

Communications

Mathematics education and social justice *or* Learning to meet others in the classroom: a collective reflection

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All human interaction involves the experience of otherness. Mathematical activity is no exception. Whether through history, social practices, language, aesthetic experiences or cultural practices, the experience of otherness in mathematics comes ineluctably, consubstantial of teaching-learning. In light of this, many voices claim their legitimacy and space of action in the mathematical world. Necessarily, this perspective carries fundamentally critical aspects by bringing into focus marginal or in-minority ways of being-in-mathematics, often suggesting social and political demands.

But what are these marginal voices? What actions can be taken to give them more space to be heard? What implications do they have for the mathematics classroom? What are current prospects for research on/in this theme? Above all, what conceptual or theoretical frameworks can help us think about mathematics education in these terms?

The sociality of the learning process means, for us, formation and transformation of consciousness, which is precisely (con)sciousness, that is to say, “to-know-with-others”. In this sense, the mathematics classroom doesn’t assign itself the role of promoting an individualistic idea of autonomy, but rather one of social engagement (see Arendt, 1961), where fundamental openness to the other and respect of otherness appear central and critical. This is the deep sense in which we questioned the idea of social justice in the context of mathematics education during a working group offered at the 2016 Canadian Mathematics Education Study Group (CMESG), held in Kingston, Ontario.

We provided some “pretextual” material for our exploration, including Fasheh (2015) and Peterson (2015) along with resources, in text, video or audio format, from various authors (Bakhtin, Levinas, Freire, Adichie, Zizek, Radford, Vithal, Skovsmose, Gutstein). Our ambition, as coordinators, was to provide an atmosphere of radical openness where the group of 19 participants could feel free to explore difficult questions as they arose in the moment, and to do this over the entire three days of group meetings.

Together, we explored the nature of social justice in mathematics education by living aspects of it through attentiveness to being in relation to the other and ourselves. Tensions within the group became occasions for critical discussions on the challenges of living pedagogy that is focused

on “just justice”. Attending to multiple voices, desires, needs, responsibilities and commitments, we explored our learning with and from the other during the group meetings.

This collection of communications provides an opportunity to widen the dialogue by offering critical reflections on our experiences and the emerging questions we now carry. It is quite a difficult task to re-visit a personal experience. Indeed, the first other that we meet is probably ourselves, and it is already hard to reveal ourselves to ourselves. Maybe knowing the other is first knowing the other in ourselves, to grasp the other who is immanently in the middle of doing the making of ourselves. Ten participants have contributed. Yasmine Abtahi and David Wagner discuss mathematical activities and the potentially violent aspects of doing mathematics. Natasha Davidson reminds us how “X is *our* X”. Barbara Graves and Jhonel Morvan point to the very tensions of teaching and learning, leading to a reflection about responsiveness and engagement in the quest for social justice. Tom Kieren examines ethics in mathematics classrooms in relation to social justice. Collette Lemieux highlights the importance of silence, in order to find ways of being with the others. Finally, Joyce Mgombelo, Tatiana Peres Toledo and Tina Rapke draw upon their experiences to examine the conditions of enacting social justice in mathematics classrooms.

Across these communications, the question of *violence*, in its ethical sense, recurs explicitly or implicitly. Violence appears as a central theme to think about social justice and mathematics education in multiple acts: concerning mathematics itself in its innermost horizon; concerning the difficult task of making room for the other in the classroom; concerning the constitution of the “us” (in French, the *nous autres*); concerning acts that try to federate people and ways-of-being together. The opposite concern, the *act of welcoming the other*, also reverberates through all of the contributions. Throughout, we find different attempts to grasp the appearance of this welcoming the other, related to what is called “enacting social justice in the classroom”, “being attentive to the others”, “the possibility of a curriculum that could include social justice values” or “learning to *hear* the other”.

Our narratives, our attempts at learning with and from the other, find us working to be open to the gift of learning and being taught by each other. To be, as Biesta (2013) writes, one “who can welcome the unwelcome” and “who does not limit himself or herself to the task of learning” but is instead “open to the possibility of being taught” (p. 460). Our experience together continues, living as both teachers and learners of mathematics education for social justice, teaching and learning being open to the other and respecting otherness.

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Violence in un-rooted mathematics

YASMINE ABTAHI, DAVID WAGNER

Yasmine: Let's think about how mathematics is extracted from the life experiences of people and how claims of universality may be a violence that perpetuates social injustice. From where did mathematics get such power to possibly perpetuate social injustice?

Dave: All systems of human action (all discourses) are in some ways violent. Gandhi wrote in multiple contexts that to live is *hisma* (violence). When I inhale, I take oxygen that someone else might take. When I eat, I eat what someone else might eat. Like Gandhi, I wish to commit myself to *ahimsa* (non-violence). This non-violence cannot be achieved, but it is a worthwhile quest. I want to find ways of making my mathematics less violent, but it is important to acknowledge that there is violence in mathematics, and thus that this violence need not dissuade us from doing mathematics.

How is mathematics violent? Generally speaking, mathematics comprises moves to abstraction in the domains of number, measurement and position/location. Any time I abstract, I am dismissing important contextual particularities that are fundamentally connected to the "truth" that I am extracting. Fasheh (2015) beautifully connected this process to the extraction of sugar, which is present in all food. When we extract it and try to make it pure, it becomes poison. This is true of mathematics and of sugar. I think abstractions are powerful and potentially good in some ways, but we have to remember that they are born in the act of dismissing and ignoring context—it is *willful ignorance*.

How do you see violence in mathematics? What experiences have you had that have inclined you to pay attention to this aspect of mathematics?

Yasmine: Sometimes a less-context-based tool has more power over tools that are more context sensitive: for example, a chicken factory over a chicken farm or the worldwide banking system over local economies. I see this "power of abstraction" as a power that leads to producing more, faster, and *the same*. If mathematics becomes less-context-based and less situated in local communities, then it gains a power of abstraction. As seen, for example, with the power of the international banking system, such power can perpetuate social injustice. And as you put it, mathematics may become violent.

But this is different from if and how I have seen violence in mathematics. I do not see violence in mathematics, as I rarely see violence in any act of living. I have a more peaceful view of living, of humans, and of nature. As a Being of my history and culture, I believe what makes me useful to others and to my place is to be *neek* (possibly translated as good). "Neek in Thoughts, in Words, and in Deeds" (*The Zend-Avesta, The Gathas, Zoroaster*, 617 BCE). The word *neek* in Persian has a deeper meaning than the word good.

An action or a thought that is *neek* carries within it the wisdom of the doer. It is not a right-doing or wrong-doing, it is useful and wise-doing.

So I ask, is mathematics *neek* in what it does to our Thoughts, our Words and our Deeds? If the situatedness of mathematics is ignored, is it still wise and useful?

Dave: There are connections between the privileging of abstraction and an increasingly global society. A Mi'kmaq elder once described to me how her mother had asked her to fetch potatoes from the garden. I expected her to say that her mother had asked for a certain number of potatoes, but instead her mother said "enough" with a gesture indicating volume. Potatoes in a garden are not standard in size, so it makes no sense to ask for seven potatoes (or another number). We grade potatoes so that there is some standard sense of understanding of the amount we are pricing or buying. However, standards always reflect dominance and privilege. Why do we use kilograms or Arabic numerals?

Your question, "Is mathematics *neek*?" feels like this: "Is speaking *neek*?" I am inclined to think that there are *neek* ways of doing mathematics, and *neek* ways of speaking. Similarly, there are violent mathematics and violent utterances. I see mathematics in the same category as speech, positioned as relatively neutral. However, I wonder if mathematics might be fundamentally violent, characteristically violent, characteristically *neek*, or fundamentally *neek*. Nevertheless, I think the most important question to consider is how to do mathematics with more good and less harm. What specifically do you see as potentially harmful and potentially good/*neek* in mathematics?

Yasmine: I think your question relates to my previous question—enquiring if what mathematics does to our Thoughts, Words and Deeds is *neek*. I go back to what, I think, makes many other aspects of our being *neek*: our roots and our root-ed-ness. To clarify, I again borrow from old Persian thoughts. In *Masnavi-e Ma'navi*, Molavi (1253) described living as a drawing compass. He explained that one leg of the compass is fixed and rooted in a certain place. Yet, the other leg moves, drawing circles around the rooted leg. That is, in our living we have a part that is strongly based in our local root (our cultures and history) and a part that moves to connect to others, to feelings, places, cultures and people.

To me, a kind of mathematics that is *neek* is a mathematics that, as Fasheh (2015) put it, is embedded in the soil of culture. It is one that is rooted in the needs and values of local communities. I see mathematics that wishes to abstract and standardize as possibly harmful to us, to nature, to places, local cultures and most importantly to our children who are growing up with a leg strongly rooted in their local culture, history and beliefs. What do you think? How can we aim towards a more rooted mathematics?

Dave: My sense is that dangerous abstractions are ones in which the whole compass is picked up and moved somewhere else. There is no longer any sense that the ideas or ways of seeing are rooted in any particular place, or that they even come from a particular place. I would think that a lot of people (probably most people) think of mathematics as the compass; whereas I see mathematics as the act of using the compasses. Compasses are meaningless or useless without

fixing a point, so the centre of a circle is central to the act of using compasses. I see human intention: choosing a point to position the fixed arm and a radius to construct something that can be used or appreciated in a context. It is hard for me to think about how others who love the compass itself may think differently, even though I was probably one of those people some years ago. I think they (and myself decades ago) loved how we could make the same circles anywhere. We loved transposing a shape or idea in many places, and so we loved the shape/idea more than the place. Now I try to love the place and the people more than the idea. I ask how particular people in a particular place may use the compass (mathematics) for their utilitarian or aesthetic purposes. What do you say about how we can move ourselves and others toward a more rooted mathematics?

Yasmine: Our roots grow stronger as we get to be with others, as we experience, reflect and try to make sense. Every community, aside from beautiful values, has its needs and concerns. A mathematics that helps people talk about, think about, and address their local issues and values is a *neek* and rooted mathematics. Moving ourselves (and others) is a journey with duties. I think our first duty towards a more rooted mathematics is to not only notice and observe, but also to value cultures and histories of ourselves and of others. And our second duty is to build on what we observe and value.

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Realizing social justice in mathematics education through attending to us

NATASHA DAVIDSON

We came together—people wanting to advance social justice in our classrooms, in our practices, in our engagement with the world, various kinds of math folk—attracted to this working group for shared and individual reasons and purposes. And we had an *X*—through an experience of sharing, an airing of issues and ideas, interest in and respect for and of one another. Yet all 19 participants still wanting to establish ownership, wanting our image observed within it, our influence to be strong—to be most strong for some; merely be there for others. But it is an *X* and it is amazing in its own right—our shared creation surprising us by its character—by its own intrinsic nature that we do not see ourselves as having moulded. Perhaps it was the combination of all of that intellectual energy. Perhaps it was the manifestation of social justice in that room and in our discussion.

As we excitedly exclaim over this wondrous thing, having created it, we then start to poke it, sometimes gently, just to see what it is. It starts to collapse. It is an *X*—in our strug-

gle to be closest to it, to hold it the longest, to impart our own wisdom upon it, we almost forget—it is *our X*. Our *X* of our shared experience, our love, the concrete expression of our love for one another and more generally, a statement about our hope for the future, for humanity. It came from our collective belief that we, individually and together can bring something better to the world. In particular, we love this *X*, we don't want to be the one to destroy it by over-exposure to conflict between participants. What we do want is to impart to it all that is the best in each of us, with a conscious emphasis on the moral construct of best.

So we calm and relax ourselves, in order to fall back into our more gentle struggles of trying to impart to this, now *Y*, of our collective making, all those pet ideals we still carry and still unsure thoughts of how the other feels.

Who is the other? I don't know but I think I want to focus on the us.

I hope as our *Y* develops that it reflects the love that created it. I hope that it doesn't suffer too much from struggles those 19 participants indulge in by trying to have this *Y* be in their own image. I don't want another to be told that doors are closing unless they do the math—how many were lied to by these words? Or was it always the truth, as words become realities by their very utterance. And what of the math they must do? It is all a prescription, but whose prescription?

Trying to protect my religion (religion of mathematics, god is mathematics), I say *it* is the truth—there *is* a right answer. Yes, through my lens there is *a* truth and *an* answer, but I mustn't forget that there was a question and the decision on what the question should be, is all about subjectivity. About I, me, my lens, my culture and my values. If I want to defend my god then I need to realize, accept and embrace that this god is indifferent to my subjective choices—that anyone's choice may be as legitimate, and any other's question as pressing to answer.

How does the creation of *Y* impact my practice, what will it look like in my room?

It isn't my room, my classroom; it is our room, our classroom. Where room needs to be made for us, for you and for me, but most importantly for the dynamic interaction that requires a positive space for the development of what will become us. It is a room in which I hope to share some information with the other while keeping my eyes firmly open to what the other has to share with me; and in this I hope there is space created for us, in any room, but especially the classroom.

Tensions among competing goals when teaching mathematics for social justice

BARBARA GRAVES, JHONEL MORVAN

Jhonel: Teaching for social justice could be a monumental task. But, tensions arise when we fail to see the fluidity of this kind of teaching. Teaching for social justice is definitely

not a fixed endpoint. Cochran-Smith (2010) contends that social justice in education is an attitude that “acknowledges the social and political contexts in which teaching, learning, schooling, and ideas about justice have been located historically as well as acknowledging the tensions among competing goals” (p. 447). The word *tensions* here is significant, since it may be one of the characteristics of any intellectual effort to frame the concept of social justice. Esmonde and Caswell (2010) argue that even when concerns for social justice remain at the forefront of pressing issues surrounding mathematics education, there is still no or little consensus on how to define or how to effectively work towards equity, as defined by Gutiérrez (2002, 2012). A question remains: are there always tensions in conversations regarding social justice?

Barbara: Isn't it the tensions that motivate engagement and conversation? Don't they signal the need to converse and make space for each other?

Jhonel: Tensions could lead to engagement and conversations once they are unravelled and some common understandings established.

Barbara: I see tensions arising as an integral aspect of genuine human interaction. They provide the opportunity to learn if we choose to listen. This is why my personal reflection revolves around the work that Cynthia and David accomplished during our three days together. When tensions arose within our working group, they used the tensions as a generative site for further understanding. Planned activities were set aside to allow space for engaging with one another.

Cynthia and David asked, “What conceptual or theoretical frameworks can help us think about mathematics education in these terms?” Vithal (2012) speaks of a pedagogy of forgiveness which inserts a point of hope and creative action. Varela (1987) argues “the chance of surviving with dignity on this planet hinges on the acquisition of a new mind. This new mind must be wrought, among other things, from a radically different epistemology which will inform relevant actions” (p. 49). Varela's different epistemology is situated in a biology of knowing which embraces a non-representationist stance that he termed *enactive* to evoke the view that the world we know is enacted as we engage in interaction with others. A model of complexity thinking underlies this view which focuses on dynamic, non-linear interactions and suggests the value of adaptive and co-emergent learning systems.

Jhonel: In the context of effective mathematics teaching, interaction within the community of practice is neither static nor linear. Anthony and Walshaw (2009) suggest it is a nested system involving the school, the wider education system, and the home and local community. These ideas suggest a relationship between social processes and conceptual development implying the connectedness of learning.

It appears to me that effective mathematics teaching not only fosters positive outcomes for all students but does also recognize their rights to access high-quality mathematics. Accessing rigorous mathematics implicitly means that students understand curriculum content and see their connections to everyday life in their own social contexts. Inspired by Anthony and Walshaw's work (2009), I would

argue that effective mathematics pedagogy acknowledges that all students, irrespective of age, gender, race, socioeconomic status, and ethnicity have mathematical identities and have potential to become powerful mathematicians. Effective mathematics teaching requires “interpersonal respect and sensitivity and is responsive to the multiplicity of cultural heritages, thinking processes, and realities found in everyday classrooms” (p. 149). So Barbara, when you mentioned adaptive and co-emergent learning systems earlier, I believe that the language you used fits well with the notions of good conceptual understanding, effective procedural fluency, strategic competence, and adaptive reasoning in mathematics. In what way does teaching for social justice in mathematics differ from effective mathematics teaching?

Barbara: I see effective mathematics teaching as a necessary but not sufficient condition for teaching for social justice, since it is possible for a learner in a supportive and respectful learning environment to become mathematically accomplished without ever considering concerns of social importance. With the goal of empowering the powerless, Paulo Freire, used literacy to educate how power and oppression play out in people's lives. In a foreword to the thirtieth anniversary edition of *Pedagogy of the Oppressed*, Schull (2000) wrote: “Fed up as I am with the abstractness and sterility of so much intellectual work in academic circles today, I am excited by a process of reflection which is set in a thoroughly historical context, which is carried on in the midst of a struggle to create a new social order” (p. 12).

In our context, in Ontario, Canada, one of the most compelling examples of the ways in which the objectives of a mandated mathematics curriculum can be accomplished in the service of social justice issues comes from the work of educators at City View Alternative Senior School in Toronto (Stocker, 2012). These educators incorporate all the curriculum subjects mandated by the Ontario Ministry of Education to educate and engage students about the world in which they live. For social justice educators like David Stocker, mathematics functions “as a sophisticated tool to understand the world” (p. 173). In his words, “Ultimately, the reason I teach mathematics and social justice together [is so] that people younger than I might have the tools to understand the world in order to change it” (p. 173).

Jhonel: Can one then argue that teaching mathematics for social justice will transform every student into an agent always considering concerns of social importance? Maybe this is not realistic. However, as mentioned earlier in relation to Anthony and Walshaw's work, I think the interpersonal respect, the sensitivity and the responsiveness to the multiplicity of cultural heritages, thinking processes, and realities found in everyday classrooms would suffice to spark consciousness of social justice in most students. In that regard, effective mathematics teaching is coherent with Cochran-Smith's (2004) six principles of teaching for social justice: it enables significant work in a community of learners, builds on students' cultural knowledge and interests, teaches skills and bridges gaps, works with families and communities, diversifies assessment, and makes activism an explicit part of the curriculum.

To the point of seeing effective mathematics teaching as a necessary but not sufficient condition for teaching for social justice, I posit that it is perhaps the reason why tensions arise when different interlocutors fail to see the fluidity of teaching for social justice. Cochran-Smith (2004) and Esmonde and Caswell (2010) would concur that it is not a fixed endpoint. Instead, Esmonde and Caswell write “it is a process of continuously facing dilemmas and adopting an inquiry stance about how to resolve these dilemmas” (p. 20). From that standpoint, teaching mathematics for social justice is first and foremost effective mathematics pedagogy. It is not about teachers’ personal agendas or causes. Or is it? Instead, it is about empowering students to tackle social justice issues inside and outside of their school settings as an act of responsible and productive citizenship.

Barbara: When you say, “the interpersonal respect, the sensitivity and the responsiveness to the multiplicity of cultural heritages, thinking processes, and realities found in everyday classrooms would suffice to spark consciousness of social justice in most students”, and you relate it to Cochran-Smith’s six principles, one significant difference is that Cochran-Smith includes making activism an explicit part of the curriculum. In my view that is a necessary requirement.

Jhonel: Being responsive to multiple cultures, thinking processes, and the realities of all students implicitly covers the same ground as an explicit activism. Does a teacher have to be an activist to teach for social justice? I don’t think so. Is it enough to simply rely on effective teaching and hope it will spark awareness of social justice? That would be very far from the truth; as Kumashiro (2015) contends: “Common and commonsensical notions of ‘real’ and ‘good’ teaching do not involve challenging oppression and can actually help to perpetuate rather than change the oppressive status quo of schools and society” (p. 1). Maybe teaching for critical thinking may offer a happy medium.

Barbara: Making activism an explicit part of the curriculum does not require that the teacher be an activist, but it may require an appreciation of an activist stance.

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Around social justice mathematics education and ethical relations

TOM KIEREN

I wish to turn our attention to social justice issues as they might pertain to teaching and learning in a single classroom and particularly raise the question of just how we—students, teachers, curriculum makers, evaluators—can be with one another and with mathematics in a classroom that attends to social justice.

Barbara Graves, in our discussion of ways of allowing for such justice in our classrooms, reminded us of Maturana’s definition of love as *making room for the other beside us in our praxis of living* (Maturana & Varela, 1980). To me, this suggests the many measures of inclusivity that value the knowing of *all* students in our classroom, as opposed to systematically favouring the few and isolating, marginalizing, denigrating, *etc.* the knowing/being of any students. Such positive practices might be seen as a consequence of the ethics at play in such classrooms.

Elaine Simmt and I looked at ethics as orientations of teachers and students toward knowing actions in the praxis of living together in classrooms (Kieren & Simmt, 2009; Simmt & Kieren, 2015). Below, I briefly lay out our three categories of ethical actions and try to portray them as orientations toward or leading to socially just actions in classrooms.

- *Provisional ethic.* One ethic entails orientations toward social justice by *provision* of curriculum opportunities for *all students*. At a conceptual level such provisioning entails the teacher *making room* for the students beside themselves. A teacher who makes such provisions might use what Simmt calls variable entry prompts (Kieren & Simmt, 2002), that allow students to engage with mathematical tasks from the point of view of their own strengths and in interaction with others to help bring forth actions and products that an observer sees as mathematics. Further the teacher with such a *provisional orientation* develops such learning opportunities tailored to her/his students while being able to show just how this tailored curriculum in action is consonant with standards (see, for an example, Preciado-Babb, Metz & Marcotte, 2015).
- *Attentional ethic.* Central to this ethical stance is the role of observing (Maturana & Varela, 1980). The

teacher and the students observe and therefore attend to the on-going work of the students or teacher in the classroom and take up and transform these observations for their own use, either in modifying the learning demands (teacher), or in using the observed ideas in their own work in their own way (students). This ethic potentially allows all students in interaction to create appropriate mathematically rich inter-objects (Maturana, 2005) and allows students' work to not simply converge on "right" pre-given knowledge, but to create with others mathematical thinking that is their own and yet *converges* with that of others.

- *Occasional ethic.* Maturana (1988) has been explicit about the ethical implications of all human actions in the world we live: everything we do becomes part of the world we live as we bring it forth as social entities in language. Human responsibility in the multiversa is total. Thus any mathematical actions a student or the teacher shares in a classroom necessarily can affect others, implying a social responsibility for actions. But this orientation also shows the potential value of interaction in mathematics knowing and, in terms of an attentional ethic, allows the possibility for created mathematical inter-objects as products of a socially just classroom.

These ethical orientations provide different possibilities for *whose knowing is valued in the classroom and for whom room is made to come to know mathematics*. From my own experience, this mathematics can be diverse, and rich, for *all students*.

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Silence in a social justice workshop

COLLETTE LEMIEUX

Even in a social justice working group some members can become silenced. An introductory activity can go a long way to

setting the tone for any group. Cynthia led us through an interesting activity that culminated in us trying to count to twenty without knowing who was going to count next. We could not discuss strategy. This meant we had to pay attention to non-verbal cues and turn taking. This activity has the potential of setting a good tone as it allows us to become aware of each other. To be successful we had to work as a community.

But I learned something different from the opening activity. I learned that if our group were to complete the task, then some needed to be silent. For the first few numbers, most of us said something, but as we got closer to the goal more and more of us said nothing and let others lead the way. This dynamic played out in the working group. At first we all spoke, but then as the days went on, some of us stopped speaking. This dynamic was particularly apparent on the second day, when it felt that about six of us just stopped talking altogether. In the activity, the silence helped achieve a goal. In the group, it felt that voices were being lost.

This experience led me to wonder: in a group of people who are passionate about respecting and accepting the other, how do you help them respect and accept the other who is in the same room with them? There is no easy answer to this. To take a page from Alcoholics Anonymous, the first step is recognizing that there is a problem. In the initial activity, we were aware of other's cues, but did we notice when others went silent? Did we think about what that meant? I would guess that we didn't. That same lack of awareness permeated the rest of our time together. We may have noticed individually that a person had stopped talking, but as a group we failed to notice the silence of the few.

Though there are no easy solutions, I would make the following two suggestions as starting points. 1) For anyone facilitating a group, notice who hasn't spoken. Approach them to find out why or provide a way for feedback (e.g., quick check-ins before breaks). 2) For participants in a group, when someone else speaks *hear* what they are saying. Not what you think they are saying. Not what you think they mean. But actually listen. Respecting and accepting others starts by hearing their voice.

Creating space or conditions to attend to otherness

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What is the other or otherness? How can we conceptualize the other and otherness in social justice? How do our conceptualizations speak to mathematics teaching/learning? We share our ideas and thoughts about these questions through three reflections, which each speak to a sense of creating space or conditions to take into account otherness in professional settings and in the mathematics classroom.

Informed by an enactivist perspective we take heed of Maturana (1988):

As we put objectivity in parentheses because we recog-

nize that we cannot experientially distinguish between what we socially call perception and illusion, we accept that existence is specified by an operation of distinction: nothing pre-exists its distinction. In this sense houses, persons, atoms, or elementary particles, are not different. (p. 39)

Maturana implies that other or otherness is based on our own distinctions as human beings existing in language. In other words, our identity is based on what we are not. The other becomes these things that we perceive as different from us. For example, identifying as teacher can be an act of distinguishing from a student. Perhaps one could identify oneself as a teacher *and* a learner, so that these identifying differences might switch and blur: classroom teachers and students are all full participants of the learning environment. Perceptions of the other are permeated with biases and assumptions of an individual. This idea speaks to the notion that what one might see as problems and inconsistencies in the other reveals more about themselves than the other. There is always the risk of reducing the other to individual perceptions. Telling a single story could be dangerous, since it might create a reduced perspective of the other (Adichie, personal communication). Our experiences are therefore described in three reflections and focus on how to interact with the other.

The first reflection shows the importance of the quality of interactions with others. The second brings the fact that enacting social justice in our teaching of mathematics involves including ignorance in our actions. It emphasizes the importance of keeping a fresh eye on students and that teachers should recognize the limits of their knowledge and respect the as-yet-unknown of mathematics itself. The third reflection brings up the particularities of the working group, and the importance of listening to the others, listening to connect and build upon mathematical solution strategies.

Tatiana: making space for and learning about ourselves through the other

Assumptions, biases, and beliefs could lead to refusing interaction with the other. Establishing an ethical relationship requires an effort to be aware of how assumptions and biases might affect interaction. In order to coexist, there is a need to see the other without allowing disagreements to provoke animosity towards the other. Animosity towards the other does not leave room for coexistence. Freire (1996) describes how the person in charge of his talk at a university denied a student the time to read Freire's work. This person perceived any kind of reading of Freire's work to be undesirable. An ethical relationship cannot be built by silencing the other. Freire recognizes the right to be angry against a certain position, but not to disrupt interaction.

Rorty (1999) describes how hope for the creation of a kinder world "is to sew [diverse] groups together with a thousand little stitches—to invoke a thousand little commonalities between their members" (p. 87). I believe that in the working group, some of these commonalities and connection points were established. I experienced my reactions to comments that to me seemed undesirable to the development of mathematics education for social justice:

my eyes would grow wider and a rush of blood would make me straighten my back, with an occasional twitch of the lips if the topic was very dear to me. I observed my reactions and realized how I was reacting to a specific word or an idea that I found undesirable. With every word that I disagreed, I could understand myself a little better. In the interaction in the group, I worked towards the goal of coexistence in the words of Maturana and Varela (1987): "If we want to coexist with the other person, we must see that his certainty—however undesirable it may seem to us—is as legitimate and valid as our own" (p. 245). I feel that my understanding of social justice was expanded by incorporating other perspectives.

Joyce: the other in the classroom

Two things stand out for me. First, I wonder about the other or otherness in social justice as it pertains to mathematics teaching and learning. The relationship between the teacher and students hinges on the experience of otherness. Against this background, what would it mean in social justice if we take students as the other in mathematics teaching and learning? Or, as Barbara Graves reminded us, what would it mean to recognize our students as legitimate others? It is not surprising that our conversations involving the child or student dominated the working group. We should avoid the temptation to explain away this observation by justifying the dominance of the child in teachers' conversations as an obvious outcome of the fact that we teach children or students. After all, they are at the centre of education. While there is some truth in this observation, it does not address the child or the students as the other. Jardine (1998) provides us with a direction. With respect to a teacher's encounter with "problematic students" Jardine alludes:

The monstrous child thus faces me with my own ability (or lack of ability) to remain open to the new, to face my own renewal: am I able, as a teacher, to listen anew to *this* child and let what I take to be established be reenlivened and made new through their questions? (p. 132).

Enacting social justice in our teaching of mathematics thus involves including ignorance in our actions. We cannot "know" our students. Students remain the other to the teacher. What I perceive as problems or inconsistencies in my students are "what is more in me". Therein lies the ultimate ethical nature of teaching.

The second thing that stands out for me is something that Tina brought to our attention regarding mathematics. I wonder whether or not discussions about social justice and mathematics teaching and learning take for granted mathematics itself. For example, some of our discussion centred on bringing or including social justice contexts in mathematics teaching. While I think that this approach is important, I also question whether or not mathematics itself is taken for granted. In some ways, mathematics is now reduced to social justice contexts or social justice contexts are added to mathematics. What would it mean to enact social justice in mathematics teaching and learning? In my own work, I refer to Boole (1972) to bring the notion of pedagogical ignorance:

Mathematical certainty depends not on the subject matter of investigation but upon three conditions. The first is a constant recognition of the limits of our own knowledge and fact of our own ignorance. The second is reverence for the As-Yet Unknown. The third is absolute fearlessness in meeting the *reductio ad absurdum*. In mathematics we are always delighted when we come to any such conclusions as $2 + 3 = 7$. We feel that we have absolutely cleared out of the way one among the several possible hypotheses, and are ready to try another. (p. 44)

That is to say, enacting social justice in mathematics teaching/learning might mean that the teacher recognizes the limits of her knowledge and respects the “as-yet-unknown”. This idea is actually what is at the heart of cognition in enactivism: the bringing forth of signification that is missing, not pre-given. Put differently, enacting social justice in teaching mathematics is setting conditions for the teacher and students to bring forth the world of mathematical significance.

Tina: listening to and creating space for the other

My experiences of the working group were different from my past experiences with mathematics education researchers. I wondered whether or not we were attending to mathematics and how social justice was enacted within the group. Thinking about the ways in which I enact social justice in my own classroom, my thoughts went to Davis’s work (1997) on listening and how I listen to students. Listening to students, in the classrooms in which I work and have previously discussed (Allan *et al.*, 2015), involves setting aside your own preferred approach to solving a mathematics problem to really listen to other solution strategies. Listening is not about identifying and privileging your own preferences in others’ thinking, but is about listening to connect and build upon mathematical solution strategies. Through listening I become “a participant in the exploration” (Davis, 1997, p. 369). In the working group, I attempted to become a full participant in the learning environment by setting aside my preference to work on mathematical problems and desire to discuss specific mathematical ideas, in order to listen and connect the working group conversations with the teaching and learning of mathematics. This is how I attempted to make room for the other.

These ideas seem to be connected with Ellsworth’s (1989) paper entitled “Why doesn’t this feel empowering?” and, in particular, her indication that the notion of other may have fluid characteristics. I am specifically reminded of when she cites Min-ha who says “there are no social positions exempt from becoming oppressive to others [...] any group—any position—can move into the oppressor role” (p. 322). This point leaves me thinking that it is about who is doing the perceiving and thus it begs the question: what was

the relationship between mathematics and the notion of the other or otherness within the working group?

Threading together the three reflections

In enacting social justice, the notion of the other or otherness, in our view, is grounded in ethical experience. Our experiences and thoughts during and after the working group seem to converge at the point of how one should behave to create space or conditions to take into account otherness. Being able to recognize the other as a legitimate other involves learning about one’s own biases, observing the behaviour of colleagues, and an attitude of pedagogical ignorance in the classroom. Mathematics education for social justice might be seen as a way of being in life rather than a style of teaching. Enacting social justice in the classroom is more meaningful than layering mathematics education with social justice. Bringing the topic of social problems into the classroom might make students well informed, but it probably will not provide students with the experience of living social justice. Mathematics education for social justice relies on the relevance of building ethical relationships in the context of the classroom and its implications, rather than imposing an expansion of ethical relationships to every single human being in the world. Mathematics education for social justice must strive to create conditions for a variety of voices to coexist in the classroom.

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