Integrating Critical Mathematics Education with a Foucauldian Lens: Unveiling the Nature of Mathematics

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This paper aims to interpret Critical Mathematics Education (CME) through the integration of a Foucauldian perspective, with an emphasis on the nature of mathematics. The underlying principle of CME is to foster awareness among students of the world around them, thereby taking actions to make the world a more just and equal place. To reach this emancipatory objective, it is necessary to elaborate on the constructed and constitutive nature of mathematics. It is a vital step towards challenging dominant discourses and fostering critical engagement. Drawing on Foucault's theory of power provides valuable insights into how CME can be applied thoroughly.

Keywords: critical mathematics education; Foucauldian approach; power; discourse

Critical Mathematics Education

Critical mathematics education (CME) was introduced by Frankenstein (1983) and Skovsmose (1985) in the USA and Europe, respectively, aiming for humans to be critical mathematics literate who are capable of using mathematics to question the available structure of organizations to take action against injustices and inequalities (Frankenstein, 1990). CME has roots in critical pedagogy proposed by Freire in 1971 as a way of liberation and emancipation of ideas. In his well-known book, "Pedagogy of the Oppressed", Freire (2018) criticized dominant forms of education and suggested "problem-posing education" where teachers and students are equal learning partners having a dialogue.

Freire (1971) presented the concept of "problem-posing education" as a viable alternative to the conventional "banking education" model, which relies on traditional classroom dynamics where the teacher assumes a position of authority, and students are regarded as passive recipients to be filled with the teacher's knowledge. In problem-posing education, the classroom becomes a space for inquiry and exploration, where students are encouraged to engage with the subject matter actively and to question and analyse the world around them. Instead of being passive recipients of information, students are regarded as active participants who actively contribute their own perspectives and experiences to the learning process.

The goal of problem-posing education is to foster critical consciousness and empower students to become active agents of change in society. It seeks to challenge oppressive structures and promote social transformation by encouraging students to critically examine and question the existing social, political, and economic "realities". Nevertheless, any attempt to undermine authority in pursuit of liberation would be considered presumptuous without a comprehension of these power dynamics, as power relations within the classroom are significant points of consideration.

In the Freirean tradition of CME, power is viewed as a one-way flow from top to bottom, following Marxist ideas. The traditional classroom discourse reinforces these power dynamics, at the micro-level, with the teacher in an authoritative role and the students as passive recipients. At the macro-level of society, to combat oppressive

power, marginalized individuals must engage in a revolutionary movement for emancipation, facilitated by literacy. However, framing the struggle against power solely risks reducing CME to a mere teaching technique, effectively making it a normalized feature of education (Kollosche, 2016). This reduction necessitates assumptions of an eternal truth. In other words, this conceptualization of power results in a fixed knowledge viewpoint "from which epistemological and ethical certainties can be determined" (Ernest, 2016, p. 104), and this extends to mathematics.

Mathematics is not static and neutral; it can either empower individuals or reinforce the beliefs of dominant organizations. Skovsmose (1994) terms this the "formatting power of mathematics." The formatting power of mathematics lies in its connection to technological decision-making and action within social, political, and economic contexts, as dictated by the language of mathematics (Skovsmose, 1998). As a language, mathematics emerges due to demands for communication which are "the principal force behind all human intellectual activities, and thus, all these activities are inherently social in nature, whether performed individually or in a team." (Sfard, 2000, p. 161). It is constituted by complex power relations, so thereby a product of social practices rather than existing outside of human touch.

To fully apply CME and achieve its 'liberatory' objectives, it is crucial to deconstruct and elaborate on its concepts. In this paper, I aim to critique CME concepts and mathematics using a Foucauldian lens. Utilizing a Foucauldian approach "towards power, knowledge and discursive practices provide a language and analytical tools to gaze behind common convictions in mathematics education and to perceive and analyse them as regimes of truth connected to the socio-political." (Kollosche, 2016, p. 77). In the following sections, I will introduce the Foucauldian concept of power to elaborate further and reframe CME concepts. Therefore, based on the concepts of power, knowledge, and discourse, I will define mathematics as a discourse in the last section, foregrounding its constitutive and constructed aspects in the mathematics classroom.

Recasting CME from Foucauldian Theory of Power

CME conceptualises, drawing on Marxism, power as belonging to the top of the hierarchy, called hegemonic power. Eliminating this power, therefore, is a route to emancipation since it distorts presumed reality. However, this seems utopian because to fight against the institutions and organizations at the top that hold power requires a revolutionary movement with an equivalent level of power (Foucault & Corps, 2010). This conceptualisation of power underestimates its positive and productive features that constitute elements of modern society (Smart, 2002). On the other hand, power, in the Foucauldian approach, can be exercised by the bottom level of the pyramid as tactics or any other structure as strategies at the macro level (Lynch, 2014). Through Foucault's conceptualisation of power, the traditional liberal perception of "liberation" should be modified. Critiquing the power and knowledge interplay helps to clarify the view of liberation and freedom as well.

Foucault's emphasis on power and knowledge aimed to uncover the mechanisms through which power operates and produces truth claims, social norms, and subjectivities (Foucault & Gordon, 2010). He examined how power relations shape and regulate individuals and societies through discursive practices, institutions, and techniques of control. Foucault's analysis focused on the historical, social, and contextual aspects of power, rather than on individual beliefs or subjective experiences.

According to Foucault's concept of power, the power of governing does not only belong to a dominant, oppressive class of society, and subjects are not the objects of power. As Foucault (2007) outlined:

> Individuals are not the object of government; the action of government is not brought to bear on individuals. The captain or pilot of the ship does not govern the sailors; he governs the ship. In the same way, the king governs the city-state, but not the men of the city...Men are only governed indirectly, insofar as they have boarded the ship. And men are governed through the intermediary or relay of boarding the ship. (p.123)

Unpacking this quotation, power is not exclusively possessed by dominant or privileged individuals or groups but is present in various social interactions and relations (Lynch, 2014). Consequently, for example, tests and examinations in education also function as instruments of power, revealing truths about students. Through administrative regulation and the use of statistical techniques, student performance is compared and normalized, leading to the establishment of a "regime of truth" and the assignment of individuals to specific positions and categories (Ball, 2017; Cotton & Hardy, 2006).

Reflecting on Foucault's concept of power, I have redefined the aim of CME; in the pursuit of critique, CME should not aim to "produce an account that is more truthful or closer to the truth but to sabotage and disrupt validity and meaning by exposing the conditions for the formation of truth and to examine its incumbents" (Hand, 2008). Therefore, in the realm of CME, the aim of "fighting against hegemonic power" can be modified to "taking action against injustices and inequalities" acknowledging that power is not solely concentrated in hegemonic structures. This action should involve individual-level critique rather than relying solely on a utopian revolutionary movement. That is to say, emancipation becomes a matter of re-making ourselves "from within the parameters of a particular historical situation" (May, 2014, p. 79).

The purpose of CME, therefore, should not be to create an accurate or truthful account of something, but rather to deliberately undermine and challenge the concepts of truth and meaning by revealing the factors that shape our understanding of truth. To me, in that way, CME can be an effort of "emancipation" that is practiced at the individual level in the form of critique towards liberation.

Mathematics Classroom Discourses: Mathematics Discourses and Generic Educational Discourses

Foucault's conceptualisation of power provides a nuanced analysis of how mathematics and mathematics education are utilized in specific discourses, influencing social practices and individuals' lives. This perspective allows us to view mathematics as a discourse encompassing various tools such as statements, visual representations, graphs, and equations, which capture certain aspects of our perceived reality. In this sense, mathematics can be conceived as a human activity as "putting discourse in the place of disembodied knowledge brings down the conceptual barriers that separated the individual from the social" (Sfard, 2000, p. 161). It is significant to understand underlying power dynamics, politics, and historical constraints in shaping mathematics and mathematics education.

Mathematics is not detached from human engagement and participation but is shaped by socio-political and socio-economic factors, while simultaneously influencing individuals' subjectivities through embedded implicit biases and

assumptions (Andersson & Barwell, 2021). It is defined as a discourse about "human communication; the most unique of this communication is language in use." (Ryve, 2011, p. 169). Mathematics is a language that constructs narratives, produces objects, and situates individuals within specific contexts, influencing and constraining their positionality. By critiquing and deconstructing these mathematical objects, we can uncover underlying assumptions and gain valuable insights into the nature of our perceived reality.

In a mathematics classroom, mathematics and generic educational discourses are at play, influencing each other in a cyclic relationship (Ryve, 2011). The complex and interwoven relations of these discourses produce the subjectivities of learners and teachers, ascribing them to particular roles and functions. Non-mathematical, generic discourses may "influence the epistemological issues of what it means to know mathematics and who could become a knower in mathematics" providing categories and some "possibilities for subjects to participate in mathematics discourses" (Ryve, 2011, p.174). Similarly, mathematical discourses have the power to create specific categories; for example, the idea of "normal" individuals and society, which originated alongside the development of modern statistics in the 19th century (Andersson & Barwell, 2021). The term 'statistics' itself emerged as a result of its gradual utilization by governments to effectively govern their nations based on data about 'the State'. (Hand, 2008).

The process of normalization extends its influence to broader educational discourses. In 20th-century modern pedagogy, there was a focus on altering the distribution of outcomes through the normal curve, which assumed unity for comparing individuals within the same conceptual space (Ball, 2017). In today's neoliberal pedagogy, a different form of normalization is at play, involving the testing and monitoring of students to predict their future roles as essential contributors to economic growth, viewing them as future human capital for productivity (Ball, 2017).

Learning occurs through active participation in a certain discourse (Sfard, 2000) which refers to systems of stories that construct objects and shape subject positions. It involves a historical, material, and multiplicative explanation of causal relations (Gutting, 2005). Foucault emphasizes the importance of examining the history and socio-political functions of a specific discursive formation to assess its presumed reality and understand its impact in a broader context (Dreyfus & Rabinow, 2002).

However, modifications in the mathematics curriculum are not aligned with historical development. Instead, they are designed based on gradual increase in complexity, categorising and ordering in a certain way. Cotton and Hardy (2006) called this "a constructed naturalness" of mathematics, and they point out the UK National Curriculum for Mathematics in 1995, consisting of "4 areas of mathematics, each ordered and described for 8 levels of attainment," and the configuration in 1989 with 14 areas and 10 levels, as examples (p. 89). Even though these categorisations taken as natural changing the nature of mathematics, have already forgotten, the current UK curriculum introduced in September 2014 is also structured around different attainment levels. This "sequential complexity of mathematics" can be traced back to the Euclidean construction of axiomatic system which is built on foundational axioms and lemmas that lead to theorems, followed by proofs (Ernest, 2021).

The presentation of mathematics "as an ever-increasing set of eternal, immutable truths" (Lakatos, 2015, p. 151) is maintained in the discourse of 'certainty of mathematics' in the traditional mathematics classroom discourse. This allows

normalisation and dividing practices "which limits the access to the discipline and at the same time contributes to a regime of truth which presents mathematics as an apolitical and universally potential endeavour" (Kollosche, 2016, p. 80). The discourse of certainty of mathematics has its roots in Platonic ideas that suggested that pure mathematics is reserved for the bourgeoisie. In contrast, applied mathematics is associated with the working class. This separation maintains the ascribed status of subjects for the sake of the status quo.

In conclusion, the epistemological assumptions about the nature of mathematics have a profound impact on mathematics classroom discourse. By recognizing and foregrounding the discursive nature of mathematics, we can gain insight into underlying historical constraints and complex power dynamics, leading us towards a path of emancipation and freedom.

Conclusion

This paper has explored the integration of CME with a Foucauldian lens, focusing on the nature of mathematics and its implications for the mathematics classroom discourse. CME aims to empower students to become critical mathematics literate individuals, capable of questioning existing structures and taking action against injustices and inequalities. By reframing CME through Foucault's concept of power, we understand that liberation is not solely about overthrowing hegemonic power but also involves individual-level critique to challenge dominant discourses. In other words, freedom "is not as though there is what we might call a 'truth' of what we can become, and that once we understand our historical situation, we can discover that truth" (May, 2014, p. 79). Instead, it is a process of experimentation through various possible transformations.

Mathematics is revealed as a discourse deeply intertwined with socio-political and socio-economic factors, influencing subjectivities and shaping narratives. By foregrounding the discursive nature of mathematics, we can strive towards a more emancipated and liberated mathematics education as it allows us to understand the historical constraints and complex relations in the mathematics classroom discourse. The cyclic force relations between mathematics and generic educational discourses show possible applications of the Foucauldian approach in CME.

Acknowledgements

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