Knowledge beyond colour lines

Towards repurposing
knowledge generation in
South African Higher Education

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TOWARDS A SOCIALLY JUST 'PERSONAL THEORY OF PEDAGOGICAL PRACTICE' (PTPP) IN MATHEMATICS THROUGH A CRITICAL PEDAGOGICAL LENS

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Introduction

Higher education practitioners' conceptualisations of personal theories of practice are central to this chapter. The idea of 'theory of practice' is embedded in the notion of 'social justice in critical pedagogy' (Breunig, 2016). The novelty of these formulations is that higher education practitioners' personal theories of pedagogical practice in the context of teaching and learning mathematics interface with the notion of 'critical pedagogy'. We discuss how social justice, as a fundamental value, becomes ingrained in the notion of 'personal theories of pedagogical practices' of mathematics lecturers. The questions asked are:

- How can the realisation of social justice be conceived as an educational aim in a mathematical pedagogical context?
- What role do personal theories play in that realisation?

The authors take a social justice pedagogical approach to exploring these issues in teaching and learning mathematics at the higher education level.

Personal conceptualisations of pedagogical practice in mathematics are considered in the context of issues such as mathematical knowledge production and its purpose, affordances in mathematical power and freedom, and an acknowledgement that critical thought is integral to mathematical learning. Critical pedagogy acts as an overarching notion within which values of shared understanding, dialogical engagement, and the navigation of power differential are considered. Perceived epistemological superiority or inferiority attributed to certain sources of knowledge run counter to the idea that knowledge exists beyond the boundaries of race, colour or gender. Within these considerations, the following sections examine how pedagogical practice is conceived at a personal level in relation to the centrality

of dialogue, shared power, and critique in pedagogy. These three notions are dealt with in detail to answer the questions formulated earlier.

‘Personal theory of pedagogical practice’ (PTPP) in mathematics

In this chapter, the PTPP idea has been proposed, specifically in the context of mathematics lecturers’ instructional practices. PTPP is proposed to mean a set of deep-rooted convictions of a practitioner regarding what it means to teach and learn mathematics at a university for students from previously disadvantaged backgrounds. PTPP is also considered to refer to what it means to teach mathematics to cohorts of mostly first-generation students drawn mainly from previously disadvantaged backgrounds.

When university education is considered a means to escape poverty and inherited social injustices, theories of practice evolve to embrace such social obligations or defend convictions often misaligned with transformation discourses (Swartz, Ivancheva, Czerniewicz & Morris, 2018). As early as 1997, the Department of Education had indicated that the education system had a role to play in social transformation (RSA DoE, 1997). Two decades later, while vestiges of inequalities and injustices continue to plague the South African nation’s psyche, educational practitioners often position themselves precariously regarding their theories of practice, frequently exacerbated by conflicting realities, internal and external to the practice of teaching, that inhibit the purpose of such practice from being a “social mission” (Hargreaves, 2003:5). A transformation agenda for institutions, underpinned by such a ‘social mission’ and a commitment to transformative justice, is not guaranteed by forced compliance but rather by a “deeply personal, emotional and intellectual” allegiance to social justice as a virtue (RSA DHET, 2015:23). However, the inculcation and practice of social justice through education by practitioners automatically subscribing to such notions is problematic in the post-apartheid era in South Africa, partially because disadvantaged racial groups’ welfare does not always determine the post-apartheid education system’s priorities (Chetty, 2014). In this regard, policy formulations have not necessarily resulted in any tangible difference in these racial groups’ educational development. Such students’ lack of access to, for example, communication technologies has resulted in them being systematically side-lined from university admission. Issues of systematically reinforced injustices of this nature put the notion of personal theories in the context of current social realities in South Africa. In this sense, personal theories reflect a set of emotional and intellectual preferences that characterise practitioners’ commitment to social justice that explicitly translates to students’ welfare in previously disadvantaged racial groups (Rodd & Sanders, 2018).

Practitioners' view of PTPP through the lens of critical pedagogy

A brief note on critical theory (CT) is essential before considering critical pedagogy. A central idea of critical theory is that, in a capitalist or neoliberal society, people's desire for emancipation and the forces that oppose such desires are in perpetual ideological conflict (Fleming, 2012). As an ideology, neoliberalism puts forward a set of statements about pedagogy that promotes the private sector's interests, relegating society's collective development to insignificance. Neoliberal discourses have thus dominated the higher education scenario; these discourses are naturally in conflict with emancipatory pedagogies, often becoming casualties during transformation. Emancipation and the "critique of domination and exploitation", in this sense, are an "ontological dimension" of critical theory (Fuchs, 2015:3). Fuchs's (2015) point is that human beings have existential significance beyond their class. 'Critical theory' aims at a holistic social transformation, resulting in creating a just society with "peace, wealth, freedom, and self-fulfilment for all" (Fuchs, 2015:3). A classless society, devoid of exploitation and domination, becomes the moral imperative of such a social structure. By critiquing domination and exploitation, critical theory thus asserts its ontological position on what constitutes social reality and its nature. An association with historically oppressed people's social and emancipatory struggles is central to critical theory (Fuchs, 2015:4). Critical social theory, a tenet derived from critical theory, also emphasises the need for eliminating unequal power relations that perpetuate domination and oppression as mechanisms of social injustice (Evans, 2010).

Critical pedagogy (CP) as an educational standpoint to view power imbalances prevalent in educational institutions is attributed mainly to the Brazilian educationist Paulo Freire (Freire, 2018). CP advocates for the emergence of new discourses in critique and resistance to interrogate pedagogical practices that overtly reproduce subjugation (Stinson & Wager, 2012). Taking the fundamental position that education is political, with associated power imbalances, CP proposes a critical examination of the social order that, in turn, leads to discernible action to defend social justice (Rodriguez & Huemmer, 2019). CP also envisages the attainment of critical consciousness to expose the "cultural imperialism" inherent in the higher education system (Mayaba, Ralarala & Angu, 2018:39). This is performed by linking the curriculum content with social problems and considering teachers as "transformative individuals" who assume agentive and dialogically mediatory roles in the realisation of social justice (Mayaba, Ralarala & Angu, 2018:39).

Freire (2018) significantly articulates CP's confluence of theoretical and practical dimensions to bring about social change as a conscious educational enterprise. Freire emphasises critically observing the world as an act of responsible citizenship, as CP theorises. Equally, Freire stresses, as a practical dimension of CP, the importance of actively "intervening in

the larger social order” to change the world (Yi-Huang, 2018:68). This also leads to the injustice being recognised and decisively dealt with in pedagogical contexts. More formally, CP is anchored to form the individual's critical consciousness related to the social and cultural realities he or she is inextricably exposed to. This consciousness, in turn, helps the individual transform such realities to personal advantage. CP thus emphasises a critical awareness of situations and critical transformative actions that ensue, and such awareness leads to the notion that education is ultimately the “practice of freedom” (Hooks, 1994:24). It is this freedom that universities under neoliberal dispensations are happy to renounce for the sake of material capital production.

Given the power of critical consciousness brought about by CP, what is the significance of PTPP in mathematical teaching and learning? In the context of teaching mathematics to a group of students from previously disadvantaged communities, a mathematics curriculum aligned with CP (as a guiding principle) plays a significant role in such students’ intellectual emancipation. Practitioners’ PTPPs should be mindful of a generation of students waiting to be liberated from a sense of historically indoctrinated intellectual subservience. PTPPs thus need to evolve into a vigorous social and educational commitment to help liberate students from such indoctrinations. However, this commitment should not be a casual occurrence but a concerted responsibility of informed academia (Yi-Huang, 2018).

Critical pedagogy and ‘teaching and learning of mathematics for social justice’ (TLMSJ)

As a social practice, education – mathematics education in particular – should essentially involve tackling social justice issues, strengthening the notion of “mathematics for all” (Larnell, Bullock & Jett, 2017:19). A noticeable trend in higher education has been that social justice issues are tackled at a very instrumental and trivialised level, such as changing curricula or instructional environments’ physical structures (Larnell, Bullock & Jett, 2017). What has been lacking in those efforts is an awareness of the harsh social realities that socially excluded, underprivileged students daily and the non-existent “mathematical opportunities” in those realities (Larnell, Bullock & Jett, 2017:19). As an emerging scholarship and discourse, TLMSJ facilitates scholarly debates on racism within the larger teaching and learning discourses. Its seminal contributors, such as Frankenstein (1983) and Gutstein (2003), have placed this notion on a firm footing of ideas from critical theory and critical race theory (Gutstein & Peterson, 2013:19). However, since its inception, the idea has been variedly conceptualised, such as “reading and writing the world with mathematics” and “teaching mathematics for social justice” (Gutstein & Peterson, 2013:20). The multiplicity of associated meanings and scope are explicit in these phrases. However, Gutstein’s and Peterson’s idea was to inculcate socio-political consciousness, agentiveness in critical citizenship, and an affirmation of worth and value in one’s identity (Gutstein & Peterson,

2013). Gutstein and Peterson (2013) proposed that rigorous mathematics learning should take place within this value-laden context. A commitment to use mathematical knowledge to create critical consciousness and abolish social injustices is fundamental to all these varied notions. However, Freire's notion of critical theory is considered the overarching conceptual frame within which all these ideas are conveniently positioned for proposing mathematics as an ideological tool for advancing critical consciousness.

As an approach in critical mathematics (CM), the idea of TLMSJ is, however, derived from approaches put forward by Freire in the context of his position on critical education (Freire, 2005), including offering critiques on knowledge production; fostering critical consciousness; advancing problem-posing as a pedagogical alternative (Stinson & Walshaw, 2017:20). Central to TLMSJ as a social project is a call for realising that mathematical knowledge is not value-free or apolitical but dynamically created and recreated as individuals reflectively act on their world. By contrast, oppressive mathematics education forces marginalised people to internalise oppression silently, considering it a natural consequence of education mistakenly. However, the racial dimensions of oppressive mathematical instructional practices have been largely under-researched (Stinson & Walshaw, 2017:24). Such practices often trivialise the qualitative attribute of the mathematical agency that underpins high confidence in participatory learning. Thus, mathematical agency reinforcement is a significant aspect of moving towards social justice through critical mathematics education afforded to marginalised racial groups. With its inherently agentic nature, critical mathematics questions the implicit exclusionary practices in higher education by which mathematical affordances and participation of certain racial groups remain questionably low. Such institutionalised yet covert exclusionary practices, despite their widespread occurrence, are yet to be engaged at a scholarly level for more appropriate theorisations from a social justice point of view (Stinson & Walshaw, 2017:26). As Gutstein (2006) noted, these practices are inherently opposed to fostering any degree of critical consciousness and cultivating a politically agentic nature in students, leading to a total 'miseducation' of such African students in mathematics (Brantlinger, 2013:2). Social justice-related response to this issue would be that poignant issues of a social and political nature should constitute the authentic contexts in which mathematical instruction is practised. This will lead to mathematics, as a field of study, being used as an instrument to raise critical mathematical consciousness that forms the basis of a deep-rooted awareness of other racial injustices hidden in the practice of education (Brantlinger, 2013:2).

In general, critical theorists believe that racial marginalisation essentially leads to individuals from marginalised racial groups being excluded from mainstream social platforms due to the inherent power differentials designed to favour whites at the expense of the indigenous Africans in particular (Chetty, 2014). It is often noted that racist educational practices were more explicit during apartheid in South Africa. However, such practices have assumed

a rather subtle dimension in the post-apartheid era. The notion of race seems to have been replaced by that of class. Unfortunately, the previously disadvantaged racial groups, especially those at the very bottom of the social and economic stratum, remain in the same sad predicament of being in “civic alienation” (Chetty, 2014:94).

Looking further into explaining this phenomenon of alienation, based on some critical theoretical foundations, Frankenstein (1983) and Skovsmose (1994), as the seminal contributors to the notion of critical mathematics, have drawn their arguments mainly from the Frankfurt School of critical thought. Frankenstein (1983) makes significant contributions to arithmetic and statistics pedagogy based on a critical consciousness-driven content structure (Brantlinger, 2013). Gutstein’s (2003) notion of ‘reformist critical mathematics’ (RCM) has four constituents:

- critical consciousness (awareness of social and political institutions that influence lives);
- critical agency (awareness that people can make a difference towards a socially just society);
- positive cultural identity (realisation of the validity of own culture); and
- dispositional change towards mathematics and mathematical power (Gutstein, 2003).

In this framework, critical mathematics education calls for disadvantaged students’ social and academic empowerment to adopt mathematical training as critical literacy, achieved entirely by embedding sensitive socio-political themes in the mathematics curriculum (Buell & Shulman, 2019). For instance, data with considerable social significance can lead to students’ critical enlightenment, empowering them with skills and knowledge to question the intellectual subjugation they suffer through inadequate mathematics education; further empowering them “to oppose suppressive and exploitative situations” (Mayaba, Ralarala & Angu, 2018:7). Such situations are characterised by blacks’ experiences of being dehumanised in one’s own mother country, as used to be the case in South Africa (Mayaba, Ralarala & Angu, 2018:8). As the practice of freedom, mathematics education should thus be purposely geared towards disrupting the epistemic conventions that suppressed racially subjugated people to even more intellectual dependence. Critical mathematics education should present the mathematics curriculum as a political episode in students’ lives enacted by students’ emotions, beliefs, and aspirations they bring to the classroom (Mayaba, Ralarala & Angu, 2018:8). Student aspirations should then become the themes around which instructional units are designed to incorporate social justice as an essential mathematics educational aim (Bond & Chernoff, 2015). Increased incorporation of students’ voices and their lived lives in classroom practices constitutes the ideal social justice-based classroom (Bond & Chernoff, 2015:28). Research has also proven that mathematics happens to be the perfect platform for students to scrutinise injustices practised in society. A high degree of objectivity that characterises the content matter in mathematics and the emotional disconnectedness of mathematical and statistical arguments requires students to be equally mathematically empowered to take a critical position in social justice arguments.

Students illiterate in mathematical argument methods eventually lose out in situations that compel them to pose significant mathematical statements in defence of social justice (Bond & Chernoff, 2015:28). Such defences result from a symbiotic pedagogy incorporating mathematics and social justice where mathematics uses its empirical tools to expose the power imbalances that often underpin social injustices perpetrated in educational environments. With the precision and accuracy of mathematical methods, students feel empowered to take on social justice issues prevalent in their environments.

The common factors that characterise all critical pedagogies are:

- firstly, the belief that education and society are interrelated entities; and
- secondly, an aspiration to advance the cause of social justice through changes in education and hence society.

In this way, educational change and social change are “mutually constitutive and dialectically related” (McArthur, 2010:495). However, critical pedagogy is not a set of canonical pedagogical prescriptions of best practices (McArthur, 2010:500). Instead, it is a dynamic ideological proposition that strives to consolidate and strengthen our desire to bring about social justice through educational enterprises (Stinson & Walshaw, 2017). This answers the criticism levelled against critical pedagogy regarding its presumed disconnect between theoretical propositions and practical classrooms applications. Theory and practice, at least in the context of CP, are in a dialectical relationship: one is not conceived independently of the other. Also, the application of CP at the classroom level is a context-dependent affair. The ideological tenets of CP need to be rigorously experimented with and perfected in each instructional context, giving the individual practitioner a particular paradigm instead of the details of choices to be made in practice. However, McArthur (2010:500) warns that the individualistic nature of CP is cautiously approached, in that institution-wide efforts incorporating group dynamics are essential for the success of CP. While individual efforts are important, pedagogical enterprises conducted at the institutional level have to support individual academics’ efforts. After all, in the African context, CP’s ultimate goal is to strive for a curricular and instructional framework evolution that provides an outright rejection of institutionalised dehumanisation of Africans (Shilliam, 2016:263).

Another important aspect of mathematical learning considered in the post-apartheid South African context is that mathematics has been conventionally considered a ‘gatekeeper’ subject that guarantees entry into a different social status (Rolheiser, Evans & Gambhir, 2011). Mathematical competence, then, naturally becomes an issue of equality and justice because of its affordances. A social justice-based pedagogy for mathematics is more significant in a South African context than anywhere else. A generation previously deprived of mathematical affordances finds itself having to tackle mathematical learning as an existential imperative for itself and future generations. However, post-apartheid South Africa’s neoliberal characteristics trivialise mathematics and mathematical learning

by making them tools for commodifying natural resources (Brown, Solomon & Williams, 2016). Emancipatory aims in higher education, advocated for from multiple platforms in educational theory and practice, are often met with such “capitalist infiltration of education” (Cole, 2017:223).

Critical mathematics and critical mathematical inquiry in the context of PTPP

Critical mathematics essentially conceptualises mathematics as a field of study constructed around students’ and teachers’ cultural identities. Engaging effectively in mathematical learning involves inherent socio-political issues in which such identities are crucial (Stinson & Walshaw, 2017). As a tool for critique and an object of critique, critical mathematics scrutinises mathematical knowledge sources, explores social problems and their solutions and responds to injustices (Skovsmose, 1994).

There is an unprecedented emphasis in critical mathematics on dialogically facilitated problem-solving and critical thinking as an essential attribute of higher education environments (Rambiritch, 2018). This is in line with problem-posing and problem-solving being considered fundamental to “Freire’s liberatory, humanistic concept of education” (Greenstein & Russo, 2019:8). At a curricular level, nurturing competencies in problem-solving, reasoning, and mathematical communication essentially lead to mathematical power attainment (Gutstein, 2003). Critical mathematics inquiry (CMI), in this context, is inherently political (Breunig, 2016). Both students and teachers assume the role of agents of social change. The teacher’s agency plays out in transforming the students into citizens capable of undertaking agentive ways of transforming society (Breunig, 2016:4). The classroom should then have its practice anchored in its students’ lives, having a critical outlook on the world around and on itself. The mathematical problems selected for such a classroom should have a set of subjective and objective criteria by which the choice of problems is achieved (Goodson-Espy, Naresh & Poling, 2016). The ‘subjective criteria’ refers to the problems being aligned with the student’s current mathematical, conceptual understanding; the ‘objective criteria’ refers to the use of authentic data drawn from a current social issue with which the students easily identify, from a social responsibility point of view (Goodson-Espy, Naresh & Poling, 2016:791). CMI further envisages the inculcation of values such as empathy and tolerance and an appreciation that all individuals can do mathematics (Goodson-Espy, Naresh & Poling, 2016:792).

It will be inappropriate to leave out the notion of humanising pedagogy at this stage. As a form of critical pedagogy, such is anchored in Freire’s notions of humanisation and pedagogy (Freire, 2018). Freire used these ideas to put up a formidable defence against the dehumanisation trends inherent in certain educational practices (Freire, 2018:25). Freire

argued that humanisation practice facilitates the attainment of freedom of the oppressed, transforming the world, which, according to him, was the world's humanisation of itself. Subscribing Marxist humanism notions, Freire's version of humanism placed the societal systems that reproduced social inequalities under critical scrutiny. Freire thus created what later came to be known as the 'pedagogy of humanity' (Freire, 2018:54). The point here is that social justice pedagogy is much more than a mere teaching method. It manifests in various forms as an amalgam of "philosophy, politics and practice" and places a high demand on students and lecturers to eradicate oppressive social systems (Michalinos, 2018:5). The pedagogy of humanity, however, is not to be seen as an instrumentalised set of pedagogical tools but rather "a way of living in the world", meaning that pedagogical decisions are taken to suit the contextual needs, acknowledging the fluid nature of learning environments (Michalinos, 2018:5).

In the context of mathematics education, humanising pedagogy may be considered a platform on which educators and students can be engaged in mutually humanising activities (Zinn & Rodgers, 2013). Such activities are best carried out in mathematical problem-posing and mathematical dialogical engagements that lead to critical consciousness. Mathematical critical consciousness is taken here to mean (deducing from Freire's notions of consciousness) an awareness, created through mathematical learning, about social, political, and economical inconsistencies that characterise oppressive, racially discriminatory practices, and an urgency to respond to those injustices. The post-apartheid higher education sector in South Africa is a typical scenario in which rehumanising pedagogies in mathematics are particularly significant (Michalinos, 2018:6). Despite significant emancipatory rhetoric emerging at a scholarly level, eradicating "pedagogical inequalities" prevalent in the mathematics education sector in South Africa is yet to manifest in tangible praxis in alignment with such rehumanising pedagogies (Leentjie, 2018:26). In this sense, rehumanising mathematics has mathematical, social and epistemological aspects (Stinson & Walshaw, 2017). The mathematical dimension relates to the attainment of mastery in the language, skills and practices associated with mathematical learning; the social dimension relates to the use of mathematics as a tool for social critique; while the epistemological dimension relates to mathematical empowerment in the creation of mathematical knowledge (Stinson & Walshaw, 2017:16). Mathematical empowerment of the citizenry along these three dimensions will result in reclaiming mathematics as a tool for emancipation instead of a device for constructing a stratified society.

The phrases that constitute critical mathematical inquiry are purposefully chosen to signify the scope of the underlying proposition: 'critical' signifies questioning the entities such as vested and exclusive power afforded to a selected few, the rights and privileges of the elite, and socio-political and educational inequalities experienced by certain groups of society; 'mathematical' signifies powerful forms of thinking that encapsulates "pattern[-]seeking,

conjecturing, experimenting, generalizing, visualizing, representing, and proving” (Stinson & Walshaw, 2017:5); and, lastly, ‘inquiry’ is considered an agentive intellectual positioning from which to explore mathematical ideas by posing questions, verifying theories and substantiating relationships.

In *Pedagogy of the Oppressed*, Freire (2018) provides us with ideas on critical pedagogy and seminal insights into the notion of CMI (Freire, 2018:6). Freire’s views on oppressive institutional power, the subjugation of argumentative thought, and the deprivation of educational opportunities for marginalised people are intense. Freire’s notion of praxis has also significantly influenced the evolution of CMI as a philosophical construct. Freire called on citizens to become critically aware of the limitations within which their lives are shaped, to engage reflectively in a transformative course of action to bring about change. It is interesting to note that the evolution of emancipatory mathematical thought of this nature can be traced to Freire (2005) yet manifests quite subtly in Gutstein’s (2006) notion of TLMSJ. It is also interesting to note that Frankenstein (1983) associated mathematical literacy with an attribute of ‘critical citizenry’, hence a significant dimension of TLMSJ. Mathematical literacy – particularly statistical literacy – is a critical tool for the masses to defend themselves against the myriad ways social injustices are depicted as just practices, using statistical misrepresentations.

Let us now turn to see how Gutstein (2006) theorised the notion of teaching mathematics for social justice, as constituted by a set of social justice pedagogical goals and another set of mathematics pedagogical goals. Figure 16.1 represents this distinction:

FIGURE 16.1 Gutstein’s (2006) model of teaching mathematics for social justice.

'Writing the world' signifies an attempt to transform the world through purposeful action (using mathematics to rewrite the world). Reading, on the other hand, is about reflection. Gutstein's (2006) model incorporates the action and reflection dual process, resulting in attaining social justice and mathematical pedagogical goals. Reading the mathematical word constitutes mathematical power development (Gutstein, 2006). It uses mathematics to expose power relations, unequal access to resources and opportunities, and racially discriminatory practices. 'Succeeding academically' simply means gaining access to advanced mathematics courses, leading to careers in mathematics. This is significant in the case of previously marginalised students, according to Gutstein (2006:23). Changing students' orientation to mathematics entails envisaging a major shift in the perception of mathematics' nature. This perceptual shift results in mathematics' nature being seen as a powerful toolset that helps us understand authentic phenomena.

Social justice pedagogical goals, as proposed by Gutstein, include reading and writing the world with mathematics. Reading the world involves using mathematics for understanding imbalances in power relations, unequal access to resources, and racial discrimination, *inter alia*. Writing the world with mathematics involves, on the other hand, the explicit use of mathematics to transform the world through the creation of trust in one's agency. As a social justice pedagogical goal, cultural and social identity development involves anchoring mathematics teaching in the students' own language, culture and community to equip them with the necessary tools to survive the onslaught of an alien culture (Stinson & Walshaw, 2017).

An interesting question on how Gutstein's teaching mathematics model for social justice can help practitioners structure the classroom and learning environments is relevant at this point. A salient aspect of the instructional practices that CP envisages, which precludes a preconceived set of canonical prescriptions for practitioners, is the dialectical (and hence dynamic) nature of learning itself. Central to the instructional discourse in such learning environments is the "oppressed students' experience of living as dehumanized beings" (Mayaba, Ralarala & Angu, 2018:8). These authors further emphasise the political nature of the CP-related curriculum, "shaped through a dialectical relationship with students that incorporates the knowledge, hopes and desires they bring with them to the classroom" (Turner, Hayes & Way, 2013:343). Gutstein (2003) shares some ideas from his own classroom experience in TLMSJ regarding this dialectical relationship. In a two-year study, Gutstein was involved as a teacher and researcher at Diego Rivera School, Los Angeles, USA, that catered for a large Mexican American (Latino) underprivileged community. Through his practice, Gutstein emphasised his students' need to "understand, formulate and address questions and develop analyses of their society" as critical to their attempt to be socio-politically conscious (Gutstein, 2003:40). To this end, he developed "17 real-world mathematics projects that connected to students' lives and experiences" that helped

him inculcate the qualities of personal and social agency among the students (Gutstein, 2003:42). The projects involved mathematical problems embedded thematically in open-ended questions relating to issues such as abortion, homosexual marriage and teenage pregnancy. Using a mathematics in-context (MiC) curriculum that the National Centre for Research in Mathematical Sciences Education developed, Gutstein managed to bring contemporary social issues to the forefront of mathematical learning, culminating in his students attaining significant mathematical power. Gutstein attributes this power to the students' "powerful sense of justice stemming from his or her life experience as a member of a marginalised community" (Gutstein, 2003:67). It is important to note that Gutstein used various non-conventional instructional techniques (for example, narrative essays on mathematically significant social justice issues) to instil a sense of agency in transforming the society of which the students formed part. While the students' agentiveness, in this case, played a pivotal role, how one fosters that agentiveness within a curricular content that may be prescriptive cannot be predetermined.

TLMSJ is a complex notion derived from the idea of critical education having relevance in any educational endeavour that tries to consolidate the emancipatory intellectual activity's value. However, as opposed to a formal social justice-compliant curriculum, students' problem-posing is fundamental to such an emancipatory concept as mathematics education. TLMSJ is also characterised by its exclusive use of applied mathematics (statistics, for instance) for addressing social injustices. An interesting contrast is seen in critical mathematical inquiry in which mathematical engagement takes place in the context of pure mathematics, often within the classroom environment. A democratic environment in which free mathematical argument is facilitated with students' viewpoints acknowledged and appreciated is possible in such environments.

PTPP evolving in a critical pedagogical context

As an instructional approach in a teacher-training context, CP is well acknowledged as a pathway to considerable social change (Keesing-Styles, 2003). The social change envisaged here is focused on the free existence of individuals who are otherwise exposed to influential discourses that curtail their freedom. At this point, CP draws many ideas from critical theory. CP essentially advocates for concerted action towards transforming the individual's life through the practice of education and the attainment of freedom (Keesing-Styles, 2003). Thus, CP becomes an inherently political ideal that evolves in the form of an educational mission towards abolishing unequal power relations, racial prejudices, and injustices that often characterise educational institutions (Keesing-Styles, 2003:2). Freire's (2005) notion of CP was not, however, reducible to a set of propositions or prescriptive tools to be used in the classroom for achieving social transformation. Freire conceptualised CP in a much broader sense. The researcher considered each

classroom a system of individuals for whom learning becomes a dialogically negotiated and participatory affair, characterised by an absence of power imbalances. Prescribing an emancipatory pedagogy for the whole class would thus not make sense because of the varied nature of the social contexts to which each student belongs. This aspect is often considered a critique of CP because it points to an apparent absence of a convincing theoretical discourse upon which the educational world, as envisioned by CP, can be anchored; and the associated praxis stipulated for practitioners (Keesing-Styles, 2003:5). On the other hand, critical pedagogies are best considered dynamic: they are constantly being shaped and reshaped when one pedagogy becomes adapted to a particular context. Freire (2005:11), in this sense, differentiates between two such contexts:

- the real dialogue between students and teachers in which both are considered “equally knowing subjects”; and
- the real social life contexts in which people live.

Within the overarching philosophy of critical pedagogy, the notions of ‘critical mathematics’, ‘critical mathematical inquiry’, and TLMSJ can thus be considered a coherent confluence of ideological positions in the context of lecturers’ PTPP. Critical mathematics advocates for students’ identities to be acknowledged in the learning process. Such learning essentially involves tackling various issues of a socio-political nature of which racial discrimination and prejudice are just one aspect. Critical mathematics invokes a critical disposition that interrogates mathematical knowledge sources, acknowledging mathematics as a tool for and an object of critique. On the other hand, CMI is more of an active and agentive theoretical positioning that emphasises purposeful action leading to transformation. Critical interrogation of issues and posing investigative questions in relation to mathematically significant social contexts is consistent with this notion. In this sense, CMI has a significant practical dimension; it involves a particular interrogative approach to the teaching and learning of mathematics directly translating to classroom practice. TLMSJ, as a related concept, has an intense focus on the advancement of social justice as an aim of the practice of education. As a paradigm of research in mathematics education, TLMSJ has evolved into a formidable platform from which critiques of societal injustices, constructed from a mathematics instructional point of view, can be launched. TLMSJ also offers a platform for researchers to offer theorisations and counter-theorisations towards forming a convincing rationale for social justice to be the focal point of mathematical learning. Finally, this chapter argues that personal theory is central to professional practice; hence, a change in such practice is naturally a function of change in ‘personal theory’. Ultimately, it is the individual’s core convictions constituting a personal theory that determine whether social justice is a worthwhile cause to be pursued in mathematical instruction. Theoretical positions of critical mathematics, CMI, and TLMSJ are presented here as an interconnected network of rationale in which ‘personal theory’ can be placed central, translating directly into practice. The salient point is that TLMSJ has its particular emphasis on dialogical and negotiated

ways in which instructional content is decided upon, learning facilitated and mathematical content embedded in contentious social justice issues. Thus, students' mathematical learning by positioning their content in their own voices cannot be overemphasised. PTPP, in this context, serves as a platform from which practitioners are likely to contemplate social justice as a rationale for their practice.

Conclusion

This chapter has interrogated three major issues using CP as a theoretical frame:

- How social justice as a fundamental value becomes ingrained in the notion of personal theories of mathematics lecturers;
- How the realisation of social justice can be conceived as an educational aim in a mathematical pedagogical context; and
- How personal theories play a role in that realisation.

These issues were considered within the ideas of critical pedagogy, TLMSJ, and personal theory, which constitute the conceptual framework for this piece. Gutstein's (2006) model of teaching mathematics for social justice offered a convenient explanation of how a set of social justice pedagogical goals, and a set of mathematics pedagogical goals, collectively constitute social justice as a broad educational aim in mathematics education.

Critical pedagogy offers a solid basis for understanding social justice as a value in education. Subscribing to the notions of equality and social order as defined by Marxist ideologies, critical pedagogy instils the element of critique and inquiry in instructional decisions for practitioners and students. Pedagogical preferences of practitioners often have consequences that manifest in students' ideological formations, and hence conceptions of justice and morality in future generations. In this sense, critical pedagogy shapes the future based solely on the value of 'critique' and the democratic nature of learning; in the South African context, it will be mathematics with its historically elitist status of being an exclusive European scholarship domain. Post-apartheid South African higher education, as this chapter argues, is yet to make significant strides towards abolishing its elitist status and making it a tool for the emancipation of the African people.

Pedagogy is considered centred on dialogue in CP, characterised by the teacher-student, rapport-defining engagement with equally shared power (Breunig, 2016). While underscoring the facilitation of critical dialogue and consciousness in pedagogy, this chapter has made an effort not to develop yet another framework for CP to oppose other ideologies or inadvertently replace one with another. Rather, it has tried to position PTPP among such ideologies (Rodriguez & Huemmer, 2019). The argument is that enforced ideological compliance with CP notions towards forming one's personal conceptions of practice and enacting such conceptions in classrooms contradicts CP's very ideals. Therefore, what

'ideological alternatives' are left? Reconfiguring the social justice imaginaries to surpass the coloniality framework, embracing a pedagogy of opportunity devoid of race, gender or class constraints, holds the key. Students' intellectual agentiveness and positionality, as powerful contributors to the social justice discourse, must be reclaimed. Practitioners' personal conceptions of practice must be understood in the context of these notions.

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