

(RCP) Rethinking Critical Pedagogy

Volume-1, Issue-1, May 2020.

Mathematics Education to Counter Neoliberal Hegemony¹

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ABSTRACT

Drawing on a critical participatory action research approach, this paper investigates how critical mathematics education responds to the tension between the needs of a neoliberal system and the needs of students to fulfill their potential as citizens and as human beings. The original contribution of the research is that despite obstructive implications of market-driven changes, a practice of mathematics education to promote critical citizenship can be implemented through open-ended projects that resonate with inquiry-based collaborative learning and dialogic pedagogy.

Key words: *Critical Mathematics Education, Critical Pedagogy, Neoliberal Hegemony, Critical Citizenship, and Democracy*

¹ This paper was presented at 9th International Conference on Critical Education in Napoli, Italy in July 2019

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1. BACKGROUND AND RATIONALE

Over the last three decades, public education in the U.S., and in many other countries, has been undergoing a transformation. It has been largely reshaped by top-down neoliberal policies, according to which the success of schools, teachers, and students is measured by quantitative, standardized test results. In this view, education is a personal commodity, and it is suggested that schools should be run like businesses (De Lissovoy, 2015).

Neoliberal ideology makes the positivist assumption that knowledge is independent of human subjectivity; it therefore imposes on students an externally generated, standardized curriculum (Gandin & Apple, 2002; Hyslop-Margison & Naseem, 2007; Schneider, 2015). In this view, the goal of education is to transmit knowledge to students. Evidence for successful transmission is provided by test scores. Raising test scores thus becomes the primary focus; teachers are relegated to the role of transmitting an externally prepared, “teacher-proof” curriculum³ with the goal of preparing students for standardized tests. This phenomenon is experienced especially in working-class, radicalized communities in the U.S. (Darder, 2002, 2012). Students are framed as passive consumers of knowledge: there is little need for dialogue, active participation, collaboration, or inquiry oriented toward new possibilities.

This neoliberal transformation redefines the connection between democracy and education in economic terms and promotes consumer-based, individually responsible citizenship. Nevertheless, it has been presented as the only way to solve the problems in public education.

In contrast to the neoliberal view is a view that may be called *humanizing*. In this approach, public education has a democratic mission: to provide students with opportunities to develop skills, attitudes, and values to be loving, lovable, and caring individuals, as well as critical citizens (Darder, 2002, 2015; Noddings, 2003). Education that aims to meet the needs of students as human beings and young citizens should be

³ The “teacher-proof” curriculum is a fully scripted, narrow curriculum that does not allow teachers to make adjustments.

dialogic and open to possibilities; it should promote participatory and social justice-oriented citizenship in order to establish and sustain a “thick” version of democracy initiated as a bottom-up movement (Orlowski, 2012; Westheimer, 2015).

There is thus a sharp divergence between neoliberal education that meets the needs of the market and humanizing education⁴ that meets the needs of students as human beings and citizens. Humanizing education necessitates a bottom-up, critical approach to teaching in order to create channels for dialogue in classrooms.

A small but increasing number of scholars in mathematics education are focusing on the sociopolitical and socioeconomic aspects of teaching and learning (Frankenstein, 1983; Gutstein, 2006; Skovsmose, 2011). These studies are united in positing a radical critique of traditional perspectives, and are generally framed under the umbrella of “critical mathematics education” (CME). CME aims to foster critical citizenship and catalyze transformative social changes (Frankenstein, 2010; Gutstein, 2006; Skovsmose, 1994; Valero & Zevenbergen, 2004). CME is concerned with issues such as socioeconomic diversity, equity and justice, student and teacher autonomy, and the socioeconomic functions of education (Skovsmose, 1994, 2011; Skovsmose & Borba, 2004). From this vantage point, CME can be seen as a response to the neoliberal agenda in mathematics education.

The work of Skovsmose (1994, 2011) provides a coherent foundation from which to define a practice of CME. There is some classroom-based research that draws on CME in the high school context (Brantlinger, 2014; Gutstein, 2006). However, currently no classroom-based research exists in the CME literature that frames a practice of mathematics education within the high school context to challenge neoliberal imperatives. This deficit motivates the present research.

2. AIMS AND RESEARCH QUESTIONS

In this research I enact a critical stance toward mathematics education. It is situated in my own classroom teaching as a means of investigating the ways in which high school mathematics can be taught and learned in the neoliberal era. An underlying purpose of

⁴ The term is used in this presentation in the sense of Freire (2000), who states that dialogue is an ontological necessity for humanizing education.

this approach is to promote a thick version of democracy and critical citizenship. As noted, a practice of critical pedagogy aimed at promoting participatory and social justice-oriented citizenship radically conflicts with a market-driven education, which is primarily designed to produce consumer-based, individually responsible citizens. Therefore, this approach is generally not welcomed in school settings fundamentally shaped by neoliberal ideology. As already mentioned, neoliberal educational policies impose a narrow, “teacher-proof” curriculum, thereby reducing the teaching profession to a merely clerical endeavor (Giroux, 1988).

Recent theoretical studies (De Lissovoy, 2015; Giroux, 2012; Skovsmose, 2011; Skovsmose & Greer, 2012), consistent with critical pedagogy and CME, generate two main conclusions. First, with its top-down imposed policies and implementations, contemporary market-driven educational changes curtail the potential of educational practice to promote democratic values and critical citizenship. Second, it is, nevertheless, important for students and teachers to be engaged with an educational practice that enacts humanizing education and that promotes participatory democracy. These contradictory stances cannot be reconciled without evidence produced via classroom-based research. Therefore, it is worthwhile investigating whether it is possible to implement CME in the presence of neoliberal restrictions.

As background to this project, my Master’s thesis focused on teachers and the teaching profession in relation to neoliberal educational transformation in the U.S. Results indicated that although teachers’ values and attitudes shaped their responses to neoliberal changes, top-down, market-driven changes diminish teachers’ academic freedom and professional authority. Additionally, reflecting on my own journey of conducting the research for my Master’s thesis and my own classroom experience as a high school mathematics teacher, I concluded that willingness is a necessary but not a sufficient qualification for being a critical educator. As a public school teacher, I was also engaged with the question posed by Henry Giroux (2012): Can democratic education survive in a neoliberal education system? The research questions of the current study emerged out of my strong and consistent

desire to make “small openings”⁵ in my classroom to help my students develop both communicative competencies and critical mathematical literacy to become critical citizens. The overarching research question assumes that the teacher is willing to practice CME. Therefore, emergent questions for this study are as follows:

1. While facing top-down restrictions imposed by neoliberal educational policies and pedagogies on a daily basis, is it still possible for teachers to create small openings for humanizing education through CME?
2. How can collaborative and dialogic mathematics education be facilitated to help students to become critical citizens?
3. How can CME be practiced without disrupting the process of preparing students for standards-based assessment?

These questions oriented my thinking toward the central question of my research:

What are the potentials and limitations of CME in terms of classroom teaching in the neoliberal era?

An overarching concern of this investigation was to provide evidence that CME can counter neoliberal hegemony in education.

3. SIGNIFICANCE OF THE STUDY

Although there is a growing body of theoretical studies in the CME literature, there are very few classroom-based studies conducted in high school mathematics contexts that support the applicability of CME. For example, the importance of dialogic pedagogy is emphasized in the existing CME literature (Skovsmose & Alrø, 2004). However, the research suggests that authoritative (anti-dialogic) teaching is the dominant approach in most mathematics classrooms (Alexander, 2005; P. Scott, Mortimer, & Aguiar, 2006). Perhaps, as a relatively new domain of research, the CME literature has yet to offer more helpful answers to the following specific question: Can a mathematical formula, concept, or axiom be taught in a dialogic form within a neoliberal education system? Answers to this question constitute original contributions to the CME literature.

⁵ The term “small openings” is due to J.C. Scott (2008), a political theorist and former professor at the University of Wisconsin-Madison.

Similarly, although theoretical studies exist, which emphasize the importance of inquiry-based collaborative learning, the CME literature lacks examples of identified classroom-based research that provide distinctive insights into the dynamics necessary to promote participatory and social justice-based citizenship. My research aims to address this gap in the current literature. Findings will be presented that may bridge the existing gap between theory and practice in the CME literature.

The present research is empirically significant in its potential provision of classroom-based data that provides new insights into definitions of dialogue, collaboration, and inquiry as aspects of CME. Moreover, existing studies offer limited insight into pedagogical practices. Therefore, it is crucial to generate research in mathematics classrooms to establish a dialectical relationship between theory and practice (Aguilar & Zavaleta, 2012; Almeida, 2010; Hannaford, 1998; Vithal, 1999). In this context, the present research has the potential to make a significant contribution to professional development of teaching mathematics in relation to democracy and justice.

The prominent studies in the existing CME literature draw either on Freire or Habermas. Instead, to capitalize on these important scholars, the philosophical perspective of the current study is built on the ideas of *both* Freire (1997, 2000) and (Habermas, 1972, 1973, 1984). From this point of departure, an emphasis on the complementary ground of Freire (embodying a Latin American perspective) and Habermas (embodying a European perspective) collectively empowers the theory of critical education to create a counterhegemonic force against neoliberal educational policies, therefore greatly contributing to scholarly studies in CME.

4. METHODOLOGY

My research questions could be most appropriately investigated through classroom-based research. Therefore, an action research methodology was well suited for my project. Resonating with the natural flows of classroom teaching, action research methodology allows the cycle of *plan-act-observe-reflect* (Carr & Kemmis, 1986). The research methodology adopted here enables students to democratically participate in classroom activities and the process of knowledge construction. The methodology can be considered

an adaptation of critical participatory action research (CPAR) as conceptualized by Kemmis, McTaggart, and Nixon (2014), in which research participants are seen as active agents of change as opposed to passive objects of the process. Therefore, the methodology is conceptually consistent with both critical and participatory praxis.

This study was conducted in a mathematics classroom in a high school where I teach full time. It involved a year-long mathematics class with 28 students, aged 14 to 17. Included in this study are data collected from student journals and presentations, as well as my field notes and reflective journal.

5. END-OF-UNIT PROJECTS

Table 1

Content and Themes of End-of-Unit Projects (EUPs)

EUP	Mathematics content	Theme
1	Linear equations and functions	Standardized assessment
2	Multipart functions: analysis of domain and range	Critical mathematical literacy
3	History of mathematics	Universal values of humanity
4	Systems of inequality	Community service
5	Exponential functions	Student loan debt crisis

As shown in Table 1, end-of-unit projects (EUPs) are lessons taught over two consecutive days in 90-minute block periods, one period each day. Each EUP was intended to be an inquiry-based collaborative lesson to promote dialogic teaching and learning. During each project, data were collected from students' journals, samples of students' work, whole-class discussions, field notes, and my reflective journal. In terms of data collection and analysis, each EUP constituted a segment of data to answer a specific research question. Each EUP is considered a plan-act-observe-reflect cycle.

6. RESULTS

CME IS ATTAINABLE

The findings led to the conclusion that despite an educational environment resulting from the market-based standardization movement, CME can be implemented through the interconnected dynamics of collaborative learning, dialogic pedagogy, and inquiry-based practice. When these elements were oriented toward promoting critical citizenship and a “thick” version of democracy, students began to take on democratic values, critical mathematical literacy, and critical citizenship.

The main conclusion of the current study concerns three domains. First, the cycles of plan-act-observe-reflect gradually turned the classroom into an egalitarian community of mathematics learners. A facilitative pedagogic ambiance was created where the students experienced mathematics learning in the form of a dialogue. Second, lessons presented as end-of-unit projects (EUPs) created a communicative space for students to develop and exercise critical mathematics literacy, democratized the learning process, and initiated bottom-up responses to counter the hegemony of neoliberal ideology in education. Third, certain practical limitations of CME must be acknowledged, given the overwhelming neoliberal colonization of education in the U.S.

THE MATHEMATICS CLASSROOM AS A MICRO SOCIETY

Although some theoretical studies emphasize the importance of making the classroom a community (Kennedy, 2009; Murphy & Fleming, 2010), none of them concerns mathematics. Put differently, the CME literature is silent on classroom-based approaches. The most important original contribution of my study to CME, therefore, is that it is firmly rooted in an actual U.S. high school mathematics classroom. The present study bridges the gap between theory and practice, because a mathematics classroom was transformed into a community.

All classroom practices in CME must be oriented toward creating an egalitarian community of learners. The basic elements of CME in the classroom—dialogic pedagogy, collaborative learning, and inquiry-based lessons—are unsustainable if they are not dialectically structured to establish and maintain an egalitarian community. The following three interconnected sub-conclusions substantiate the central conclusion.

First, the present findings show that mathematical concepts can be taught through dialogic pedagogy—authoritarian teaching is not the only way. The CME literature distinguishes between dialogical and nondialogical teaching of mathematics. I posed the following question: Can CME completely avoid nondialogical (authoritarian) teaching? Mortimer and Scott (2003) claim that the authoritarian approach is inevitable when mathematics and science teachers introduce a new topic. On the contrary, the findings here indicate that dialogic teaching is effective for teaching mechanical aspects of mathematics. Introducing a topic through dialogue is not attainable in a traditional classroom driven by vertical student-teacher relations, however: It requires instead an egalitarian community.

Second, this study confirmed that students' learning improved to the extent that they were able to learn from and with each other to materialize their full potential (Vygotsky, 1978); there was no need for more competent students in small group work. This process of egalitarian peer collaboration also helped me as the classroom teacher to become a facilitator (Wells, 1999). These findings have an important implication for the notion of zone of proximal development (ZPD): In order to apply ZPD as part of CME practice, the classroom must be an egalitarian community of learners. In the absence of a facilitative classroom environment and egalitarian peer interactions, the ZPD process could instead produce power relations among peers, thus reproducing transmission-style education.

Third, this study revealed that the “ideal speech situation” outlined by Habermas (1990, 2005) can be attainable only if the classroom is an egalitarian community of learners. After four cycles of planning, acting, observing, and reflecting, our classroom had visibly become an egalitarian community. Creating conditions for the ideal speech situation was a time-consuming process and required a radical change in power dynamics. However, we were rewarded with qualitative changes in peer interactions and student-teacher relationships. Findings also demonstrated that empathy is an effective and significant element in creating grounds for the ideal speech situation. As articulated by Freire (2000), empathy in the classroom cannot be generated only by exchanging ideas and arguments in the absence of love and hope.

As there is no previous classroom-based research on CME linking mathematics education to democracy and critical citizenship, this study provides the first response to the question, What are the potentials and limitations of CME in terms of classroom teaching in the neoliberal era? The answer can be framed in four domains.

First, inquiry-driven collaborative learning and dialogic pedagogy democratized life in the classroom. In EUPs, the students experienced mathematics learning as a democratization of classroom life. We experienced a “thick” as opposed to a “thin” (neoliberal) version of democracy (Orlowski, 2012; Westheimer, 2015). In agreement with Freire (1998), I found that teaching critical citizenship necessitates democratizing life in the classroom. As the classroom became a democratic space, we had solid ground on which to relate mathematics to larger social, economic, and political issues.

Second, the study revealed the significance of making small openings in the classroom colonized by neoliberal (and neoconservative) educational implementations. The openings created by EUPs allowed me to incorporate critical mathematical literacy and critical thinking into the standardized curriculum. The students discussed some premises of neoliberal ideology and questioned irrational and unjust implications of market-driven educational policies. Through whole-class discussions, the students developed a collective, bottom-up response to neoliberal hegemony. In their view, education is a human right and a social investment, not an individual commodity and personal investment. As they embraced inquiry-based collaborative and dialogic learning, they rejected the competitive, authoritarian, and rote aspects of neoliberal pedagogy.

Third, the process of developing bottom-up responses entailed critical thinking as part of critical literacy. Engaging in the structural analysis of society and imagining a better one, the students objected to corporations’ involvement in education and made proposals to make society at both micro and macro levels more just, equal, and sustainable. In this sense, the students were engaged in critical thinking that draws on communicative rationality and that recognizes the ethical and political dimensions of critical thinking. This version of critical thinking differs radically from the neoliberal version that draws on technical rationality to solve business problems. EUPs fostered critical mathematical literacy, through which the students developed ability to question authorities and keep

them accountable. Therefore, this study promoted a thick version of democracy and a participatory, social justice-oriented citizenship.

Fourth, the students clearly opposed neoliberal policies and implementations. When communicative space was made in the classroom, students raised their voices against the neoliberal world view. Students' journals indicated that they did not consent to neoliberal ideology as a dominant discourse. As Habermas (1975) articulates in a broader sense, the system colonizes the life-world and prevents free public debate, which makes legitimacy of the system questionable. The legitimacy issue applies to educational policies as well. The results here show that a start can be made by creating small openings in the classroom, where students can develop bottom-up responses to counter neoliberal colonization.

LEARNING MATERIALS IN CME

There is a gap between theory and practice of CME in terms of developing word problems and projects to counter neoliberal pedagogy. The findings from the current study begin to bridge the gap. In relation to the elements of CME, five aspects of potential projects and word problems can be identified.

First, a distinctive element of dialogic pedagogy in CME is alternative learning materials; notably, *open-ended* problems and projects. In other words, projects must be in harmony with the principles of dialogic learning. Problems must be a forum where students can relate their learning to a larger society in order to negotiate social, political, cultural, and economic issues that affect their lives. I concluded that CME projects must not be limited to the exercise paradigm or solving modeling problems.

Second, word problems and projects in CME must be multilayered, so that students working in small groups can negotiate implications of the problem and build on each other's contributions.

Third, problems must be inquiry-driven for the students to learn mathematical skills and knowledge that are transferable to different domains of study. Word problems must help the students improve their conceptual understanding, procedural knowledge, and numerical fluency in order to pass standardized tests and be successful in the conventional sense.

Fourth—and the most important element of problems oriented toward CME—problems must be built on clear ethical and political grounds to be able to counter neoliberal hegemony. It is worthwhile here to revisit the forth project, EUP 4. We contextualized the community volunteer service issue to counter neoliberal hegemony in education. I noticed the significance of the political and ethical ground on which I designed the project to distinguish the notion of helping others—“false generosity” as posited by Freire (2000), in a thin version of democracy—from “solidarity” in a thick version. The same distinction can be applied to the notion of critical thinking: To promote critical mathematics literacy, word problems and projects should help students distinguish between critical thinking based on technical rationality and one based on communicative rationality.

Fifth, the findings serve as a reminder that critical mathematics teachers need to be aware of risks to their job security and be proactive about them. The learning targets in the U.S. standardized curriculum are part of the management and control process in public schools. A mathematics teacher, therefore, must find ways of linking word problems and projects to these standards. Otherwise, they could face disciplinary consequences. In my case, each EUP, with one exception, was connected to a specific learning target outlined by the school district. However, I could not link EUP 3 to any learning target, as the standards do not mention the history of mathematics. The principal’s classroom visit at that time put a question mark on my evaluation. This caused only a minor problem for me, but it could have turned into a much more serious issue.

The conclusion is that for the sustainable practice of CME, word problems and projects must be linked to learning targets in the standardized curriculum. This is a new contribution of my study to the existing CME literature. However, I do not claim that my conclusion is the final answer. There is a need for more classroom-based research from different parts of the country—and from other countries—to provide political and pedagogical insight into integrating word problems and projects into the standardized curriculum without punitive consequences.

MANAGEMENT AND CONTROL

This study has shown that a mathematics teacher who wants to practice CME should allow for some potential consequences. CME is not welcomed in schools colonized by

neoliberal pedagogy. Although a teacher may succeed in creating an egalitarian community of learners in the classroom, life in other classes is mostly organized by market-driven educational discourses. This situation could demoralize students and teachers alike. Therefore, a practice of CME must openly negotiate these kinds of situations with students through whole-class discussions.

My research shows that it is possible to practice a humanizing education that sides with students as human beings and citizens against the imperatives of the neoliberal system; however, such a practice is accompanied by certain political challenges. It is sustainable only if the classroom is treated as a democratic community. Because market-driven objectives currently colonize classroom life, it is imperative to create small openings in which students can develop critical mathematical literacy, reclaim their voices, and thereby subvert neoliberal hegemony.

LIMITATIONS AND SUGGESTIONS AND FINAL WORD

My study provides a solid framework for CME in relation to market-driven educational changes. However, I do not claim that this is a complete frame. I conducted research in one class in one high school. Although neoliberal educational policies have been widely implemented across the U.S., educational changes may have impacted states—even school districts within states—to different degrees. Therefore, further research in other settings should be undertaken to develop a more comprehensive picture of the scope and limitations of CME.

I am aware that the transformative changes in our classroom may not mean so much at the macro level. Nevertheless, this study created small openings in a high school classroom and initiated an egalitarian community of mathematics learners. By doing so, it showed that a classroom *could* be transformed into a community and thus neoliberal pedagogy could be countered. With the creation of many more small openings, these promising results could be expanded to show that a dialogic teaching of mathematics and a more democratic education is possible, even within educational conditions that are contradictory to the larger emancipatory vision of critical mathematics education.

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