CHALLENGING ABLEISM BY TEACHING PROCESSES RATHER THAN CONCEPTS

Rossi D'Souza
Homi Bhabha Centre for Science Education – TIFR, Mumbai, India

Through the course of my research and teaching experience with visually challenged students, I realize that a major source of the disablement and exclusion of students is a dominant ideology through which mathematics is perceived as a given set of definitions, concepts and procedures to be learnt, presented and applied to supposedly real world problems. Difficulties in learning these given ideas constructs many students, especially visually challenged students as unfit to learn and practice mathematics. Mathematics should be taught instead, as a process in which students engage in acts of discovering patterns, exploring the logic behind them, defining concepts for communicating ideas, etc. Instead of getting students to have their ideas conform to given mathematical ideas, the role of the teacher should be to provide or create favourable material conditions for authentic mathematical ideas to emerge and learning to happen. This implies (and calls for) a change in ideology.

INTRODUCTION

At the *Mathematics Education and Society* conference at Portland State University, Professor Ole Skovsmose (2015), during his plenary talk had posed the question, "What could critical mathematics education mean for different groups of students?" This question was a general response to the discourse around Critical Mathematics Education which addressed social justice issues related to disability, race, poverty, privilege, etc. Other papers also addressed similar critical issues. For example, Anna Bright (2015) presented her thought-provoking work on analysing word problems that normalized white upper-middle class perspectives that subtly promoted consumerism.

The presentations were very relevant. However, I found something missing – addressing Ableism as a form of oppression, how it operates in mathematics and whether mathematics education could play a role in the of liberation or emancipation or self-determination of disabled people. The nature of mathematics was also taken for granted.

The purpose of this paper is not simply to add disability as yet another identity that needs consideration while dealing with exclusion, oppression and liberation although it is very essential to do so. Neither is the aim of this paper to present a new methodology for teaching mathematics to visually challenged students. In this paper, I argue that ableist ideologies drive ableist actions. I thus argue in favour of some ideologies over others. But before that, I clarify my position on disability.

Ableism and the social model of disability

One common sense understanding of disability is shaped by observations of how some people suffer owing to lacking necessary body parts or functions. We locate the fault of the suffering within the individual since their bodies and abilities don't conform to our idea of 'normal' or 'ideal' bodies and minds. Subsequently, the onus of dealing with the problem is on the individual. This understanding can therefore be categorized as an *individual model* of disability.

However, according to another way of understanding, the problem is due to Ableism, which Fiona Kumari Campbell (2001) describes as “A network of beliefs, processes and practices that produces a particular kind of self and body (the corporeal standard) that is projected as the perfect, species-typical and therefore essential and fully human. Disability then is cast as a diminished state of being human.” If we understand that the problem of disability is based on Ableism, we see that the source of the problem is not individual but social. Society is systematically organized in such a way that it is prejudiced against people with impairments.

If we presuppose social, political, economic and architectural structures as given and unchangeable, we must fall back on the individual model to look for solutions. But such solutions have proven to be inadequate. Instead, we need to question how and why structures are designed in a way so as to exclude or disable a large number of people. We need to search for systemic solutions which are based on a social model of disability.

Ableism in mathematics education

In the context of mathematics education, Ableism operates in the designing and organizing of the curriculum, pedagogy, architecture of a school, its toilets, its fixed time-table, its policies, allocation of funds, etc. based on the idea of a standard (read: ablebodied or 'ideal') student. It subsequently constructs students as failures/meritorious or bright/dull or gifted/slow learners depending on how much they benefit from the organization of these structures owing to their level of conformity with or deviance from that ideal of the typical/standard student.

In addition to the structures of schools and their curriculum, even the nature of mathematics teaching is practiced in an Ableist manner. For example, my students would independently express how they were subjected to learn mathematics (and of course give exams) as individuals secluded from peers. One student named Rani said that she felt included in her previous (municipal) school where the teacher would be fine with her learning in a group with her friends, and felt excluded in her new school where she had to sit alone. Teltumbde (2008) refers to the emphasis on 'individual learning' as hyper-individualism which he argues as stemming from neoliberalism. He states that,

> Hyperindividualism, atomizes society into discrete individuals, each against the rest of them... (it) envisages every individual in competition with all others in the world. Neoliberalism legitimize(s) the right of (the) strong to exploit (and even eliminate the) weak. It establishes the inevitability of the “underclass” of those who cannot participate in competition, which should survive only as subservient to those who are competitive. ...it only values winners in competition (and) believes that the world should be (an) enjoyable place for those who deserve it and should be rid of those who do not. The latter only deprive the former of what is genuinely theirs and are therefore parasites.

Hyperindividualism would indeed benefit few students at the expense of others, thus constructing them as failures. This also suggests that the problem of being expected to learn as individuals, is systemic and not limited to isolated instances of a few teachers teaching “badly”.

Engaging in a process of continuously learning from the students and critically analyzing my beliefs and actions along with documenting and critiquing problems related to Ableism, and how students would critically acknowledge injustice, was a small step towards addressing the problem. The next step was figuring out what to do about it. A satisfactory response could only come from the people directly affected by the problem. So I approached my students. Since I have a decent understanding of mathematics and realizing that students' job aspirations would involve entrance tests in mathematics, I proposed to teach them from the textbook with the aim of helping them pass exams. But they said that their teachers were already doing this albeit with some structural limitations, and they insisted that I teach them the basic fundamentals of mathematics. We did have some prior experience in studying mathematics together.

I began by asking the students about their difficulties in mathematics. To this every student stated that they found “steps” (which they are expected to write when answering each question) the most difficult part of mathematics. Most of them would do a lot of mental mathematics and it was rather evident that in this process, the students would be engaged in various inter-connected thought processes which cannot be represented as linear statements. Their understanding of mathematics was rather good, although they would express themselves in different ways. In another incident, a student angrily complained that, “if mathematics is all in the head then why is there a heavy emphasis on using a pen and paper?” The textbooks contained various instances wherein concepts would be defined based on how the “eye” would see things. It only occurred to me later that “steps” relies heavily on visual processing. To summarize, there were taken-for-granted assumptions that:

- Having “good eyesight” is a necessary criteria for being fully human. (Corollary: Not having *good* eyesight rationalizes dehumanization)
- Students understand topics better when they are presented in a visual manner. (Corollary: If possible, topics must be presented visually)
- Students should communicate their mathematics in a visual manner. (Corollary: Marks should be cut for not writing down *crucial* “steps”)

I call the network of these practices and beliefs *visuonormativity.*

I had documented the teaching sessions and shared those insights as a conference paper (D'Souza, 2015). In those sessions, we engaged with the topic of divisibility in which we would solve problems related to factors of a number, discuss about prime numbers, etc. On the last day of those sessions we discussed the nature of mathematics, to which the students seemed to arrive at a consensus that mathematics is only about calculations. I thought that this was a failure on my part. They did learn mathematics indeed, but it was possible that they could have got the idea that mathematics is just a set of concepts, and more so, those related to calculations. This learning didn't seem like something that could be in the direction towards their self-determination, which is essential while addressing the role of education in liberation from oppression.

Addressing Ableism and other forms of Oppression

Before addressing Ableism (or any other form of oppression), it is essential to try understand how different forms of oppression intersect with each other, because we often end up reinforcing one form of oppression to address another. Although, broadly there are striking similarities between different forms of oppression like racism, casteism, sexism, ableism, etc. in terms of say, having a dominant group, having a higher likelihood of experiencing systemic violence, being labeled, being made to feel unfit or deficient or deviant from “normal people”, etc. there exist differences between them. And these differences and intersections need to be considered while addressing different forms of oppression. For example, the argument that women or dalits are as capable of visuospatial reasoning as men and upper castes, could be problematic when used to justify the normalizing of visuospatial reasoning which constructs visually challenged students, who do have trouble reasoning visually, as deficient and in need of separate schooling, or unfit for learning mathematics. The same could be argued about the use of computer animations to teach mathematics and advocating for all schools to go digital and add technology to their pedagogy. Although, it is a fair argument from the perspective that adding technology to the curriculum would enhance students' learning, there is a danger that such technology could further reinforce stereotypes with regard to the mathematics learning capabilities of visually challenged students. Any intervention or pedagogy that could possibly construct some students as less capable of learning must be subject to great scrutiny before implementation or even be discarded as being against the philosophy of inclusion.

But this would lead us to ask then, what is inclusion? To begin with I would state that it is not simply a school that includes “all students” and caters to their needs; although that would be a good start. I would agree with Idol (1997, pp 384) who contrasts mainstreaming and inclusion by stating that, “Inclusion is 100% placement in general education whereas in mainstreaming, a student with special education needs is educated partially in a special education program but to the maximum extent possible is educated in the general education program... The underlying assumption of mainstreaming is that participation in the majority group will be in accordance with the standards of the dominant system... (Inclusion) implies the existence of only one unified educational system that encompasses all members equitably”

This too would (and should) raise questions like for example, if we try to design inclusive schools would there be enough seats to accommodate all students and and would enough teachers be employed? What if there aren't? Why aren't there enough seats and enough teachers? What would be the medium (language) of instruction in these schools? (How) would we address the requirements of a student who is dependent on another person for basic needs? (How) would the rights of this person and other disabled people be addressed? What if the school cannot afford to cater to the rights and needs of disabled students and teachers? Why would it not be able to afford? Can we accepth the argument that the government may be too poor and unaccountable to pay for that? How would caste oppression be addressed in a school? And would it depend on the caste of the teacher? Are these issues not within the purview of the school? Then what is the role of a mathematics education researcher who works towards inclusion? Is it to presuppose the fact that the number of seats in schools is much less than the number of children in the country, and then work with the few students who reach school, and teach them curricular mathematics (eg. Geometry) in the medium of instruction of the school using assistive tools for visually challenged students? How would this be different from being exclusive?

To understand how to approach these questions, one would need to look at how education is a part of every other socio-political and economic structure in society. Still, these questions (and more that would emerge) are difficult indeed. However, there needs to be a note of caution lest we slip into the trap of believing, from a position of relative powerlessness, that all their problems stem from either the economic structure or the impairment of a child especially. Also, the struggle for educational rights for disabled students should not presuppose the unassailable nature of mainstream schooling, our economic structure, our government and State and society at large.

Ableism as Idealism?

There is a problem with ideologies that place (fixed) ideas (of a person, or of people, of society, the world, etc) in a more fundamental position than real people. In the case of Disability as well, I argue that such an ideology operates, which translates into an Ableist society.

We call the set of ideologies that locate ideas as fundamental while nature and people as secondary, as Idealism. An Idealist practice is driven by the ideology through which ideas are basic, and that people or nature (or anything made of matter) should conform to ideas (of person, nature, etc).

In the case of idealist mathematics education, definitions are understood to be fixed and immutable, the concepts are taught as though they are fundamental, and word problems are presented as real situations that should conform to or should be modelled strictly by those given concepts. Ideas are not looked at as reflectios of the material world. Such an ideology is similar to that critiqued by Engels (2011, p. 45) where concepts are dealt with as though they are "...*principles*, formal tenets derived from *thought* and not from the external world, which are to be applied to nature and the realm of man, and to which therefore nature and man have to conform."

Mathematics is often presented as a given set of principles, concepts and procedures to be learnt, presented and applied to supposedly concrete problems. Subsequently, when students are assessed, they are understood as having either a misconception or the right conception based on whether or not their knowledge conforms to this set of principles, concepts and procedures. Mukhopadhyay and Roth (2012, pp. vii) begin their argument for exploring and acknowledging alternate forms of mathematical ideas, by stating that, "Even though constructivist theory emphasizes the personal construction of knowledge, actual mathematics education practices generally aim at making students construct the "right", that is, the canonical practices of mathematics – not realizing that for many, this may mean symbolic violence to the forms of mathematical knowledge they are familiar with, and that the standard processes typical of mathematics education contribute to the reproduction of social inequities." Although there is some need in teaching students, say conventional units, etc., mathematics education should not be limited to that. In the case of disability too, students are indeed familiar with and capable of constructing knowledge in a form different from accepted mathematical practices. In fact, whatever form of mathematics knowledge they could be familiarized with must be explored with the students, rather than with the curriculum.

A set of (mathematical) ideas to which all students (irrespective of their capabilities, disabilities, backgrounds, foregrounds, motivations, mental state, etc.) are expected to have their (mathematical) ideas conform to, would for certain construct students as failures if they cannot catch up.

Materialism as a solution?

As opposed to such an Idealist ideology, Materialism is an ideology through which Matter (or things - which are actually processes in physical reality) is seen as fundamental while ideas as secondary. Anything material, including people and their interactions with nature and other people, are more basic than ideas like God, mathematical models, laws, ideals, etc that are created by people. Ideas are derived by, and cannot exist without, people.

Engels (p. 46) asserts through a Materialist ideology, that, "The principles are not the starting-point of the investigation but its final result; they are not applied to nature and human history, but abstracted from them; it is not nature and the realm of humanity which conform to these principles, but the principles are only valid in so far as they are in conformity with nature and history."

And consistent with the historical account of how mathematicians practice mathematics, when students discus either real world situations or mathematical ideas, they indeed decide how to model situations, and in the process define (read: invent and operationalize) concepts.

For example, in my field work, we tried to decide how to categorize numbers as odd or even. The outcome of this session was interesting. In the beginning of the discussion, the narrative among the students was that, the number of ice creams which could be evenly divided by 2 should be categorized as *even* (eg. 2, 4, 6,...) while those that could not, as *odd* (eg. 1, 3, 5,...). When posed with the question of the number zero, all seemed to arrive at a consensus that zero is both, odd as well as even. The justification was that, zero leaves no remainder when divided by 2, hence it is even; however, we cannot divide zero by two since we have nothing to divide. Hence, zero is odd. During further discussions, a student named Faizan raised his discomfort with including zero as an odd number. He argued, that numbers have the property that "odd + odd = even"; "even + even = even"; "odd + even = odd" and "even + odd = odd", for all natural numbers. And based on these properties, he made his definition by which zero would be even and not odd. Quite a few students never knew this property of integers (that odd+/- odd = even, etc.) and were noticeably amused by it

Interestingly, Faizan's reasoning was consistent with the development of mathematical ideas. His reasoning was an example of how concepts are always in the process of change and development rather than being fixed, static "things". Jammer (1999, p.2) also argues how:

> "a concept finds its strict specification only through its exact definition (which), historically viewed, is a rather late and advanced stage in its development. ...The history of a concept has not yet run its course, it is true even once it has achieved such a "defined" position, since it attains its complete meaning only through the ever-increasing and changing context of the conceptual structure in which it is placed."

Later during the session, the number -4 turned up. So I put forth the question of whether -4 is an odd or even number. The discussions included the following dialogue:

Me: So what about -4? Is that an odd or an even number?

Faizan: Before deciding that, we need to know where did these numbers like -1, -2 come from? I mean there has to be a reason. For example, when we found numbers that could be divided by two, we called them even and those that could not be divided, as odd. So where did these numbers like -1, -2 come from?

Me: So Faizan says that we need to know where numbers like -1, -2 come from?... Maybe we can look at some examples of where negative numbers can be found and then...

Faizan: Sir, when we visited the mall, the lift had numbers -1 and -2 for the upper and lower basement.

The discussion that ensued surrounded the need to conceptualize negative numbers. In between, Faizan interrupted stating that negative numbers are very old, while malls with basements are comparatively new. He later on hypothesized that maybe during the Harappan civilization, building structures which had some sort of basements could have given rise to the concept of negative numbers. The discussions continued with other hypotheses and examples that led us to conclude that it makes most sense to categorize -2, -4, … as even numbers so that negative numbers fit into a continuous pattern of alternating even and odd numbers whether read backwards or forwards.

Dialectical Materialism to be more specific

In the next session, one of the students, Prasad, argued that zero is neither an even nor an odd number. Since we used “numbers” to model some amount of ice creams, zero indicated no ice creams, and thus, was not a number. Other students also made similar claims. Their reasoning was that since zero was “nothing”, it was neither even nor odd (since there's nothing to divide by 2). Hearing these arguments, Juilee who wasn't present at the previous session said, “until now I'd always think that zero is an even number; but now I think that it is neither odd, nor even.” However, discussing properties of numbers other than its oddness and evenness, got the students, including Juilee, to arrive at a conclusion that zero was best categorized as only an even number. Numbers were now spoken off (and understood) in isolation from the context of ice cream.

At times a student would make a claim that another student would not agree with, but this disagreement would be resolved through a dialogue in which the other student would voice out a contradictory claim, with a logical justification. Through the dialogue a consensus would be arrived at. This should not be interpreted as “one student had a misconception, and was corrected by another” since both had valid justifications at the time.

To clarify the point I'm making, let's focus back on Juilee. At the beginning of the class, she claimed to think that zero was an even number. During the class, she then thought that zero was Not an even number. And at the end of the class, she again would categorize zero as an even number (albeit with a better understanding of the conepts than prior to the beginning of class).

Although, she made supposedly contradictory claims, it would be wrong to say that at times, she had a misconception. During each moment of the classrooms interaction, she had a valid reason for each of her supposedly contradictory claim of categorizing zero as either even or Not even. I would say that these contradictions are not only acceptable but rather essential to learning. Tse-tung (1937) argues that “contradictions within a thing is the fundamental cause of its development...” He further states how “objective contradictions are reflected in subjective thinking, and this process constitutes the contradictory movement of concepts, pushes forward the development of thought, and ceaselessly solves problems in man's thinking.” And learning is a dynamic process that progresses dialectically through being convinced, and then confused, and then convinced again, etc.

Summary and Conclusions

The central argument of this paper has been to propose a transformation (of ideology) with regard to the nature of mathematics education. i.e. to transform the understanding of school mathematics from: “a body of knowledge – a set of concepts, etc. that children should learn and apply” to: “what children do and what ideas emerge as they explore/discover patterns and attempt to communicate them or find some logic behind them or explore the pattern further so as to find more patterns.”

It is important to be conscious of what the philosophy of (the process of) mathematics is, and not merely as what its contents are, but rather, how it is developed through social interactions. Through interactions and doing mathematics, new mathematical ideas get developed, and learning happens. And such learning is always in the state of development, and progresses through a process of resolving contradictions eg. being convinced of a claim and facing a conflict on realizing contradictions in it. And only through attempting to resolve those contradictions does learning progress. Dialogic teaching could be one method in trying to resolve conflicts and mediate in the development of mathematical ideas and also the students' learning. However, this should not be understood as a new idea to be "applied", but rather, an idea that emerged through interactions with people. The essence of a materialist ideology (as my proposed solution) is to begin with real, active, concrete people whoever and however they may be. If they are misfits with regard to, or are oppressed due to, an institution however sacred, we must work with the so called misfits towards changing or annihilating the institution so as to make society more equitable. Our ideas must change with our developing understanding of concrete people through increasing interactions with them.

By teaching mathematics as a process, I found some success in creating favourable conditions for authentic mathematical ideas to emerge from my students during which they were also learning. As they exercised mathematical agency and were actively involved in deciding even how to define concepts, they experienced the freedom to invent their own legitimate mathematics. They also developed a more holistic understanding of mathematics, and hopefully other aspects of the world.

These learning outcomes were also possible since we had known each other for years, during which we built up a rapport only after which would we feel comfortable enough to question and joke about topics (including mathematics) which are otherwise believed to be too sacrosanct to be questioned.

References

Bright, A. (2015). Education for whom? Word problems as carriers for cultural values. *Proceedings of the Eight International Mathematics Education & Society Conference*, Portland State University, Oregon 21-26 June 2015 (pp. 355-368)

Campbell, F. Kumari. (2001). Inciting legal fictions: Disability's date with ontology and the ableist body of the law. *Griffith Law Review, 10*, (pp. 42-62)

D'Souza, R. (2015). Challenging Ableism in High School Mathematics. *Proceedings of the Eight International Mathematics Education & Society Conference*, Portland State University, Oregon 21-26 June 2015 (pp. 427-440)

Engels, F. (2011) [1878]. Anti-Duhring. New Delhi:People's Publishing House

Jammer, M. (1999). Concepts of Force. Mineola, NY: Dover

Idol, L. (1997). Key questions related to building collaborative and inclusive schools. *Journal of Learning Disabilities, 30*(4), (pp. 384-394).

Mukhopadhyay, S., Roth, W-M (2012). Alternate Forms of Knowing (in) Mathematics. Rotterdam: Sense Publishers

Skovsmose, O. (2015). Uncertainty, Pedagogical Imagination, Explorative Reasoning, Social Justice, and Critique. *Proceedings of the Eight International Mathematics Education & Society Conference*, Portland State University, Oregon 21-26 June 2015 (pp. 111-122)

Teltumbde, A. (2008) Globalization and Dalits: A Perspective of Buddhist Economics. Navi Mumbai: Srujan Prakashan

Tse-Tung, M. (1937) On Contradiction. Retrieved from: https://www.marxists.org/reference/archive/mao/selected-works/volume-1/mswv1_17.htm Retrieved on 7th April 2016