Challenging Ableism in High School Mathematics

Rossi D'Souza
Homi Bhabha Centre for Science Education, Tata Institute for Fundamental Research, Mumbai

Although disability is case of oppression wherein disabled people are marginalized, denied access and full participation in society, it is generally perceived simply as something wrong with a person. Ableism, a central part of disability, manifests in mathematics education when mathematics is presented, taught, and even defined in terms of the visual (assuming that all can see). Education research focussing on disability rarely challenges ableism in the curriculum and focuses mostly on how disabled children learn or how they can be taught. This contributes neither towards liberation nor empowerment. Using critical ethnography in my fieldwork, I argue for an expanded understanding of mathematics for social justice as well as for justice towards mathematics as a discipline.

Introduction

Disability means different things to different people. Although it needs to be addressed as a case of social oppression wherein disabled people are marginalized, denied basic human rights, access to knowledge and full participation in society, disability is popularly understood simply as something wrong with an individual.

This "*individual model* of disability" identifies the causes of disability as being limited to the functional limitations or psychological losses, which are assumed to arise from impairment (Oliver, 1990). Such understandings also underpin the *charity model* where disability is perceived as a sad event that happens to unfortunate people who are rendered abnormal and deserve sympathy. The *medical model* adds on to the charity model by assuming that disability is a medical condition suffered by "damaged" or "disfigured" or "abnormal" individuals who need to be "normalized" or "fixed". The attitudes shaped by understandings of disability are reflected in the actions of people like doctors and teachers who work with disabled people.

Dominant approaches towards working with disabled people rarely recognize disability as a form of oppression. Even when abled people (who advocate visual methods of educating) discover themselves to be oppressors, they do not really stand in solidarity with disabled people but, as Freire says, "Rationalize (their) guilt through paternalistic treatment of the oppressed, all the while holding them fast in a position of dependence..." Rarely do educationists attempt to develop pedagogies in solidarity with disabled people.

Charlton (2000) argues that due to having internalized their oppression, disabled people have developed a false consciousness. For example, during my field visits I'd have people blaming blindness for their inability to excel in mathematics. A false consciousness prevents disabled people from recognizing that, as Charlton (2000, p. 27) says, "their self-perceived pitiful lives are simply a perverse mirroring of a pitiful world order." Elisabeth Fiorenza (2001) highlights the acceptance for self-alienation by stating, "The self-alienated consciousness is accepted because it is seen as natural and common sense. It convinces people that situations of oppression and dehumanization are normal" (p.111)

Models and Official Definitions of Disability

The dominant model of disability is essentially inclined towards the individual model that focuses only on, and puts the onus of disability related problems on, the individual. The social model, on the other hand locates the source of the problem of disability in society, how it is organized and the attitudes of society towards the physically/mentally impaired.

Inclusion

With regard to education, the philosophy of Inclusion acknowledges that all children are different and that all children can learn. Idol (1997) elaborates that in an inclusive school "a student with special education needs attends the general school program, enrolled in age-appropriate classes 100% of the school day. This is as opposed to *mainstreaming* where a *student with special education needs* is educated partially in a special education but to the maximum extent possible is educated in the general education program (Idol, 1997). Thus, with regard to visual impairment and the curriculum, an inclusive school should acknowledge that the emphasis on the visual in the curriculum would disadvantage some students (who need not be visually impaired). An inclusive school would also not identify individuals for whom the schools would need to be inclusive. In fact, identifying a student as "included" is a form of exclusion.

The social model of disability can also inform discourses around issues related to formal education. For example, as partially/non-sighted students have the option to select the 7th standard level mathematics examination paper for their 10th standard exams, a lot of them are encouraged (or not discouraged) to do so Here, due to society's inability or insensitivity or impatience to teach non-sighted students, society's action is rationalized by blaming disabled students. Consequently, "not having passed the 10th standard Mathematics exam" is used to justify their exploitation by, say, paying them a smaller salary for as much work or not being offered a job or the opportunity for higher studies that demands 10th standard level of mathematics.

In most cases, non-sighted people are employed but not assigned any work. However, companies are provided benefits for having disabled people on board.

Theoretical Framework

I advocate a Freirean perspective on education wherein authentic education is a means towards humanization. Such education is carried out in a dialogic manner in which there is no dichotomy between teacher and students, but both work together towards learning the causes of (an oppressive) reality and thus transform that reality. In my work, this problem is the Disability oppression in which the visual hegemony present in mathematics education plays a significant role.

I argue that Ableism assumes an (idealist) essence of the "Abled Body". However, such an Abled Body does not exist in the *material* world. Every body is in essence a continuous struggle of being simultaneously abled and disabled. While social structures are designed presupposing this "Abled Body" no one really fits this category albeit some benefit over others due to it. Furthermore, each person holds simultaneously a dual oppressor-oppressed consciousness in a constant dialectic conflict.

I claim that mathematization is a part of being human. However, the norm is to teach and define mathematics in a visually dominated manner that works towards alienating many people, especially those who are not sighted. However, this visual hegemony also dehumanizes the (predominantly sighted) benefactors of the education system. For example, sighted students are compelled to compete against their disabled friends in a dog-eat-dog world of a market controlled education system. And the winners of this rat race often celebrate this feat. This is not human. Thus, the oppressor and the oppressed are both manifestations of dehumanization. Dehumanization occurs at even more levels, for example when attention is aimed at understanding reality (so as to adapt to it) rather than the *causes* of this reality since, *being human* implies the conscious transforming of reality rather than merely adapting to it. In schools, presupposing the oppressive reality, while adapting children (especially disabled children) to it, is often the norm.

Without a good understanding of the nature of education, mathematics, etc., one may presuppose that these are essentially, activities in which the able-bodied excel, thereby assuming the need to opt for a lesser ambition. This assumption is also a contributing factor towards (disability) oppression. Critically recognizing the causes of disability mediates in the emergence of a consciousness of a human being in the process of achieving freedom. This is as opposed to "being" either disabled (and in need of special schooling) or abled (and in the need of normal schooling).

Liberation would also include the effort to reclaim the right to own and legitimate abstractions developed through the labour of mathematization, rather than have it dismissed while blindly purchasing that mathematics which is sold by the dominant elites. Recognizing their rights would mean a change in consciousness – from that of those that cannot excel in mathematics to those whose rights to mathematize have been stolen.

The revolution process of transforming an unjust reality can only be carried out by oppressed since it is only they who truly understand the brunt of the injustice meted out upon them and "can better understand the necessity of liberation" (Freire, 1970). The role of a teacher-learner can only be to engage in critical dialogue with the learners.

Research Methodology

I used a participatory research methodology within the domain of critical qualitative research as elicited in Cohen, Manion, & Morrison (2011). Critical ethnography is one such research methodology which addresses issues of oppression, empowerment, and liberation. As opposed to ethnography, which deals with *what is*, critical ethnography deals with what *could be*. Here the researcher has an explicit agenda to *achieve liberation* of people. In critical ethnography, the move is from describing a situation, to understanding it, to questioning it, and to changing it (Cohen, Manion & Morrison 2011, p. 243). In critical ethnography, the role of the researcher is to "use the resources, skills, and privileges available to her to make accessible—to penetrate the borders and break through the confines in defence of—the voices and experiences of subjects whose stories are otherwise restrained and out of reach." (Madison, 2004)

Trueba (1999) argues that "all education is intrinsically political" and critical ethnography must "advocate for the oppressed by: (a) documenting the nature of oppression; (b) documenting the process of empowerment - a journey away from oppression; (c) accelerating the conscientization of the oppressed and the oppressors - without this reflective awareness of the rights and obligations of humans, there is no way to conceptualize empowerment, equity, and a struggle for liberation; (d) sensitizing the research community to the implications of research for the quality of life—clearly linking intellectual work to real-life conditions; and (e) reaching a higher level of understanding of the historical, political, sociological, and economic factors supporting the abuse of power and oppression, of neglect and disregard for human rights, and of the mechanisms for learning and internalizing rights and obligations."

As I believe and hypothesize that the visual hegemony in mathematics education contributes to the oppression of disabled children, the documentation and conscientization included (albeit not be limited to) the assertion that the nature of mathematics is not inherently visual.

Fieldwork

Background

My fieldwork involved meetings with students of a school officially named Vivek Education Foundation School for the Blind. It is a registered NGO that was set up in 2005 and made official in August 2010. The school is essentially a study centre, which facilitates the learning of partially/non-sighted students most of whom attend regular schools (with blackboards and teachers with no knowledge of Braille). Some of the students do not attend any regular school but are preparing for their open schooling exams. Although a total of 45 students are registered with the school, around fifteen attend regularly. My fieldwork was carried out working with these fifteen students. Every student has a different history with regard to his/her eyesight. While five students are congenitally blind, one lost her eyesight due to glaucoma, another is losing it due to the same. Others have either retinal or optic nerve related problems.

Field Visits

I began visiting the school for the blind since the last weekend of June 2013 just for recreation (then, not intending to pursue my fieldwork here). Being a musician, I was offered a permanent slot 2 hours per week where I would teach music among other things. We would have discussions related to mathematics, science, and social issues. These activities helped me to gain acceptance into their group. In the following months, in addition to the Saturday visits, on weekdays, I would volunteer to read out their textbooks so as to help them study (not as part of my fieldwork). I would also (on their request) prepare notes for them to memorize. During these times, the tutoring would lead to discussions, and incidents of disability oppression would come to light. This led me to read about disability oppression and reflect on what should be done. I finally began my official fieldwork, which was planned as a series of sessions in mathematics. After discussing which topic should be learned, we narrowed in on divisibility. We also had brief discussions on the nature of mathematics. I audio-recorded our sessions (including those that involved just reading textbooks to them) and along with two colleagues, noted my experiences.

Recognition of Oppression

Our conversations contained indications that the students recognized their oppression and were conscious of being dehumanized and were yearning for freedom and justice. This included statements (by a student), “If mathematics is something done in the head, why is there such a heavy emphasis on using a paper and pencil?” This 9th std. student also expressed his discomfort with questions based on diagrams given in the book and unnecessarily long equations in Algebra. There were also instances wherein a student suggested we protest against an incident wherein a group of disabled students were denied entry into a boat. This was despite the fact that the incident was presented just to justify booking a bus for an outing.

On one occasion, one of students (a 9th standard visually impaired girl) spoke of how she felt included in her old school and experienced exclusion when she had to be shifted into a new private school (although both were “normal” schools). She said that:

> … in the new school during exams, my writer and I were made to sit outside since my reader would be a source of disturbance to the other students. The bench there was very uncomfortable. The teacher was concerned about the other students getting disturbed with no concern towards what I was going through.

She elaborated on the role played by her friends on whom she depended for taking notes. A similar observation was made during a conversation another student (who had passed her 12th std. exams) who used to have partial vision before losing all her sight. She said:

> I could not see (the blackboard) even (while) sitting on the first bench. So then what my friends would write that only I would copy. Taking books, seeing from their note books like that.

On another occasion, she spoke of how her hobby was to read books and that she read one book a day. After losing her sight, she stated that she lost her passion for reading. She said, “I can’t read books.

Braille books are there but print books… I used to read one book in one day, so that passion is gone." Having passed her 12th, she was seeking admission to colleges that would accept visually impaired students. Although she preferred St. Xavier's College which is well equipped with a resource (and research) centre for the visually challenged, called XRCVC, she expressed her compulsion to opt for a less preferred college since she would need help reaching college. This restricted her access to even XRCVC.

Alienation

There was also a case of a partially sighted student being labelled as a slow learner who expressed his inability and hence, refusal, to learn mathematics.

Pity and Dehumanization

There was no observed instance of abled teachers recognizing the process of dehumanization that came with reference to imposing an ableist curriculum on disabled children or otherwise.

Sometimes during our sessions, there would be visits by elite guests. The students would introduce themselves and talk about their impairments. The school owner would then speak of the children's achievements. He would then speak of the "charity" work done by volunteers (including me) for the "unfortunate" children. On certain occasions there were cultural events held at either National Association for the Blind (NAB) or sometimes at The Blind School where the students were expected to perform. The students would prepare a dance routine and sometimes a drama. We would also sing together while I played the guitar. These events were generally sponsored by either individuals or some organization. A sponsor would then speak about the efforts done by his organization to benefit the blind students. In one of the speeches the speaker mentioned, in front of the students that they had nothing before being part of NAB. On another occasion, a student who began to speak of disability was interrupted by a volunteer who repeatedly said, "You are not disabled!" During these events I would speak to the visitors. One of them told me that on the following day a math teacher would be visiting to teach them Mathematics to help them do well in the banking examination. On another occasion, one of the teachers of the school told me that banking is the best option for the children. While emphasizing on the effort to help the children to get employed in bank, she said, “The bank is the best place they can get a job since their options are less.” She continued, “In my office also there are a lot of openings and many people who work there don’t do anything since there is less work to be done.” This teacher was herself visually impaired. However, the aspirations of the children did not include banking or allied disciplines. One of the congenitally blind student wishes to pursue higher mathematics. Another student has an interest in languages but decided to pursue management since that would “ensure her getting a job”. One wishes to be a lawyer and another a (natural) scientist.

I visited a “special school” in Bangalore that worked with “students with learning disabilities”. The school was equipped with a loom used to knit fabric. This was to make students employable. A school authority spoke of how her ex-student was content with a (current) monthly salary of 2000 rupees stating that, “His parents don’t expect much from him, so he’s happy”.

On Their Learning of Mathematics

On the first day of the teaching, there were ten students present. Their ages ranged from 9 to 20 years. Age did not turn out to be an issue regarding what would be an “appropriate level” of mathematics. We began by asking the students which topic they found difficult. Most of them said “steps.” (It took me weeks to understand that this “difficulty” underlay a case of ableism, after being pointed out by a student) After an hour of discussions and deliberations with the students, we decided to carry out daily sessions beginning with the topic of multiplication, which later reshaped into the topic of divisibility. On asking whether they had any specific difficulties, one of the students asked the rationale behind putting the number zero below the units place while multiplying two digit numbers. To elaborate her query she gave the example of 42 into 42. On deciding to explore the problem, all the children there expressed their desire to work it out. Five students used the *Taylor mathematical slate* (an instrument used to perform mathematical operations on a grid using hexagonal pegs whose orientations indicate different mathematical objects) to work out the problem, four used their notebooks while one just gave out the answer and explained how he did it. This student was 15 years old and in the 9th standard his explanation was "42 2's are 84, hence 42 20's would be 840 and double of that is 1680. Now since we are left with 2, we add 84 giving the answer, 1764."

As time progressed each one of the students arrived at the same answer independently and all explained their procedures through narratives. All the students were fluent in performing multiplication of three digit numbers with either the slate or using their notebooks or without any tangible objects (i.e. purely through thought). They did, however, rely on their peers for explanation of the questions posed. On asking the rationale behind certain procedures, however, most did not understand the question. So to be specific, I asked whether successive addition would yield the same result i.e., if the multiplication table were extended till 42, would the result be the same? A few answered in murmurs. One student did not understand what it meant to have a multiplication table going beyond 10. Her understanding of the tables was that it ended at 10 with no relation among the numbers in the tables. It turned out that a few other students also thought this. This issue was sorted out during the rest of the session. We focused on the right hand side of the multiplication tables and got the children to speak it out. Through discussions, each child understood the rationale behind the construction of the multiplication tables. There were times when only a few children could comprehend what I was saying. But these instances were resolved by letting the children discuss amongst themselves. It was quite common for a child to explain to another on the latter's palm. This was done not just for multiplication tables, but generally for communicating. As we moved on to multiplying bigger numbers, the children seemed as capable of multiplying them with as much ease as was with smaller numbers. However, unsure if they could see any patterns in multiplication of any two numbers I decided to focus only on the multiples of numbers. Many were fascinated by the observation that multiples of ten ended with a zero. Much more so was on the divisibility condition for nine. Discussing the reason behind this was interesting albeit not fascinating for them. They did not consider "proofs" as a part of mathematics. Nonetheless, I continued to discuss divisibility of other numbers. We did reach a consensus on the ways of determining whether a number is divisible by 2, 3, 4, 5, 6, 9, 10, 11, and later on, other composite numbers. (Divisibility test for 9 was proved using the abacus, which some children were fluent with). In the course of time, all the older children were competent in justifying why a particular number is divisible by another. For numbers less than 1000, they would perform the division algorithm in their minds and give out the answer as a justification for divisibility. To test our understanding, I presented an example: "Is the number made of ten 3s followed by 15 (i.e. 333333333315) divisible by 15?". Since many didn't understand the question, I chose smaller numbers, 315 and 3315. When they still didn't understand, I asked those who did understand to explain to those who did not. This worked well. But still the students would work out the solution by actually dividing the number by 15 and giving out the answer (although in their mind using long division; and it was rather quick). Impressive as it was, I did not know whether they would use their understanding of divisibility rules for divisibility by 3 and 5. Hence I chose a bigger number: Ten 3s followed by 15. After presenting this problem and the usual two minutes for the children to explain to their peers, the correct answers along with explanations did emerge. On ending that day's session, one of the students (a 15 year old girl) gave me some homework (which I did not do). She asked me to solve thousand 3s and 15 i.e. 333...315 ÷ 15; that is, a 1002 digit long number where the first thousand digits are made of 3s followed by one and five which had to be divided by 15. We left for the day. It was Friday. We met again on Monday and I forgot about my homework. I was reminded about it. I tried solving it audibly saying, "I will first divide the number by 3 and the result by 5". I asked the children whether that would yield the correct answer. In a minute, they answered in the affirmative. I continued, "So 333333 thousand times followed by 15 divided by 3 would yield 111111 thousand times followed by 05. This number divided by 5 would be, let's see, 11 divided by 5 is 2 and leaves a remainder 1 which moves on to the next 1. Thus continuing, I will have a thousand 2s followed by 1". She immediately said I was right. Being surprised that she was so confident, I asked her to explain and she said that "315 divided by 15 equals 21, 3315 divided by 15 equals 221 Therefore, the answer is a thousand 2s followed by 1". Although I was impressed, I couldn't help feeling a little uneasy for what I considered inductive reasoning in mathematics. I articulated my discomfort. Her reply indicated she, in fact, did not use inductive but rather deductive reasoning. Her reasoning was precisely that dividing the first 33 would yield a quotient 2 and leave remainder 3 that would pass on to the neighbouring 3 and so on thereby having as many 2s in the answer as 3s in the question. This would result in the last 3 tagging onto 1 which when divided by 15 would yield a quotient 2 and remainder 1 which would tag onto 5 thereby leaving 15 which gives the last digit as 1 leaving remainder 0.

After discussing a few more numbers we ended the day with homework to think of numbers that would divide 3600. The next day we explored what the children had to say. Each child presented 2 numbers whose product was 3600 and explained to the rest how they arrived at a particular number. The responses were of the form, "Since it ends with 0, its divisible by 10. Hence it is also divisible by 360" another said "100 and 36" yet another answered "9 and 400", etc. I answered "75" and justified saying that "Since the number is divisible by 100, it must be divisible by 25" Since it is also divisible by 3 and considering that 3 is not present in 25, 3600 is also divisible by 75. We had already reached a consensus that if a number is divisible by another then it is also divisible by a factor of that number. There was no confusion on "75" being a factor. I divided 3600 by 75 and got 48. So my answer was "75 and 48". I used this mode of reasoning to introduce the idea of relative primes. The students got a clear idea about: Divisibility rules for 2, 3, 4, 5, 6, 8, 9, 10, 11, and numbers made up of a product of those numbers (e.g., 15, 35, etc.), idea of primes, relative primes, LCM, GCD, the rationale behind writing the number 0 for multiplication, intuition of mathematical induction, etc.

On my last session, we discussed the nature of mathematics. All reached a consensus that it is about calculation. Proof was not considered a part of mathematics. They also said that even people who have never been to school know mathematics citing examples of young vendors. On future visits after finishing the fieldwork, a discussion with a student enlightened me on various aspects of visual dominance in school Mathematics. However, the concepts which were taught in a visual manner when presented from fundamental principles were easily accessible to him. During a session on Euclidean geometry, the student was able to represent a cube and even a 4D hyper cube on my palm. Here, the 2D shapes were discussed using *wikisticks*. Beginning with a point and then going on to a 1D segment and then to a 2D square (by first drawing the segment and replicating it while joining the corresponding sides), we extended the same to represent a cube as a 2D square followed by a replica of the same followed by joining the corresponding vertices keeping in mind that each side represented unit length while each angle a right angle. Here, it was not necessary to mention that the eyes make square look like parallelogram when looked at from the side (as is assumed to be the understanding behind drawing a cube in "normal" schools). On asking about a 4D extension, he was able to represent it on my palm.

Summary and Reflections

Although I had initially read significant material on disability oppression, the same literature made more sense as it became contextualized. Theoretical concepts like dialectics, oppression, praxis, comradeship, dehumanization, exploitation, cultural imperialism, hegemony did not seem so abstract anymore. I got a better understanding of what it meant to say that disability is form of oppression. I realized that mathematics is not inherently visual (although the way the eyes distort objects can be mathematized). However, mathematics being taught through an ableist narrative is an oppressive practice while having students learn in a manner accessible to them can be empowering. Through asserting that disability is a form of oppression and working in solidarity with disabled people, I have learned to believe that the visual hegemony in mathematics can be challenged. Although I began with questions like, "How do I teach non-sighted students mathematics?" I realized that my approach legitimized ableism. My current questions now include questions, "How do we work towards a praxis for solving the problem of ableism in mathematics education?" I have proposed as my PhD thesis to use critical ethnography to develop a counterhegemonic pedagogy in mathematics with my visually challenged students.

References

Charlton, J. (2000). *Nothing about us without us: Disability oppression and empowerment.* Los Angeles: University of California Press.

Cohen, L., Manion, L., & Morrison K. (2011). *Research methods in education*. New York, NY: Routledge.

Fiorenza, E. (2001). *Wisdom ways: Introducing feminist biblical interpretation.* Maryknoll, NY: Orbis Books.

Freire, P. (1970). *Pedagogy of the oppressed.* London: Penguin.

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

Madison, D. S. (2004). *Critical ethnography: Methods, ethics and performance.* Thousand Oaks, CA: Sage Publications.

Oliver, M. (1990, July). The individual and social models of disability. In Joint Workshop of the Living Options Group and the Research Unit of the Royal College of Physicians (Vol. 23).

Trueba, E. (1999). Critical ethnography and a Vygotskian pedagogy of hope: the empowerment of Mexican immigrant children. *International Journal of Qualitative Studies in Education, 12*(6), 591–614.