysis and autoethnography. The findings report that the teachers believed that the course provided not only a new language but also a legitimization to transform their pedagogical philosophies and practices (and research agendas) away from the “traditional” and toward a mathematics for social justice.

Introduction

Since 1989 the National Council of Teachers of Mathematics (NCTM) has argued not only for instruction in mathematical Content Standards, but also for instruction in mathematical Process Standards (NCTM, 1989, 2000). The NCTM’s recommendation of blending content and process standards throughout mathematics instruction requires the development of a different mathematics classroom—different from the “traditional” mathematics classroom found in most U.S. schools (see Hiebert, 2003, for a discussion of the traditional curricula and pedagogy in the mathematics classroom). In this different mathematics classroom, students are no longer passive, empty depositories awaiting the teachers deposits—what Freire (1970/2000) coined, “the ‘banking’ concept of education” (p. 72)—but are active co-creators of classrooms “where students of varied backgrounds and abilities work with expert teachers, learning important mathematical ideas with understanding, in environments that are equitable, challenging, supportive, and technologically equipped for the twenty-first century” (NCTM, 2000, p. 4). These co-created classrooms, if desired, can set in motion a different mathematics pedagogy—a mathematics pedagogy positioned within critical theory.

Purpose

Just as the NCTM recommends, mathematics pedagogy positioned within critical theory blends content and process standards throughout mathematics instruction in co-created classrooms; it differs, however, in that critical mathematics pedagogy centers instruction specifically around issues of social and political justice and reform (e.g., see Frankenstein, 1987, 1990, 1995; Gutstein, 2003, 2006; Gutstein & Peterson, 2005; Skovsmose, 1994a, 1994b, 2005). In other words, knowledge and understanding of mathematics from the perspective of critical pedagogy is understood as a means for student (and teacher) self-empowerment to organize and reorganize interpretations of social institutions and traditions, and to develop proposals for more just and equitable social and political reform (Skovsmose, 1994a). Most of the research on critical mathematics pedagogy has reported the teaching practices of exemplar critical mathematics pedagogues (e.g., Marilyn Frankenstein, Eric Gutstein, and Ole Skovsmose). Much less research has reported how mathematics teacher educators (and programs) might assist in developing critical mathematics teachers (e.g. see Bartell, 2005). Therefore, the purpose of this study is to examine the effects of a graduate-level, critical mathematics education course on the teaching

philosophies and practices of three mathematics teachers (middle, high school, and 2-year college) who completed the course. Three research questions guided the study:

1. How did exposure to critical theory transform (or not) the teachers' philosophies of mathematics and mathematics teaching and learning?
2. How did exposure to critical theory transform (or not) the teachers' mathematics classroom teaching practices?
3. How did exposure to critical theory transform (or not) the teachers' research agendas?

Theoretical Framework

Critical theory provides the underlying theoretical framework for the study. The origin of critical theory is associated with the Frankfurt School (*circa* 1920), which holds a Marxist theoretical perspective: to critique and subvert domination in all its forms (Bottomore, 1983/2001). As these critiques—derived from philosophy, sociology, psychology, and so forth—evolved they became known as critical theory.

The philosophical and theoretical perspectives of critical theory are as varied as the disciplines and scholars who have contributed to its development. Nevertheless, in the most general sense, critical theory maintains sociopolitical critiques on social practices and ideology that mask “systematically distorted accounts of reality which attempt to conceal and legitimate asymmetrical power relations” (Bottomore, 1983/2001, p. 209). Included in these critiques is an examination of how social interests, conflicts, and contradictions are expressed in thought and produced and reproduced in systems of domination (Bottomore, 1983/2001). Critical theorists contend that an examination of these systems of domination will bring about an awakening of consciousness and awareness of social injustices, motivating self-empowerment and social transformation.

The concepts of self-empowerment and social transformation are reoccurring themes found in the scholarship of a contemporary critical theorist, Paulo Freire (e.g., see 1985, 1998a, 1998b, 2000). Freire's literacy scholarship (but not limited to literacy) advocates a critical, dialectical reading of the word and world, so as to write the word to *rewrite* the world. It is his scholarship and his popularization of the concept of *conscientização*—“learning to perceive social, political, and economic contradictions, and to take action against the oppressive elements of reality” (Freire, 1970/2000, p. 35)—that provides, to a certain extent, the foundation for critical pedagogy. In the most general sense, critical pedagogy supports pedagogical theories and practices that encourage both teachers and students to develop an understanding of the interconnecting relationship among ideology, power, and culture, rejecting any claim to universal foundations for truth and culture, as well as any claim to objectivity (Leistyna & Woodrum, 1996).

In the most general sense, critical pedagogy enacted in the mathematics classroom adopts the pedagogical theories and practices of critical pedagogy, while explicitly using mathematics as an analytical tool for examining social injustices. Or more specifically, critical mathematics pedagogy is teaching mathematics for social justice. Teaching mathematics for social justice has two dialectically related sets of pedagogical goals: one set focuses on social justice and the other set focuses on mathematics (Gutstein, 2006). Building from Freire's literacy scholarship, the social justice pedagogical goals are reading the world with mathematics, writing the world with mathematics, and developing positive cultural and social identities (Gutstein, 2006). The mathematics pedagogical goals are reading the mathematical word, succeeding academically in the traditional sense, and changing students' (and teachers') orientation to mathematics (Gutstein, 2006).

Methodology

Grounded in critical inquiry (Crotty, 1998) and participatory action research (PAR, Kemmis & Wilkinson, 1998), the methodology employed in the study is Freirian empowering research (Lather, 1986). The goal of Freirian research is to blur the distinction between research, learning, and action by providing the researcher and the participants opportunities to collectively engage in the struggle toward social justice; it encourages researcher-participant reciprocity, turning participants into co-researchers while providing the means for researcher and participants' self-empowerment (Lather, 1986, 1991).

Participants & Research Site. The participants were selected from a group of 19 graduate students who completed a graduate-level course (spring 2006) entitled *Topics in School Mathematics Curriculum: Critical Theory and Teaching for Social Justice*. Three students were selected purposively (Silverman, 2000) as participants in order that a mathematics teacher representing middle, high school, and college would be included in the study. The three participants are full-time teachers and part-time doctoral students. All three are White, middle-class women in their early-to-late 30s; in other words, the "typical" mathematics teacher (U.S. Department of Education, 2003). And in keeping with the tenets of Freirian participatory action research, all three participants are co-researchers on the study. In fact, the three participants are co-authors of the study, along with the first author (the developer and instructor of the course) and one of the first author's full-time doctoral students, who also took the course.

The course was an elective, 3-credit hour, graduate-level seminar offered at Georgia State University, a large urban research university in Atlanta, GA. The course had three reading-intensive components. First, it provided students with a brief overview of critical theory, familiarizing students to the scholarship of Marx and Engels and to scholarly critiques of their work. Second, it provided students with an overview of critical pedagogy, surveying the scholarship of Paulo Freire, Henry Giroux, Maxine Greene, Joe Kincheloe, Shirley Steinberg, and others. Third, these overviews provided students with a foundation to begin an initial critical analysis of the scholarship of critical mathematics pedagogues, reading scholarship from Ubiratan D`Ambrosio, Paul Ernest, Eric Gutstein, Mamokgethi Setati, William Tate, and others.

Data Collection. Data collection consisted of four artifacts written by the three participants (i.e., co-researchers and co-authors): two written assignments from the course, reflective response essays written 3 months after the course, and autoethnographic "storytelling" narratives written 9 months after the course. The artifacts from the course were reading journals and eight-text page, reflective, academic essays submitted by each participant. The journals included written summaries of each manuscript read during the course, participant-selected significant quotations from each manuscript, and comments regarding the participant's struggles with each manuscript and how it might (or might not) assist in her teaching and research. The reflective, academic essay positioned the participant's mathematics teaching and research within critical pedagogy, and discussed her struggles and concerns in positioning mathematics teaching and learning (and research) within critical theory. The third artifact, the response essay written 3 months after the course, asked each participant to respond to the three research questions of the study. And the fourth, and most important, artifact, written 9 months after the course, was an autoethnographic narrative detailing each participant's experiences in planning and implementing a specific mathematics for social justice lesson within her respective classroom.

Data Analysis. Given that the participants of the study were co-researchers and co-authors of the study, data analysis was a combination of textual analysis (Silverman, 2001) and autoethnography (Ellis & Bochner, 2000). First, in the initial analysis, the written artifacts were shared among all authors of the study, providing each author with the "big picture." Second, the three teachers then worked collaboratively amongst themselves, searching for similarities and

differences among and across the three data sets as they articulated responses to the three research questions. And third, the first and non-teaching authors acted as critics to the teachers' conclusions, offering challenges to and asking for clarifications of the teachers' responses and autoethnographic narratives. The multiple written artifacts and the critique of the teachers' responses and narratives acted as a form of methodological triangulation (Silverman, 2000). Furthermore, because the study's conclusions were in a continuous state of member checking (Glesne, 1999), the ethical concern of "that's not what I said" (Borland, 1991) was all but eliminated.

Conclusions

This research study began with three questions in mind: how did exposure to critical theory transform (or not) the teachers' (a) philosophies of mathematics and mathematics teaching and learning, (b) their classroom practices, and (c) their research agendas. With regard to their philosophies, it is not so much that their philosophies changed, but that they now have a name for what they were already thinking. And once it was named, their way of thinking gained legitimacy in their eyes, as well as in others' view. The teachers believed that they could stand up proudly and proclaim themselves, through words and actions, as critical mathematics pedagogues, rather than feeling insecure and keeping quiet.

The teachers' mathematics classroom teaching practices, like their philosophies, have not so much changed as been given a new "voice." Each teacher felt as though they had already begun a journey toward reform mathematics instruction, but again, critical theory gave them the words and the backing to put their ideas into action. Collectively, the teachers provided specific examples of lesson plans created and implemented using critical theory, but mostly the teachers believed that there have been innumerable instances when their new *critical* outlook has influenced their choice of words, their decision to allow a discussion to stray from mathematics into something equally meaningful, and a generalized awareness of what was going on in their classroom from more than just a mathematical perspective. The teachers said that their classrooms have become more democratic, inclusive places, with class sessions moving toward a "conversation between teacher and students" (Lerman, 2000, p. 22). And perhaps most importantly, the teachers believed that they have an ongoing sense of constant change and improvement, very different from the traditional idea of there being a "best practice" that a teacher should learn and use forever.

The teachers asserted that their research agendas have definitely changed for the better since their exposure to critical theory. The teachers felt that critical theory would be an important part of the theoretical framework of their research projects. As such, it will influence how they choose specific research questions. Each teacher now has an even greater urge to "make a difference" in their students' lives, and the lives of future students affected by their research, and a belief that they can, in fact, make that difference.

For those who believe in the transformative power of critical pedagogy, the significance of the study's conclusions cannot be overstated. There are probably many mathematics teachers out there, like the teachers of this study, afraid to pursue the ideas they have because they lack the language and the legitimization; forced, through lack of knowledge, to reproduce the same traditional mathematics pedagogy they themselves endured. If those teachers could be reached, imagine how many students they could influence. Dewey stated, "If a sufficient number of educators devote themselves to striving courageously and with full sincerity to devote themselves to find the answers to the concrete questions which the idea and the aim put to us, I believe that the question [of education and social change] will cease to be a question, and will become a moving answer in action" (Dewey, 1937/1987, p. 417). Of course, a teacher cannot be

said to have chosen a method or philosophy of teaching if only one option is offered. Because the teachers now consider themselves critical mathematics pedagogues, they hope that teacher education programs will expose other preservice and inservice teachers to different options, such as critical theory, to move mathematics pedagogy away from the traditional—and toward a pedagogy of social justice.

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