

Exploring Implications of the Social Model of Disability for Mathematics Education

A Thesis

Submitted to the
Tata Institute of Fundamental Research, Mumbai
for the degree of Doctor of Philosophy
in Science Education

by

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Mumbai
April, 2021

Declaration

This thesis is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions.

The work was done under the guidance of Professor K. Subramaniam, at the Tata Institute of Fundamental Research, Mumbai.



Rossi D'Souza

In my capacity as supervisor of the candidate's thesis, I certify that the above statements are true to the best of my knowledge.



Prof. K. Subramaniam

Date: 24-04-2021

“No human being can fly by flapping his or her arms, nor could a crowd of people fly by the collective action of all flapping together. Yet we do fly as a consequence of social phenomena.”

- Lewontin and Lewins

Abstract

The research study presented in this thesis is an outcome of an attempt at exploring what “the social model of disability” could mean for mathematics education. This question was investigated through a case study of a learning centre for blind children located in Mumbai.

The social model of disability begins with a rejection of the widely held assumption that disability is a direct outcome of bodily limitations, and argues instead that disability is socially produced. The social model regards that we look at society as a whole, in terms of how individuals and their problems are embedded within a social structure. For example, from a social model perspective, we see that the exclusion of certain groups of people (for example, blind students) from the institution of schooling cannot be understood or addressed without looking into the nature of the institution of schooling, its history, its interconnection with the political economy, the history of the country and society within which the school is located, etc.

But what can the social model of disability mean when confronted with the concrete question of teaching mathematics to blind children in a way that does not further reify their “otherness” as “special” or “differently abled” students? This question is certainly not easily answerable, and forms the crux of the research study presented in this thesis.

The first chapter by means of introduction presents a background of my study, the motivations and demotivations behind exploring the topic of disability in the context of mathematics education.

Chapter 2, titled, *Contending Theories on Disability and Mathematics Education* focuses on literature surrounding Disability theory and Mathematics Education. The first section of this chapter focuses on disability, in which, an emphasis is laid on the debates between Marxist views on Disability (mostly drawing from the “social model of disability”) and postmodernist interpretations on disability that tend to reject the social model. In the second section, I explore the different arguments and contestations within the branch of mathematics education research called as, Critical Mathematics Education (CME) which takes into account the social as well as political economic dimension of mathematics education. In order to foreground my field observations within the political milieu within which my data was gathered, the third section presents an overview of the political history

of India in the context of education, and the fourth section speaks about the political economic dimension of exclusion in the context of schooling and education.

In chapter 3, I present my research methodology. The research study was predominantly a Case Study but also contained aspects of Participant Observation, Participatory Research and Critical Ethnography.

Chapter 4 titled, “Within the walls of the classroom”, contains the bulk of the data I collected from my field study. The chapter begins with two episodes of me tutoring my students but largely focuses on two mathematics camps which we organized at the study centre. The tutoring incidents indicated that disablement and enablement is largely a social phenomena implying that blindness need not disable a student from learning mathematics. It also suggested that mathematization could enable mathematics learning among blind students. The teaching sessions helped validate and refine my argument, and proved insightful in terms of suggesting ideas for making classrooms inclusive and democratic.

The second part of the study is presented in Chapter 5 and presents the limits of the solutions offered in previous chapter. Here I begin by sharing my experience of accompanying a student from the centre for his entrance exam. Through presenting the stumbling blocks that we encountered in the course of his giving the exam, I demonstrate how they revealed certain (dialectical) contradictions of capitalism. To validate the claims I made with regard to the economic dimension of mathematics education and exclusion that were revealed through that episode, and to further my understanding of the various issues that came to light, I took an interview of an ex-student of the centre who had wished to pursue higher mathematics. The entrance exam episode and the interview illuminated the political economic dimension of exclusion in terms of how the presence of mathematics in entrance tests played an ideological role in facilitating exclusion by masking certain contradictions of capitalism and the underlying laws of the market that served to foreclose any possibility for students to realize their mathematical potential. Titled, “Limits of inclusive education”, the chapter illustrates the limits of the pedagogical recommendations proposed in the preceding chapter.

In the 6th and final chapter, I summarize and conclude my research study. Having demonstrated that the exclusionary feature of schooling under capitalism is not contingent upon the disabilities of individuals, the chapter offers suggestions for thinking and moving beyond inclusion.

Acknowledgements

A number of friends, colleagues, academics and comrades have helped me in the research journey that led up to this thesis. And as I begin to list their names, I find it impossible to avoid reminiscing about the events that led to my decision to join the PhD program at HBCSE, the initial days as a first year Research Scholar, and most importantly, the kind of person I used to be prior to developing a critical perspective towards the social world owing to engaging with the field of science education. For making me who I am today, I will be ever indebted to the Homi Bhabha Centre for Science Education. The seven years long research project as reported in this thesis was possible owing to being given the liberty to initiate, develop and sustain an unconventional research project that in fact began with a decision to not consider the work as a research opportunity. Despite having the most supportive group of friends, to embark on such a journey that at any time could have transgressed into failure would have been a foolish decision without having a supportive, erudite and venturesome supervisor that I found in Professor K. Subramaniam (KS). KS agreed to be my supervisor while having 4 students under him at the time, and had already agreed to supervise my batchmate who would be his fifth research student. However, at no point of time did I ever find KS too busy to engage deeply and critically into my ideas while offering constructive feedback, recommending apt readings and pointing out glaring omissions and inconsistencies in my arguments. While KS may not have always agreed with my politics he always knew which reading material would help improve my research practice and arguments. I also thank KS for carefully reading the various drafts of my thesis and always responding promptly.

I am greatly indebted to Prof. Karen Haydock who was a faculty member during my initial years at HBCSE and later became a good friend and comrade. Karen taught me to think and act critically and politically, and helped me look at the world very differently. Karen has always been willing and excited to engage critically and patiently with my work, for which I shall be forever grateful.

I extend my sincere gratitude to Professors Sugra and Arunan who willingly agreed to be in my Thesis Advisory Committee, and for being immensely supportive and approachable throughout the duration of my research work.

I cannot thank enough my co-researchers for their enduring support and effort in maintaining a long-lasting relationship with the study centre which we refer to as “the blind school.” In particular, I thank Jeenath, Shikha and Gurinder whose contributions to this project have been monumental. They always made sure that at least one of us would be present on Saturday mornings at *the blind school* with interesting reading materials or science and mathematics related activities. In addition to accompanying us to *the blind school* for over six years, Shikha and Jeenath have also read my works in detail and have offered constructive and critical feedback which has helped me tremendously.

A heartfelt gratitude to Charudatta, Himanshu, Aisha, Aswathy and Deepika for always being there and for all the thought provoking discussions from which I have learned a lot. A sincere word of thanks to my fellow research scholars and friends, Saurav, Ishan, Shantanu, Arul, Panchami, Joseph, Shubhayan, Deborah, Chaitanya, Jayasree, Geetanjali, Rafikh, Shraddha, Meenakshi, Durga Prasad, Prajakt, Farhat, Ruchi, Ritesh, Harshit, Ravi, Anveshna, Amit Sharma and Amit Dhakulkar for their insights. I gained a lot from HBCSE’s maths group, Tuba, Arshiya, Harita, Shweta, Hari, Aaloka, Manoj and Tejaswi. I also thank the staff of the computer department, especially Anil, Soham and Rajkumar for keeping my laptop, network and printer in order. I appreciate the administration staff, especially Mr. V. P. Raul, Smita and Ravindra for all their help. Thanks to the library, canteen, gardening, security, maintenance and housekeeping staff for all their work in maintaining an environment conducive for doing research. Special thanks to the workers of Rahat foods from Cheetah Camp for their delicious and healthy food preparations.

Our relationship with the blind school was a transformative, meaningful, humbling, but most importantly a fun experience owing to the lively group of students that we had the sheer pleasure to interact and form a long lasting bond with. A special salute to Faizan who was more of a teacher-comrade in my research journey than a student. Faizan played an instrumental role in my research study, often acting as an intermediary between the students and me. Discussions with Faizan contributed immensely to my political, philosophical and epistemological learning.

I extend my sincere thanks to Babita Saroj who was more concerned with me finishing my PhD while interacting with her for my data collection. A special word of gratitude to Rani who along with Faizan and Babita played a strong leadership role in facilitating my

teaching sessions and ensuring that the teaching sessions were more democratic. I also thank Rudra, Juilee, Prasad, Monica, Afreen, Pooja, Raj, Nirbhai, Suman, Kajal, Faizan Sheikh, Shivam, Dharamraj, Arzoo, Sakshi, Abdullah, Deepshikha, Harleen, Santosh, Harshala, Aditi and the other students and their mothers whose active participation made my research effort worthwhile. I am extremely grateful to Poornima ma'am who has been an exemplary manager of the blind school and greatly helped coordinate our visits. A heartfelt thanks to Kanchan whose genuine involvement in our sessions has been quite a learning experience. I thank teachers, Namita, Gunjana and Rukmani for all their help and support. Ms. Prabha, Mr. Vivek and Deepti have treated me like family at the Vivek Education Foundation School for the Blind. Without their willingness to make us a part of their organization, none of this research work would have been possible.

Two international journals have been an essential part of my education - *For the Learning of Mathematics (FLM)* and *Disability & Society* - not only for their reading material but also for supporting the publishing of my writings. I particularly thank Prof Richard Barwell and Professor Val Williams for patiently reading my manuscripts and offering helpful feedback that helped me author really nice papers. Special thanks to Renato Marcone and Fernanda Malinosky, the editors of *Perspectivas da Educação Matemática* for their efforts and feedback while publishing my paper. Renato led us to the blind school. He also facilitated my visit to Brazil, hosted me in his home, and introduced me to a really fun and dedicated group of Brazilian scholars and activists. Among them, I particularly thank Regina, João, Guilherme, Sergio and Fabiola. I have greatly benefitted from the work and hospitality of Prof. Ole Skovsmose who invited me to Brazil and ensured that my stay was educational and fun. I acknowledge Prof. Miriam who has attended all of my paper presentations abroad and has always had encouraging words to tell. I wish to express my gratitude to Arindam for encouraging me to publish at my first *Mathematics Education and Society (MES)* 8 conference and pushing me to be a part of two MES symposia from which I have really benefitted. A special thanks to my fellow symposia members at MES 9 & 10, Magda, Aldo and Jihad.

A revolutionary salute to comrade and Professor Anil Sadgopal from whom I have learned a great deal about the political and economic aspects of education in India. Anil Sadgopal was instrumental in my politicization and made me pick up my guitar again and travel around India to extend solidarity through music with various student-led protests owing to which I had the sheer privilege of meeting with a diverse set of academics and activists

from whom I learned a lot. Sincere words of gratitude to Prof. Jayasree Subramanian for insightful discussions and encouraging me to work on critical issues in maths education. I thank Prof. Gita Chadha for exposing me to critical perspectives in science education, and always being open and willing to discuss various issues and doubts I have had. My heartfelt thanks Dr. Tathagatha whose unconventional approach to the political economic dimension of mathematics education has been instrumental to my learning, and central to my latest journal publications. Special thanks to Professors, Jayashree Ramadas, Sanjay, Prithwijit, Nagarjuna, Aniket, Arvind Kumar, Jyotsna, Anwesh, Savita for their support. I also thank the scientific staff, Vinod Sonawane, Adithi and Meena.

My work has benefitted a lot from the critical insights I received from interactions with student activists I met at various protest sites like JNU's freedom square, Jantar Mantar, HCU's Veliwada, Mumbai Baug, etc. To name everyone involved in my learning of the political dimension of education would take up many pages. However I must acknowledge Ayushi who led the first protest that I have been a part of and whose political speeches exposed me to the educational dimension of protests. In a similar vein I acknowledge my comrades from the intersectional feminist group Zehen, in particular, Shruti, Anu and Shreya, my comrades from the cultural activist group Goonj ek Awaaz, especially Raju, Vijay and Pooja, comrades from The Banned and Yalgaar, especially Dhamm and Siddharth. I thank comrades Sushmita, Shefali, Prof. Chayanika, Salim, Feroze, Varsha, Ashutosh and Mohit. Comrade Vernon has been an amazing teacher. A big shout out to my amazing and dear friends Aabha, Sanika, Joanna and Amanda whose critical perspectives on various sociopolitical and economic issues has forced me to rethink my politics at various levels and have also helped me improve my understanding of the Indian political milieu, and sharpen my arguments.

Most importantly, I thank my parents and my grandmother for all their love and support. I also thank Ransell, Rinaldo and Deepika for all their help.

I acknowledge the support of the Govt. Of India, Department of Atomic Energy, under Project Identification No. RTI4001.

- Rossi D'Souza

List of Publications

* Publications that contain material incorporated in the thesis.

In Mathematics Education Magazines:

D'Souza, R. and S. Takker (2014). Learning mathematics through puzzles. *At Right Angles 3* (2), 18–22.

In International Peer Reviewed Conference Proceedings:

D'Souza, R. (2014). Ableism and disability oppression through schooling. *Conference Abstract Booklet of the Fifth International Conference by Comparative Education Society of India: Education, Politics and Social Change*, pp. 365-367.

* **D'Souza, R.** (2015). Challenging Ableism in High School Mathematics. *Proceedings of the Eight International Mathematics Education & Society Conference, vol. 2*, pp. 427-440.

D'Souza, R. (2016). Challenging ableism by teaching processes rather than concepts. *In Proceedings of the 13th International Congress on Mathematical Education*, Hamburg, Germany: ICME.

Parra, A., Bose, A., Alshwaikh, J., González, M., Marcone, R., & **D'Souza, R.** (2017). “Crisis” and Interface with Mathematics Education Research and Practice: An Everyday Issue *In Proceedings of the Ninth International Mathematics Education and Society Conference, vol. 2*, pp. 174-178.

* **D'Souza, R.** (2017). Ableism in Mathematics Education: Ideology, Resistance and Solidarity. *In Proceedings of the Ninth International Mathematics Education and Society Conference, vol. 2*, pp. 463-470.

Marcone, R., Parra, A., Bose, A., Alshwaikh, J., González, M., & **D'Souza, R.** (2018). “Crisis” - The new normal: Fake (Post-Factual) mathematics education. *In J. Subramaniam (Ed.), Proceedings of the Tenth International Mathematics Education & Society Conference*.

D'Souza, R. (2018). The Social Model of Disability and Critical Mathematics Education. *Proceedings of the Tenth International Mathematics Education and Society Conference*, Hyderabad, India: MES.

In International Peer Reviewed Journals:

D'Souza, R. (2016). Where do/did mathematical concepts come from? *For the Learning of Mathematics* 36(1), 25-27.

* **D'Souza, R.** (2016). Ableism and the Ideology of Merit. *For the Learning of Mathematics*(3), 21-23.

* **D'Souza, R.** (2018). Disability, Economy and the Limits of Inclusive Education. *Perspectivas da Educação Matemática* 11(27), 544-564.

* **D'Souza, R.** (2020). Exploring Ableism in Indian Schooling through the Social Model of Disability. *Disability & Society*, 35 (7), 1177-1182.

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Abbreviations

CME	Critical Mathematics Education
CWSN	Children With Special Needs
ECCE	Early Childhood Care and Education
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tarrifs and Trade
GDP	Gross Domestic Product
ICIDH	International Classification of Impairments, Disabilities and Handicaps
NAB	National Association for the Blind
NCERT	National Council of Education Research and Training
NCF	National Curricular Framework
NGO	Non Governmental Organization
PWD	Persons With Disabilities
RTE	Right To Education
SSC	Secondary School Certificate
UPIAS	Union of the Physically Impaired Against Segregation
WHO	World Health Organization
WTO	World Trade Organization

*Dedicated to all my friends who are engaged in a struggle for
freedom*

Chapter 1

Introduction

“I think that the task of philosophy is not to provide answers, but to show how the way we perceive a problem can be itself part of a problem.”

- Slavoj Žižek

1.1 Introduction

The research study presented in this thesis is an outcome of an attempt at exploring what “the social model of disability” could mean for mathematics education. This question was investigated through a case study of a learning centre for blind children located in Mumbai.

The social model of disability begins with a rejection of the widely held assumption that disability is a direct outcome of bodily limitations, and argues instead that disability is socially produced. The social model offers a radically different approach to understanding disability by directing our attention to society as a whole and how individuals and social phenomena (for example, the exclusion of blind children from schools) are embedded within a social structure. But what the social model of disability can mean with regard to the concrete question pertaining to teaching mathematics to blind children in a way that does not reinforce or naturalize their identity or otherness as “special” students is

certainly not an easily answerable question. And this question forms the crux of the research study presented in this thesis.

I locate my research study in the intersection of the fields of Mathematics Education and Disability Studies, rather than special education. Although I present my research study from the standpoint of a (volunteer) mathematics teacher, this thesis is not about finding out ways of teaching mathematics to blind children. It is more about bringing a critical perspective to the question of the disablement of blind children by taking into account the political economic dimension of exclusion.

1.1.1 Background

The research study presented here began with a chance visit to a neighbouring study centre for blind children in June 2013 and culminated into a PhD research project. I joined the Homi Bhabha Centre for Science Education (HBCSE) in the beginning of August 2012 as a Research Scholar with an interest in undergraduate mathematics and in particular, Linear Algebra. This was so, owing to growing up learning mathematics as a mere tool for doing physics and then in 2010 during my M.Tech degree in Modeling & Simulation being reintroduced to mathematics by one Professor Sukraru Barve, as a subject in its own right. Although Professor Barve had completed his PhD in Physics, his outlook towards mathematics was different from other physics teachers I had encountered in the past. Mathematics suddenly felt liberating owing to it being a space where my creativity could be expressed. Mathematics was not a set of concepts and definitions and textbook problems with preexisting answers in some solution manual but an exploration in which new concepts could be created, definitions could be changed, novel mathematical models could be proposed and developed to address certain problems. The liberatory experience afforded by the new perspective on mathematics that I received during my M.Tech was something I wished to share with the larger community of mathematics learners, especially those who I saw or I knew were struggling with the discipline.

In the month of September of 2012, I got acquainted with Renato Marcone from Brazil with whom I hardly interacted. Renato's work was on the topic of Difference/Inclusion in the context of mathematics education. Renato theorized disability from a post-colonial framework to develop an argument concerning the relationship between Normality and

Disability. As part of his study, he visited India from Rio Claro, Brazil and stayed at the HBCSE campus and made a couple of visits to a neighbouring study centre for blind children. A few days after Renato returned home to Brazil, on the 29th of June 2013 four of us (Jeenath, Gurinder, Shikha and I) decided to visit the study centre albeit without any intention of pursuing research there.

The study centre catered to partially/completely blind students most of who attended regular schools (with blackboards and teachers with no knowledge of Braille). Around 45 students were registered with the centre as of 2013, almost all of who were from economically lower to lower middle class backgrounds. Some students were not part of any formal school but came to the centre to study for their open schooling exams. Prior to being a part of the study centre, these children were confined to their homes and barely received any education. The National Association for the Blind (NAB) used to send teachers to individual children's homes where they were taught for two hours, twice a week which was clearly insufficient given that in addition to the curriculum they also needed to be taught Braille, Abacus, the tactile geometry kit, etc. One of the teachers, Ms Kanak (pseudonym) who was affiliated with NAB and teaches at the centre, recalled how even the children's siblings excluded them from playing with their friends on the pretext that they might get hurt. It involved a relentless effort on the part of Kanak, to ensure that the children were no longer isolated in their homes and were part of this learning centre. The owners of the centre had also struggled to get the children admitted into the neighbourhood school amidst severe resistance from the school authorities.

During our conversation, the teachers expressed their need for someone who could teach music and English speaking. I went back and returned with my guitar. Subsequently, we were given a two hours slot on Saturdays between 11am to 1pm to keep the children engaged with activities related to music and other forms of recreation.

I particularly did not wish to look upon our visit as a research opportunity. We did not plan to return to the centre let alone maintain a relationship that lasted six years and counting. Although I was interested in pursuing mathematics education research, I did not wish to pursue my field study with students with special needs since among other reasons, I did not have any formal training in special education. Also, I did not have any working knowledge of either Braille or sign language. Furthermore, the first language of most of the students was Marathi which I had difficulty speaking.

However, the question of teaching mathematics to blind children significantly bothered me owing to seeing the children at the centre struggle with memorizing definitions of mathematical concepts. The children's struggle had less to do with learning and understanding mathematics and more to do with rote learning answers to textbook questions with the aim of passing their mathematics exams. The curriculum content was unarguably alien to the children. My immediate thoughts on the matter was that, "what they are struggling with is not mathematics!" A meaningless mathematical curriculum was being imposed on the children. And this put me in a dilemma. On the one hand, it was cruel for them to be made to mechanically rote learn answers in a subject which was evidently designed for sighted children. But on the other hand it would have been worse if they were denied the right to be trained in curricular mathematics.

Nevertheless, we pursued our visits every Saturday and also on weekdays if they had an exam coming up. After a few months of continued visits, my PhD supervisor, Prof. K. Subramaniam suggested that I treat my future visits to the centre as a pilot study for my research. However, the thought of pursuing a research project in this field made me uncomfortable since I could not see my role as anything other than an able-bodied man from a privileged position seeking ways of "helping" marginalized blind children adapt to a visuonormative and disabling world and its mathematics. While "The white man's burden" appeared to be necessary, it was also problematic. In her book *Economic Philosophy*, Joan Robinson (1962) stated that, "...the misery of being exploited by capitalists is nothing compared to the misery of not being exploited at all" (p. 46). By modifying the quote of Robinson, I would often express my dilemma by saying that, "... the misery of being made to learn a meaningless mathematics content (through tactile teaching aids or novel strategies, etc.) is nothing compared to the misery of not being made to learn a meaningless and alienating mathematics at all."

However, we maintained our weekly schedule of going to the study centre every Saturday where we began our sessions by singing songs and followed it by activities related to mathematics and science. We also had discussions related to mathematics, science, and social issues. These activities helped us develop a rapport with the children. While initially, our interactions were limited to recreational activities on Saturdays, the students and the teachers requested us to volunteer to tutor during exams. In the following months, in addition to the Saturday visits, on weekdays, we read out their text books so as to help them study for their exams. I also (on request) prepared notes for them to memorize.

While tutoring the children, they often digressed from the topic and spoke about their personal experiences. Interestingly, normative mathematics educational practices played a rather significant role in their experiences. For example, a student who I'll refer to with the pseudonym Faiz narrated an incident of playing a maths game with his (sighted) sister. Faiz narrated how in the midst of the game his sister excused herself and returned with a paper and pencil. Faiz lamented, "If mathematics is something done in the head, why is there such a heavy emphasis on using a paper and pencil?" I found it quite a pertinent concern. Faiz also expressed his discomfort with questions based on diagrams given in the book and unnecessarily long equations in Algebra.

Another event that triggered my interest in this research study was that of another student, Rina (pseudonym) narrating her experiences of being discriminated in her school (which I explain in detail in Section 4.4). While it may not have come across as shocking that a visually challenged girl was discriminated against, what struck me about her narrative was the part where she contrasted her experience with that in her previous school in which she claimed to not be discriminated against. Both were "normal" schools (with blackboards, teachers without knowledge of Braille or Sign language, etc.). By comparing her experiences in the two different setups, it became evident that Rina's enablement and disablement had more to do with her social environment than her blindness. It was not her disability that led to her exclusion but rather it was exclusion and discrimination that led to her disablement.

Without a theoretical grounding in disability studies, I conceptualized these incidents as, in one way or another, an outcome of the students' blindness. However, my PhD coursework on weekdays that accompanied my Saturday visits contributed significantly towards changing my perspective towards these stories and helped me develop a different outlook towards the question of teaching mathematics to blind children. The coursework provided me with a framework for making sense of these experiences. Particularly useful in this regard was a course offered by Prof. Karen Haydock in which I was introduced to Paulo Freire, and another course by Prof. Gita Chada from Mumbai University who taught us "Sociology of Science." Prof. Gita introduced me to the concept of hegemony which really captured my interest so much so that one day, on google scholar, I searched "hegemony, disability" not expecting to find anything relevant. However, that random decision led me to some papers that spoke of something called as "the social model of disability." On engaging further, I eventually stumbled across a paper by Michael [Oliver](#)

(1990) on the Social Model of Disability that made me look at the problems faced by the students from a radically different perspective.

1.2 Motivation for the Research Study

The concept of the social model of disability seen through the lens of the narratives of Rina and Faiz were particularly instrumental in developing my understanding of the social nature of disability and the relationship between discrimination and disablement. The social model of disability (which I will describe at length in the next chapter), to put it simply, rejected the causal relationship between physical impairment and disability. It argued instead, as the late disabled activist Young (2014) stated in her TED talk, that “we are more disabled by the society that we live in than by our bodies and our diagnoses.” However, along with the social model, I also came across multiple perspectives on disability that addressed the social dimension of disablement. And at first, I did not realize the contentiousness among them. The social model theorized disability from a historical materialist perspective while highlighting its political economic dimension. In contrast, the concept of Ableism which appealed to me later, conceptualized disability from a perspective of beliefs, culture, discourse and psychoanalysis. I saw these contending concepts as synonymous. For example, I published my early reflections in D’Souza (2015) where I theorized my experiences through the frameworks of “ableism”, “the social model of disability” and “visual hegemony in mathematics education.” In addition, I found many more frameworks that theorized disability but they all appeared the same to me since they all claimed to challenge the dominant “individual model” view on disability.

I found that to a large extent, (Mathematics) Education practices that addressed disability stemmed from standpoints in which disability was equated with some form of deficiency. Marcone (2015) spoke of this deficiency perspective through the notion of what he called, *deficiencialism* which referred to *deficiency* as a construction of *normality* (Skovsmose, 2016, p. 3). Recognizing the prevalence of *deficiencialism* in academic writings made it not too surprising, to observe a dearth of documented evidences of teaching practices that addressed the question of disability from a perspective of equity and social justice. Also, as Lambert and Tan (2016) observed, there was a “divide

between research in mathematics education and special education using Disability Studies in Mathematics Education” (p. 1057). However, there were exceptions, notably in the writings of, for example, [Healy and Fernandes \(2011\)](#), who argued against discourses that equate difference with disadvantage, and demonstrated that the only difference between sighted and blind learners lay in the tools by which each group experiences the world. [Nardi et al. \(2018\)](#) called for a broader understanding of teaching mathematics in which the learner is involved in sharing the feelings of the teacher about certain phenomena while the teacher strives to feel the mathematics of the student. With regard to how disability is understood, [Healy and Powell \(2013\)](#) pointed out that identities, including that of disability, are constructed along with social, political and economic processes, and in societies marred by inequalities, attaining equity in mathematics education becomes a complex and contentious task. This is quite pertinent in a country like India in which, as the *National curriculum framework (NCF, 2005)* points out:

Hierarchies of caste, economic status and gender relations, cultural diversity as well as the uneven economic development that characterise Indian society also deeply influence access to education and participation of children in school. This is reflected in the sharp disparities between different social and economic groups, which are seen in school enrolment and completion rates. (p. 9)

A sociopolitical understanding of disability highlighted the need for a critical approach to teaching mathematics to blind children. And the idea of carrying out this project raised many questions and challenges. One of the many challenges was a dearth of research in mathematics education that addressed the question of disability from a perspective of oppression, resistance and empowerment. [Skovsmose \(2016\)](#) mentioned how he could hardly find any study that explicitly referred to mathematics education for social justice in a context involving blind students. He then asked the question, “What could reading and writing the world with mathematics mean for blind students?” Skovsmose recognized that doing so would be a challenge for blind students, for among other reasons, due to “difficulties that arise from the relationship between Braille and mathematical symbols.” However, I found some problems with the premise of these concerns. Firstly, the mathematics with which we may want blind children “to read and write the world” may serve to further reinforce their “otherness.” Secondly, the relationship between “Braille and mathematical symbols,” as Skovsmose spoke of, presented the view that there exists a

“normal” way of writing mathematical symbols, and the “other” way, namely, Braille as is done by blind children. Skovsmose also pointed out how our conception of normality and disability is partly contingent upon “the available technology” at a given time, for example, reading glasses. While this is certainly true it could also be (mis)interpreted as saying that a blind child is only potentially suited to participate in mathematics learning.

Skovsmose (2014) argued that for mathematics education to work in support of democracy, “the micro-society of the mathematics classrooms must also show aspects of democracy” (p. 4). But this raised the question as to, what can democracy mean in a classroom where blind and mentally challenged children study alongside so called gifted children, with an “expert” teacher in a society where mathematics plays a sociopolitical role?

To critique the supposed neutrality and universality of mathematics, I turned to Pais (2013a) who narrated his exploration into ethnomathematics, that, combined with critical mathematics education seemed to hold the potential to question the role of mathematics in the school curriculum, and mathematics itself as a culturally bounded field of knowledge. D’Ambrosio (1985), one of the intellectual founders of the ethnomathematics program described ethnomathematics as “the mathematics which is practised among identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and so on” (p. 46). Whether or not it is a useful exercise to theorize the mathematics practiced by the students of the study centre, or blind mathematics learners in general, as “ethnomathematics” is certainly worth exploring. However I found ethnomathematics particularly relevant because my students were affected by the epistemological hegemony of academic mathematics. And ethnomathematics, as Pais recollected, provided the “epistemological critique of the enduring belief in the universality and neutrality of mathematics knowledge” (Pais, 2013a, p. 2). Moreover, as Pais argued, the importance of ethnomathematics is not so much related with the study of “other” mathematics but with “its critique of academic mathematics itself, through a social, historical, political and economic analysis of how mathematics has become what it is today.”

However, as Pais then pointed out, in the classroom, ethnomathematics gets stripped off of its emancipatory core and is reduced to a learning device devoid of any critical reflection on the sociopolitical aspects of academic mathematics. Subsequently, when local knowledge is brought to school it gets decontextualized from the conditions that justify

the emergence and use of this knowledge (Pais, 2013a,b; Knijnik, 2012). Pais dismissed the role of CME in providing a “solution for problems that by their very nature are economic and political” and argued that “if the purpose is the high ideals of peace, democracy, social justice and equality, the route via mathematical thinking, . . . is a dead end” (p. 5). However, it could be argued that Pais targeted his critiques at didactic practices based on how CME (including ethnomathematics) has so far been applied. However, CME necessitates “reinventions” of critical pedagogies in given contexts (Frankenstein, 1983). In the context of teaching mathematics to blind children, while locating disability as well as mathematics within the (socio) political and economic realm, the question that needs to be asked is, “How may Critical Mathematics Education be “reinvented” in view of taking into account the social and political economic dimensions of mathematics education and disability, while teaching mathematics to blind children?” And simultaneously, how may CME inform Disability Studies, considering the significant role played by mathematics education in processes of exclusion and disablement? These are some of the questions that will be addressed in this thesis.

1.3 Overview of Thesis

The research essentially began with the recognition that the current form of marginalization of blind students is structural and, moreover, not an immutable feature of human society. Therefore, taking a cue from Agostinone-Wilson (2013), the research attempts to answer two primary research questions: “How did things get this way?” and “What are we going to do about it?” (p. 6). The “things” in this research refers to the marginalized position of blind students. The use of “we” is political and invoked to highlight the fact that to address problems rooted in the political economic structure of society requires collective efforts. In order to contextualize and answer these two broad questions, the thesis is organized in the following manner.

Chapter 2 of the thesis is titled, *Contending Theories on Disability and Mathematics Education* and focuses on literature around Disability theory and Mathematics Education. I use the term “contending theories” to highlight the fact that various perspectives on disability exist within the field of disability studies which although share some common

concerns, differ significantly on certain fundamental questions. In this chapter, I emphasize largely on three perspectives of disability - The individual model of disability, the social model of disability and postmodernist perspectives on disability. While I describe contrasting perspectives on disability, I select the social model of disability as the theoretical framework for analysing my observations. In other words my thesis is written from the standpoint of the Social Model of Disability.

In this chapter I also explore the differing perspectives on mathematics education and emphasize on critical mathematics education. Although it may be correctly pointed out that CME refers to a specific research tradition, I use it as a broad umbrella term to refer to research in mathematics education that addresses issues of social justice.

In order to foreground my field observations within the political milieu of the environment from where my data was gathered, I dedicate a section in chapter 2 to present a brief overview of the political history of India in the context of education, and another section to speak about the political economic dimension of schooling and education.

In Chapter 3, I present my research methodology. My research study was an exploration into understanding the phenomenon of disablement, and implications of the social model of disability for critical mathematics education by treating my interactions at the study centre as case study. The research study was therefore primarily a Case Study Research (Yin, 2009; Adelman et al., 1976) although it also adopted methods and insights from Participant Observation, Participatory Research (Bogdan, 1973) and Critical Ethnography (Trueba, 1999; Anderson, 1989). The theoretical framework of the research methodology (in addition to the social model and CME) was shaped by drawing insights from Dialectical (Marxist) Research as described by Agostinone-Wilson (2013).

In Chapter 4, I present the first part of my field study. The chapter begins with two episodes of me tutoring students but largely centers around two mathematics camps which we organized at the study centre. The tutoring episode highlighted the social dimension of disablement which indicated that blindness need not disable mathematics learners. The mathematics summer camps provided the opportunity to concretely explore, whether, and to what extent a teacher could create a non-disabling learning environment, and what such a pedagogy could entail. The teaching camps provided empirical insights for creating inclusive classrooms which are democratic (in terms of an equitable distribution

of power among all participants) and enable learning. This chapter thus demonstrates the social nature of enablement and disablement, and offers suggestions for teaching.

In the second part of the study, as presented in Chapter 5, I share my experience of accompanying a student from the centre for his entrance exam. Through presenting the stumbling blocks that we encountered in the course of giving the exam, I present the (dialectical) contradictions they revealed. I follow this up with an interview of an ex-student of the centre who had expressed and demonstrated her desire to pursue higher mathematics during our mathematics sessions. The entrance exam episode and the interview that followed, illuminated the political economic dimension of exclusion, disability and mathematics education in terms of how mathematics education in entrance tests played an ideological role in facilitating exclusion and masking the contradictions of capitalism that served to foreclose possibilities for students to realize their mathematical potential. Titled, “Limits of inclusive education”, the chapter illustrates the limits of the pedagogical recommendations proposed in the preceding chapter.

In the closing chapter, I summarize my research study and offer suggestions that I believe can help us collectively develop a more humanist form of mathematics learning, and an egalitarian society in general.

Chapter 2

Contending Theories on Disability and Mathematics Education

“Inclusion is not enough. Diversity is not enough, and as a matter of fact, we do not wish to be included in a racist society.”

- Angela Davis

This chapter is dedicated to a review of literature on topics concerning mainly disability studies and mathematics education. I begin (Section 1) with an overview of the field of Disability Studies. I emphasize the debates between a Marxist view on Disability (mostly drawing from the “social model of disability”) and the largely postmodernist view on disability that makes an argument to move beyond the social model. In Section 2 of this chapter, I explore the different arguments and contestations within the field of research known as *Critical Mathematics Education* (CME). In order to foreground these writings within the sociopolitical milieu in which the research study was carried out, in Sections 3 and 4, I present an outline of literature on the history and politics of education in India, and the political economic dimension of schooling and exclusion, respectively.

2.1 Disability Studies

To begin, Disability studies as a discipline rejects popular perceptions about disability which equate disability with the physical or mental limitations of individuals. Disability studies views disability as socially produced. It provides an alternate perspective or framework through which disablement can be understood not simply as a “natural” consequence of physical and mental impairments but in terms of how social conditions *disable* people with physical and mental impairments. Disability studies rejects the popular assumption that regards disability as a medical condition in which the individual needs to be cured or fixed.

However, within the field of disability studies, scholars disagree on some of the fundamental questions regarding how disability should be conceptualized, and what should be our response to the question of disability related oppression. It is important to critically engage with the differing perspectives on disability because a given perspective on disability is based on certain presumptions. Consequently each perspective or model determines broadly:

1. How the phenomenon of disability is understood and presented.
2. How other social phenomena that are seemingly unrelated to disability are conceptualized.
3. The nature of research questions raised.
4. The nature of solutions offered.
5. The limits of those solutions.

The limits of the solutions feed back into the perspective on disability and reinforces those limits as indubitable features of disablement. For example, from the dominant perspective on disability which is referred to as the “individual model of disability,” the source of disablement lies within the individual. The problems associated with disability are subsequently attributed to the individual having the presumed disability. The research questions and consequently, the solutions lie in developing strategies to help disabled individuals adapt or adjust to a social structure (for example, a schooling system). The

solution involving helping an individual adapt to a particular system tends to be limited to that particular system. If there are many systems in which an individual is disabled, the problem of being disabled is reinforced as being located within the individual.

The “social model of disability” that arose as an alternative framework to the individual and medical model of disability, was originally theorized from a Marxist perspective by the Union of the Physically Impaired Against Segregation (UPIAS). The social model located disability, or rather, the current form of disablement, in the class structure of society and “the product of a mode of production under which one’s value is determined by their exploitability within the wage labor system” (Jaffee, 2016, p. 1). The nature of research questions that arise while taking forward the social model of disability, and the nature of solutions that arise, is largely what this thesis is about.

As opposed to a Marxist view on disability, a Postmodernist perspective that gained prominence in social theory in the 80s led to disability being theorized as a *sociocultural* phenomenon. Consequently, disability related experiences were argued to be constructed primarily through culturally embedded discourses. Postmodern theories also acknowledge social structure but only inasmuch as they, along with social practices, serve to reinforce culturally embedded discourses.

Another point of contention between Marxist and Postmodernist scholars of disability studies concerned the relationship between impairment and disability. For Marxist scholars (for example, Oliver (1996) and Finkelstein (1981)) disability is fundamentally different from physical and mental impairment. However, postmodernist scholars like Shakespeare (2014) argue that, “disability arises as a complex interaction of factors” and in reality, “people are disabled by society *and* by their bodies and minds” (p. 5).

A common thread that runs through the different positions within disability studies is a rejection of “the individual model of disability” that refers to the popular worldview that regards disability as a natural expected outcome of physical impairments.

2.1.1 The Individual Model of Disability

The individual model of disability “sees the problems that disabled people have as being a direct consequence of their disability” (Oliver, 1983, p. 15). In other words, it considers

the problems faced by people with disabilities as an “individual” problem, and so, in a way, it blames disabled individuals for their own marginalization and disablement.

To explain the individual model necessitates locating it in history and the political and economic milieu, in order to better understand the conditions that led to its emergence. The dominance of an individual model of society is certainly not by chance. As [Winzer \(1993\)](#) pointed out, “In any society attitudes and values are fashioned by the prevailing culture, religion, government, and economic conditions.” And “as societies change, so do their values” (p. 3).

2.1.2 Historical Roots of the Individual Model of Disability

The individual model is characteristic of a modernist view of society that not only reflects the current political economy of capitalism but also the values of Enlightenment. The individual model, which is often spoken as being synonymous with the medical model, is a radical departure from the pre-Enlightenment era that included the so called “Dark ages” which refers to the period before the rise and social acceptance of modern medicine. In the “Dark ages,” disability was predominantly perceived and officially considered “as having supernatural causes and therefore being unamenable to human treatment” (p. 4). While the concept of medicine predates modernity (a notable example is that of Hippocrates (460-377 B.C.) whose oath doctors recite today), a lack of a proper understanding of disease and sanitation (read: Germ theory of diseases) contributed significantly to the prevalence of disability prior to modernity. In fact, even though Hippocrates emphasized the use of “physiological diagnosis” he still considered the possibility that diseases and disability have supernatural causes, although he assumed that “mystical origins of mental and physical anomalies were less important than causes explainable through observation and diagnosis” ([Winzer, 1993](#), p. 16). The difficulty in studying especially delicate parts of the body, like the brain, ear and eye, coupled with a reluctance to dissect the human body contributed to various misunderstandings of disease and disabilities ([Winzer, 1993](#)).

With the rise of Christianity, the Devil added to the list of causes of disability. The idea of witches also prevailed in Medieval era right up until the mid eighteenth century. Subsequently the prevalent treatments for various disabilities and disorders included, along with medicine, prayer, exorcism, witch hunts, and various forms of executions

considering that the disabled person was believed to have been possessed by Satan. The medieval era also saw the entry of institutions for lepers which in the seventeenth century gradually converted into institutions for those considered insane (Winzer, 1993).

With the coming of age of modern medicine and the Renaissance, official beliefs in the supernatural began to decline. The contributions of activists who rallied against the practice of witch hunting cannot be overemphasized. The Renaissance saw genuine attempts at educating people with disabilities “starting with deaf persons, . . . followed by blind, and, much more tardily, mentally retarded people” (Winzer, 1993, p. 31).

A noteworthy figure of the Enlightenment was the English materialist John Locke (1632-1704) whose philosophy of Empiricism had a major influence over the people of Europe. Empiricism held the view that ideas are not innate but have experiential causes and arise from sensations and reflection. Prior to the Enlightenment, the conception of God was accompanied by an idealist worldview which had ramifications for disability. As Winzer put it, “If disabilities are imprinted before birth by God, the Devil, or nature, then they would not be amenable to amelioration except by miracle” (Winzer, 1993, p. 43).

However, such was not always the case. As Slorach (2016) pointed out, “Contrary to myth, accidents at work were usually seen as natural (or man-made) and not divinely caused punishments and so were subject to human alleviation” (p. 53). Slorach traces the rise of disability as a form of oppression to late feudalism until which, “families often lived and worked as large extended groups, enabling greater networks of support for child-rearing and caring for the elderly. And for most people, there was no concept of literacy and intellectual ability” (p. 58). “The rural production process and the extended nature of feudal family . . . permitted many people with impairments to participate in daily economic life” (p. 61). Slorach refers to a population census of 1570s Norwich that found “a ‘lame’ and one-handed 80 year old woman who worked by spinning and winding yarn and a blind man who worked as a baker” (p. 61). The introduction of farming technologies that led to surplus agricultural production led to merchant trading networks and the growth of towns that tied together previously isolated villages. Social networks also led to an exchange and spread of knowledge and inventions across different (non-Christian) civilizations, leading to conditions favourable for reason and an undermining of the Catholic Church’s authority over the minds of the people, and the rise of Enlightenment. In addition, Europe witnessed a plague and peasant revolts, repressions, the weakening of the power

of feudal lords with rural workers producing finished goods in their own homes, the rise of industry and the development of new technologies like the clock that could measure worker productivity.

The Enlightenment was indeed a radical departure from the middle ages in terms of giving rise to the prevalence of a materialist outlook towards worldly phenomena. But it wasn't favourable for the majority of the people. The Enlightenment coexisted with the "slavery of African people, the repression and impending genocide of Native American peoples, the disenfranchisement of women, the institutionalization of people with disabilities, and the exploitation of working classes" (Best et al., 2010, p. 13). John Locke was himself complicit in slavery and had invested six hundred pounds in the Royal African company that dealt with the trading of African slaves, in the year 1672 (Glausser, 1990).

Accompanying the emancipatory ideas that arose during the Enlightenment was the rise of the idea of the rational isolated individual. Human society came to be modeled as, or seen to be reducible to, a collection of free rational autonomous individuals with the isolated individual as its natural unit. Dominant economic models explained social phenomena as an outcome of individual interests, aspirations, actions, beliefs, etc. Subsequently, economic phenomena was seen as an outcome of individuals interacting with each other based on their individual economic interests. The dominant conception of capitalism was encapsulated by the infamous phrase of Adam Smith, namely, "It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest" (Smith, 1977, p. 30). By regarding society as a sum total of freely acting rational individuals who buy and sell based on individual economic interest, it was assumed, at least by the bourgeoisie of 18th century Europe, that capitalism was the most optimal system of production, that it provided individual liberty and freedom, and it alone could deliver maximum wealth that individuals are capable of producing, and would make everybody better off.

With the rise of Individualism as the prevailing ideology, in regards to the problems faced by people with disabilities, the Enlightenment saw "the unequivocal declaration that something must be done for the weak, the dependent, the disabled - for all those who could not earn a living in competition with the fit" (Winzer, 1993, p. 77). Subsequently, the 19th century saw a rise in the number of institutions like special schools which catered to the needs of such exceptional individuals, and also the rise of the asylum.

While “training was provided for socially at-risk and sensorily and intellectually disabled children, other disabled youngsters fared less well. Large number of those who were crippled, emotionally disturbed, multiply handicapped, or suffering a range of undetected or low incidence conditions were simply excluded from special institutions” (Winzer, 1993, p. 83). Consequently, “the emergence of specialized institutions marked a significant shift in attitudes toward, and treatment of, disabled individuals” (p. 79).

2.1.3 The Medicalization of Disability

With the development of modern medicine, the rise of special education and the subsequent classification of disabled people based on their particular disabilities arose the medicalization (i.e. the medical model) of disability. By “medicalization of disability,” disability studies scholars refer to a social condition in which “medical response remains the overarching social response to disability” and the “social, economic and political aspects of disability become secondary” (Ghai, 2015, p. 225). Therefore, “disabilities are presumed to be genetic, biological and even birth defects reiterating that medical intervention is regarded as a pre-requisite without any contemplation of the social perspective” (Ghai, 2015, p. 227). The prevalence of the medical model of disability has a political economic dimension to it, in the sense that, as Oliver and Barnes (2012) pointed out, the medicalization of Disabilities “encourages an ideology of ‘victim blaming.’ At the same time, the economic context of dangerous working conditions, contaminated environments and toxic waste products are seen as personal troubles.” Consequently, “Drug companies and manufacturers of medical technology are happy to step into this emerging market with ever more sophisticated therapeutic solutions to the problems of social control” (p. 86). Furthermore, as the “pathology” of disability is “located in the individual, the responsibility of procuring the cure lies with the person who is afflicted with the disability” (Ghai, 2015, p. 225).

Critics of the medical model of disability do not reject medicine but rather the hegemony of a purely medicalized view of disability that serves to obfuscate the political economic dimensions of a disabling political economic structure that serves vested interests. A critique of the medical model is also a critique of the capitalist ideology.

2.1.4 The Social Model of Disability

The dominant worldviews post Enlightenment tended to regard society as the sum total of the individual members of society. Social phenomena was thus viewed as an outcome of interactions between free individuals, each of who could be studied in isolation. Individualism as an ideology also implied that disability is an individual problem.

The social model of disability was developed as a response to the prevalence of individualizing explanations for the problems faced by people with disabilities. It introduced a “macro” or dialectical understanding of society in which the whole is regarded to be greater than the sum of it’s parts. The social model was based on the premise that social problems faced by individuals cannot be understood by merely studying individuals in isolation, or interactions between individuals. For example, the exclusion of certain groups of people from the institution of schooling cannot be understood or addressed without looking into the nature of the institution of schooling, its history, its interconnection with the political economy, the history of the country and society within which the school is located, etc.

The social model provided a “new paradigm” for conceptualizing disability that involved “a switch away from focusing on the physical limitations of particular individuals to the way the physical and social environments impose limitations upon certain groups or categories of people” (Oliver, 1983, p. 23). Through redefining the meaning of disability, the social model shifted the onus of adjusting onto society.

As Slorach (2016) and Jaffee (2016) discussed, the ideas underlying the social model of disability were first expressed by a group of disabled socialists who called themselves the Union of the Physically Impaired Against Segregation (UPIAS, 1976). The UPIAS rejected the causal relationship between physical impairments (for example, the loss of a limb or body function) and disability (the inability to participate in society). They declared in their *Fundamental Principles of Disability* document that

it is society which disables physically impaired people. Disability is something imposed on top of our impairments, by the way we are unnecessarily isolated and excluded from full participation in society. Disabled people are therefore an oppressed group in society (UPIAS, 1976, p. 4).

The social model does not disregard the biological limitations posed by our bodies in carrying out certain desirable activities but recognizes the potential of the human species in negating individual biological limitations. The late disabled activist and social modelist [Finkelstein \(1998\)](#) pointed out that, “Human beings are by nature frail animals.” But “We have acquired an accumulated body of knowledge which has enabled us to transform the ‘natural’ environment into a ‘social’ world of our own making” (p. 28). By recognizing that the frailty of human being is not the cause of their disablement, the social model emphasizes that under certain social conditions certain groups people find themselves being disabled from social participation.

To claim that disabled people are an oppressed group necessitates addressing what oppression means. Various authors ([Oliver and Barnes, 2012](#); [Gleeson, 1997](#); [Abberley, 1987](#), etc.) etc. argued why disability is a form of oppression. But saying so is not to claim that we can arrive at a monolithic theory of oppression into which we can fit different forms of oppression ([Abberley, 1987](#)). In *Justice and the politics of difference*, [Young \(1990\)](#) indicated that we do not have a clear definition of oppression. Young, however pointed out how “all oppressed people suffer some inhibition of their ability to develop and exercise their capacities and express their needs, thoughts and feelings.” Young stated that the oppression that some people suffer is not because of coercion from a tyrannical power, but “because of the everyday practices of a well-intentioned liberal society” (p. 40), thereby qualifying disability as a form of oppression.

The social model received tremendous support from disability rights activists and proved to be emancipatory to disabled individuals as well. [Egan \(2012\)](#) advocated the social model and expressed her problem with the phrase ‘person with a disability’ and the notion of ‘having a disability’. Egan lamented, “. . . I am disabled by a society that places social, attitudinal and architectural barriers in my way. This world we live in disables me by treating me like a second-class citizen because I have a few impairments - most obviously a mobility impairment.” Locating the “the difference between “having a disability” and “being disabled” within the individual and social model respectively, Egan highlighted, that the individual model presents

the idea that a person is prevented from functioning in our society by their body or brain and it’s just that person’s tough luck. If they can’t blend into this world, it’s not the world’s problem. The social model is . . . the idea that

a person with an impairment or illness is disabled by the society we live in because of all the barriers that are put in our way. (Egan, 2012)

The social model's advocacy of the term "disabled person" as opposed to "person with a disability" also stems from the social worldview underpinning the social model, while recognizing the individualist worldview behind the term "person with a disability". The former term presupposes the existence of a society within which people find themselves *disabled* from participating in society, while the latter term presupposes disability as a thing existing independent of how society is organized.

While various scholars and activists have advocated a social perspective towards disability, there have been differences between them in terms of how they conceptualized the causes of disablement and the implications for theorizing it as such. While all followers of the social model agree that disability is imposed on top of impairments, they differ with regard to the implications of such a perspective. For authors like Shearer (1981), the social model calls for society to remove barriers, a view shared by advocates of what is referred to as the "Human rights model" (For example, see Jackson, 2018). The UPIAS view of disability as developed and advocated by authors like Oliver and Barnes (2012), Finkelstein (1981), etc. recognize barriers as arising out of a social system whose defining characteristic is its mode of production. The UPIAS view also recognizes class struggle as an inherent feature of class society, and its historical contribution in bringing about radical social change and improving living conditions for the once oppressed. They thus argue that disablement, which is a structural problem and inextricably linked with the political economy, can only be removed by disabled people engaged in collective political struggles (Oliver, 1983). In my research work, I drew largely from, and lent support to, the UPIAS view as conceptualized by Oliver et al. because by providing a radically different worldview to understanding society as a whole, it proved well-suited for the task of looking into the political economic dimension of mathematics education. I maintain the use of the term "social model of disability" despite its various contending interpretations mostly as a tribute to Michael Oliver. But I also believe that my work carries on Oliver's analysis forward in a direction consistent with the underlying philosophy of the social model, to make it applicable to address the political economic aspect of the disablement of blind mathematics learners. The social model as conceptualized by the UPIAS is grounded on a Marxist conception of human society and takes a historical and dialectical materialist approach to the question of disablement.

2.1.5 On Historical Materialism

A distinguishing feature of the social model is that it investigates social phenomena through a materialist perspective. For this reason, [Oliver and Barnes \(2012\)](#) make frequent use of the term “disablement” in order to refer to material (social, economic, etc.) processes as opposed to “disability” which has the connotation of a thing like idea. Materialism as a philosophical worldview stands opposed to the idealist way of interpreting social phenomena. As [Cornforth \(1953\)](#) states, “On every question, there are materialist and idealist ways of interpreting it, materialist and idealist ways of understanding it” (p. 17). *Idealism* regards that “it is simply the *ideas* which we hold that determine the way we live and the way society is organised.” Subsequently, “Those who think in this way forget to look for the material causes” (p. 26).

The debate between materialism and idealism is not merely an abstract philosophical exercise but has crucial implications for critically understanding the world and politically engaging with it. Proponents of dialectical and historical materialism have always challenged commonly and uncritically accepted causal links between what (from an idealist perspective) appears natural and what is socially (materially) produced, what is the cause and what is the effect. For example with regard to the issue of women’s oppression, [Alexandra Kollontai \(2007\)](#), rejected the prevailing idealist discourses that served to justify the subjugation of women. Kollontai, through a historical materialist standpoint argued that:

The followers of historical materialism reject the existence of a special woman question separate from the general social question of our day. Special economic factors were behind the subordination of women; natural qualities have been a secondary factor in this process. Only the complete disappearance of these factors, only the evolution of those forces which at some point in the past gave rise to the subjection of women, is able in a fundamental way to influence and change their social position. . . . women can become truly free and equal only in a world organized along new social and productive lines.
(p. 176)

The apparently “natural” qualities of women based on which the idea of a “woman” is conceptualized are not, as Kollontai argued, the cause of their economically disadvantaged

position in society but rather, it was the other way around. Material economic factors were the cause behind the subordination of women. The prevailing discourse around the question of women's subordination was an idealist one that served to imagine and fashion causal links between oppression of women and their (immediate) physical attributes in an abstract manner thereby reifying gender differences as immutable "things" that give rise to, and thus justify a woman's subordination. Kollantai however inverted the causal relationship between what appeared natural and what was socially and economically produced, and demonstrated that material forces were behind this subjugation, but misattributed to the imagined "natural qualities" of women.

In a similar manner by referring to "the myth of woman," Wittig (2007) challenged the apparently natural binary between the categories of man and woman, and argued that the relationship between cause and effect (of oppression) appear in an inverted form:

A materialist feminist approach to woman's oppression destroys the idea that women are a "natural group". . . . by admitting that there is a "natural" division between women and men, we naturalize history, we assume that men and women have always existed and will always exist. . . . consequently, we naturalize the social phenomenon which express our oppression, making change impossible. For example, instead of seeing giving birth as a forced production, we see it as a "natural," "biological" process . . . A materialist feminist approach shows that what we take for cause or origin of oppression is in fact only the *mark* imposed by the oppressor: the "myth of woman," plus its material effects and manifestations in the appropriated consciousness and bodies of women. (p. 360-361)

Similarly, through using insights from historical materialism to address the question of Race, Coates (2015) in his book *Between the World and Me* argued that that the relationship between race and racism takes an inverted form:

Americans believe in the reality of "race" as a defined, indubitable feature of the natural world. Racism - the need to ascribe bone-deep features to people and then humiliate, reduce and destroy them - inevitably follows from this unalterable condition. In this way, racism is rendered as the innocent

daughter of Mother Nature . . . But race is the child of racism, not the father. And the process of naming “the people” has never been a matter of genealogy and physiognomy so much as one of hierarchy. Difference in hue and hair is old. But the belief in the pre-eminence of hue and hair, the notion that these factors can correctly organize society and that they signify deeper attributes which are indelible . . . is the idea at the heart of people who have been brought up hopelessly, tragically and deceitfully to believe that they are white (p. 7).

Wittig from a similar viewpoint compared the construction of “Race” to the social construction of the concept of “Women”:

. . . before the socioeconomic reality of black slavery, the concept of race did not exist, at least not in its modern meaning, . . . race, exactly like sex is taken as an “immediate given,” a “sensible given,” “physical features,” belonging to a natural order. But what we believe to be a physical and direct perception is only a sophisticated and mythic construction, an “imaginary formation,” which reinterprets physical features (in themselves as neutral as any others but marked by the social system) through a network of relationships in which they are perceived. (They are seen *black*, therefore they *are* black; they are seen as *women*, therefore, they *are* women. But before being *seen* that way, they first had to be *made* that way.) (p. 361-362)

A common feature between racism and sexism, as highlighted by Wittig and Coates is that, a network of social relations shaped by relations of production that determine how groups of people are dealt with, take the appearance of natural “things.” [Lukàcs \(2016\)](#) referred to the mistaking of social relations for “things” as Reification ([Feenberg, 2015](#)). Subsequently the apparent “thing” is fetishized as though having the natural property of giving rise to social relations. But from an anti-racism standpoint we see that “race” is an illusory effect of a definite set of social relations which belong to a definite historical period in human development. It also becomes evident that without a critical awareness (or what Feenberg refers to as a “reified standpoint”) a network of social processes appears as a “thing” called race. Subsequently, the source of the problem of racist social relations finds itself located within the so-called “race” of individuals. From an idealist perspective, the concept “race” is seen to determine the material conditions

of people imagined to belong to “another race.” However, it is not merely by chance that certain marginalized groups of people are seen to belong to a different group, as Wittig pointedly described - “before being *seen* that way, they first had to be *made* that way” (p. 362). As Parenti (2007) highlighted, today the stereotype of the “lazy native” is created as a means of depicting “Western investment as a rescue operation designed to help backward people help themselves” (p. 269). Imperialists had to *make* the people into “lazy natives” in order for them to be seen by the world as such.

Just as in the context of race and sex, scholars and activists who advocate the social model of disability have argued on similar lines that suggest that even in the context of disability, oppressive social relations have an economic basis, and problems on account of these get mislocated within the apparently “natural” attributes of individuals. The social model directs attention to the political economy and class structure because it identifies these factors as the chief aspect of social life that will have to be changed if social justice is to be achieved.

In a manner similar to how Kollantai, Wittig and Coates articulated the problems of race and sex, the social model provided, from the standpoint of disablement, a materialist interpretation of history that attempted “to provide an evolutionary perspective on the whole of human history” that effectively placed “social relationships within a historical setting” (Oliver and Barnes, 2012, p. 54).

Social perspectives of disability does not relegate the sufferings of the individual to a secondary position but highlights the social aspect of it. Helen Keller (1920a) contrasted the difference between the technical and social aspects of blindness by stating that, “We are striving to prevent blindness. Technically we know how to prevent it, as technically we know how to have clean houses, pure food, and safe railways. Socially we do not know how, socially we are still ignorant. Social ignorance is at the bottom of our miseries, and if the function of education is to correct ignorance, social education is at this hour the most important kind of education” (p. 40).

A defining feature of the social model is its recognition that the marginalization of disabled people is not a natural and permanent feature of human society and that disablement is “situated within social, political, and economic structures that ascribe its meaning within a particular place at a given historical moment” (Jaffee, 2016, p. 1).

A central aspect of the Marxist philosophy of historical materialism is the notion of what Marx (1990) and Engels (1877b) call as, a “negation of negation” which refers to the idea that, as Engels (1877b) put it, “Every kind of thing therefore has a peculiar way of being negated in such manner that it gives rise to a development, and it is just the same with every kind of conception or idea.” Applying the notion of negation of negation to the social sphere, Engels wrote,

All civilised peoples begin with the common ownership of the land. With all peoples who have passed a certain primitive stage, this common ownership becomes in the course of the development of agriculture a fetter on production. It is abolished, negated, and after a longer or shorter series of intermediate stages is transformed into private property. But at a higher stage of agricultural development, brought about by private property in land itself, private property conversely becomes a fetter on production, as is the case today both with small and large landownership. The demand that it, too, should be negated, that it should once again be transformed into common property, necessarily arises. But this demand does not mean the restoration of the aboriginal common ownership, but the institution of a far higher and more developed form of possession in common which, far from being a hindrance to production, on the contrary for the first time will free production from all fetters and enable it to make full use of modern chemical discoveries and mechanical inventions.

Engels pointed out that applying the insights of “negation of negation” to a social phenomenon or process is not at all straightforward and depends on the particular nature of the process. Also, it is not enough to negate “but also sublate the negation” which means arranging “the first negation [so] that the second remains or becomes possible.”

A similar historical materialist approach is taken by Wittig (2007) who although criticizes Marxism for not allowing women “to constitute themselves as historical subjects” (p. 364) argues for a “lesbian society” which is essentially a negation of a heterosexual society which was in turn a negation of a more primitive society prior to the formation of the division between men and women. For a lesbian, Wittig writes, “the refusal to become (or to remain) heterosexual . . . goes further than the refusal of the *role* “woman.” It is a refusal of the economic, ideological, and political power of a man” (p. 363).

2.1.6 Historical Materialism and the Social Model of Disability

The social model was developed in the 1980s primarily by Michael Oliver and Vic Finkelstein who theorized disability by locating it within the history of class society. [Oliver and Barnes \(2012\)](#) argued that current form of disability oppression arose out of the contradictions of industrial capitalism, which “created disability as an individual problem,” and “it was not until the latter half of the twentieth century that this came to be challenged, largely by politicized disabled people” ([Oliver and Barnes, 2012](#), p. 3). In fact, even in the early twentieth century, Helen [Keller \(1920a\)](#) blamed capitalism for creating “the blind man” as “a symptom of social maladjustment” (p. 38). A similar line of thinking was expressed by [Foucault \(1989\)](#) in, *Madness and Civilization* who argued, as David Cooper paraphrased, that “the invention of madness as a disease is in fact nothing less than a peculiar disease of our civilization” (p. viii). Similarly, [Fromm \(1955\)](#) argued that “many psychiatrists and psychologists . . . hold that the problem of mental illness in a society is only of a number of ‘unadjusted’ individuals, and not that of a possible unadjustment of the culture itself” (p. 15).

The social model is underpinned by a materialist analysis of disablement and situates the contemporary manifestations of disability oppression within the drive for capital circulation and accumulation. In such a milieu “ability” gets reduced to economic productivity of an individual which gets defined, “in large part, in relation to one’s exploitability as a worker for the sake of capital accumulation ([Jaffee, 2016](#), p. 2).”

In his book, *A Very Capitalist Condition*, [Slorach \(2016\)](#) presented a class analysis of the history of the rise of disablement of physically impaired people by providing a detailed account of how impairments were dealt with in different historical epochs and different societies - from pre-class (hunter-gatherer) societies to late capitalism. Slorach showed various cases of the earliest human beings who survived for decades with physical impairments thereby indicating that even the early human beings quite likely supported each other. For example, as shown by [Spikins et al. \(2010\)](#):

Remains found in Kenya of a female *Homo ergaster*, the first human-like species, were dated to around 1.5 million years ago. Examination suggested that she had hypervitaminosis A, an extremely debilitating disease greatly

hindering capacity for independent survival. Living ... in the African savannah, she must have been fed by others who also protected her from carnivores.

More recently, in 2017, a reanalysis of a 50,000 year old Neanderthal skull was carried out by [Trinkaus and Villotte \(2017\)](#) who indicated that the disabled Neanderthal man, in addition to having endured multiple injuries, was also deaf. The study also indicated that surviving with such physical conditions in a highly demanding environment could have only been possible with the help of others ([Dvorsky, 2017](#)).

Thus, as Slorach put it, “what we today know as impairment was likely to have been understood and dealt with very differently in earlier human societies” (p. 42). The development of a capitalist mode of production and the industrial revolution demanded a new type of labour, which led to the rise of disability as a specific form of discrimination. For example, spinning machines were designed for use by the *average* human beings who could not have any impairment which would hinder machine operation. Slorach also addressed how capitalism produced the normative “ablebody” by referring to [Finkelstein \(1981\)](#) who highlighted how “... the economic necessity of producing efficient machines for large scale production established ablebodiedness as the norm for living in society” (p. 3). A precondition of the development of industrialisation was “the emergence of the ‘free’ worker who is freely able to take his labour-power to the market and offer it for sale as a commodity ‘belonging’ to him, a thing that he ‘possesses’ ” ([Slorach, 2016](#), p. 91). Efficient machines capable of large scale production rendered smaller machines obsolete. This left more working people having no commodities to sell in the market except their labour power as a commodity to be applied to machinery to generate profits for the machine owner, who would invest part of the profits in purchasing additional resources, machinery and more labour to compete with a rival factory owner. A disabled worker was subsequently perceived as a “potentially ‘wasted’ investment” ([Slorach, 2016](#), p. 77).

A competitive labour market led to workers viewing each other as rivals, thereby reinforcing the prevailing ideology of individualism, thus leading people to view each other and themselves as atomized commodities and “private individuals” ([Oliver and Barnes, 2012](#), p. 80).

Capitalism thus creates an alienated culture within which individuals experience themselves as aliens. As [Fromm \(1955\)](#) described through the Marxian notion of *alienation*,

under capitalism, “man does not experience himself as an active bearer of his own power and richness, but as an impoverished ‘thing,’ dependent on powers outside of himself, unto whom he has projected his living substance” (p. 114). While alienation has been in existence since well before capitalism, what distinguishes modern capitalism is the extent of alienation having pervaded every aspect of life and society.

By putting the spotlight on capitalism, the social model illuminates certain core aspects of capitalism that impose disabling conditions for physically and mentally impaired people and reifies their disablement. Slorach showed how the development of wage labour created the desire for “measurement, comparison and ranking of units of capital according to their value, including the labour power of workers” which “stimulated the use of statistics as “political arithmetic” to promote state policy.” And with the mushrooming of city population in 1850s arose concerns about “issues of criminality and madness.” Around this time, arose the notion of the “norm” in the context of dividing the population between standard and “deviations” from the norm. Francis Galton, a cousin of Darwin and who coined the term eugenics, renamed “the law of frequency of error” to “the normal distribution error and divided the curve into ranked quartiles to designate gradations of intelligence.” Galton’s work is stated to have led directly to the concept of the “intelligence quotient” (IQ) and scholastic achievement tests that paved the way for the “eugenics movement” that “called for government policies to improve the biological quality of the human race through selective breeding” (p. 95). The social model of disability following a materialist interpretation on society thus makes it evident that disability and associated reified concepts or ideas like “normality,” “intelligence,” etc. are socially produced and have political and material economic basis behind their creation, and serve ruling class interests.

The very fact that capitalism engenders impoverishment and a growing gap between the rich and the poor, proves that the current problems faced by disabled people, a majority of who are poor, is historically contingent and unique to capitalism.

To summarize, the social model of disability, attempts to explain human society in terms of a dialectical conception of totality. By locating the source of disablement in material economic conditions, it follows that “the oppression of disabled people will only end when the oppression of all is overcome and that will only happen with major structural, economic, political and cultural transformation as well as resistance” (Oliver and Barnes,

2012, p. 176). [Slorach \(2016\)](#) argues along similar lines by pointing out that as disability “is deeply embedded within capitalism,” it “can be overcome only with a fundamental social and economic transformation of society” (p. 264). And this involves “overthrowing a system of production which systematically deprives human beings of any control over the manner, nature and product of their labour, the key means through which they affirm their humanity” (p. 269).

While the social model recognizes the roots of the individual model of disability in Modernity, it does not call for rejecting Modernity (as opposed to the stance taken by postmodernists like [Borgioli \(2008\)](#)). And neither does the social model reject the concept of the individual. The social model locates the individual in a dialectical relation with society and strives for the development of a society which would promote “genuine individuality, cultivating rounded human growth in place of a one-sided and fragmented development of skills” ([Slorach, 2016](#), p. 270).

2.1.7 The Postmodern turn in Disability Studies

The political changes in 1980s and 1990s, as [Agostinone-Wilson \(2013\)](#) highlighted, saw the rejection of Marx in academia and the acceptance of “false pragmatism/postmodernism, alongside the growth of right-wing and reactionary ideologies” (p. 7). In Disability Studies too, “the politically centre right in the disability movement” gained prominence and called for the social model to be “updated” so as to shift the focus from structural causes of disablement back to changing attitudes, accepting diversity, and attaining legal rights as ends in themselves (as discussed by [Finkelstein \(2007\)](#)). The postmodern turn presented itself as an alternative to the “obsolete” social model of disability and led to disability being theorized as a *socio-cultural* phenomenon (ignoring the political economic dimension of disability by emphasizing its socio cultural outcomes) in which individual’s experience of disability are perceived to be constructed primarily through culturally embedded discourses and reinforced through social practices and social structure (for example, see [Corker \(1998\)](#)). Postmodernist theorists of disability accused the social model for creating a rigid binary between impairment and disability thereby devaluing “individual embodied experience” ([Shakespeare, 2006](#); [Ahmed and Chao, 2018](#),

p. 175). Through arguing for a ‘relational approach,’ Shakespeare (2006) said that disabled people experience “the intrinsic limitation of impairment” as well as “the externally imposed social discrimination” (p. 41).

Shakespeare, who was once a supporter of the social model later described it as an “outdated ideology” that “outlived its usefulness” (Shakespeare and Watson, 2001). By comparing the social model with the feminist movements of the early 1970s, Shakespeare (2006) stated that in an analogous manner, “it could be claimed that sex corresponds to impairment, and gender corresponds to disability ... demonstrating that what was thought throughout history to be natural was actually a product of specific social relations and ways of thinking” (p. 30). Referring to the social model as “British disability rights and disability studies,” Shakespeare argued that what distinguished the social model from other social approaches to disability was the “distinction between impairment and disability” (p. 34). Shakespeare (2014) advocated what he referred to as his “interactional approach” which conceptualized disability as “an interaction between individual and structural factors.” Chappell (1998) criticized the social model for almost entirely ignoring learning difficulty.

2.1.8 The Human Rights Model of Disability

From a postmodernist standpoint, Degener (2017) proposed “the human rights model of disability” as an alternative to the social model. Degener described the human rights model as “an improvement on the social model of disability,” and “a tool to implement” the CRPD (*The United Nations Convention on the Rights of Persons with Disabilities*), and described the CRPD as a manifestation of the human rights model (HRM). Degener argued that, as opposed to the social model that “merely explains disability,” the HRM “encompasses values for disability that acknowledge human dignity of disabled persons” (p. 43). Similarly, unlike the social model that is supposedly lacking on various fronts, the HRM seeks to “provide moral principles or values as a foundation of disability policy.” Like Shakespeare, Degener also criticized the social model for “neglecting the experience of impairment and pain for disabled people and how it affects their knowledge and their identity” (p. 43). As per Degener’s argument, the social model neglects “identity politics” which she defines as “politics that values and cares for differences among human beings and allows to identify positively with features that are disrespected in society. Gay pride,

black pride, feminism, and disability *culture* are manifestations of these identity politics” (p. 50, emphasis mine).

Lastly, Degener argues that “whereas the social model of disability can explain why two-thirds of the one billion disabled persons in the world live in relative poverty, the human rights model offers a roadmap for change” (p. 54). Degener attributes the cause of poverty not to the inherent contradictions of capitalism but to “Lack of resources, lack of education, and a dearth of fundamental services” (p. 55) without touching upon the political economic reasons behind the denial of these very resources to a vast majority of the population.

However, as [Oliver \(1996\)](#) pointed out in his earlier work, the social model is not to be taken as a reified thing and applied in a rigid or prescriptive manner, but rather, as an alternative to the individual model, so as to raise a different set of research questions ([Oliver and Barnes, 2012](#), p. 23). Also, to emphasize that disability arises out of society, rather than out of the body, is not to deny the biological aspect of it.

Degener trivializes the idea of “explaining” disability, but by doing so, overlooks the structural nature of the marginalization of disabled people. Therefore the reasons why disabled people find themselves denied of dignity and rights in the first place remains unquestioned.

By portraying identity politics as antagonistic to social (power) relations, the HRM only serves to reify the bigotry against such groups of people as an immutable feature of human society. [Degener \(2017\)](#) laments that “Even in a society without barriers and other forms of discrimination, people need need social, economic, and cultural rights. People need shelter, education, employment, or cultural participation ... particularly ... disabled persons who have historically been excluded” (p. 45). However, Degener, far from acknowledging the political economic forces responsible for rendering housing, education and meaningful employment inaccessible to the majority of the population, decries the social model’s attempts at explaining these very problems that serve to disable all people, especially those with disabilities. Degener presents an individualist and ahistoric perspective on disablement and excludes the role of capitalism’s inherent contradictions in creating the problems faced by disabled people, and attempts to address these problems symptomatically.

The social model of disability does not deny that all people deserve rights to education, employment and housing but offers a framework that helps recognize the inherent contradictions of capitalism that leads to situations wherein the majority of the population find themselves unable to access education, employment and housing (shelter). The ideological construction of the individual within capitalism did in fact provide significant gains for the general population in terms of dismantling traditional hierarchies, and establishing legal frameworks by which individuals could secure civil, political and human rights (Oliver and Barnes, 2012, p. 97). However, owing to the inherent contradictions of capitalism, such gains have not been accessible to a large number of people.

The ideas underlying the HRM are not new. About a century prior to the conception of the HRM, Helen Keller (1920b) had responded to similar arguments by highlighting the inherent contradictions involved in providing a meaningful employment to all people under capitalism. In her essay, *The Unemployed Blind*, Keller stated:

The means of employment - the land and the factories, that is, the tools of labour - are in the hands of a minority of people, and are used with a view to increasing the owner's profits than with a view to keeping all men busy and productive. Hence there are more men than "jobs." This is the first and chief evil of the so-called capitalist system of development. The workman has nothing to sell but his labour. He is in strife, in rivalry with his fellows for a chance to sell his power. Naturally the weaker workman is thrust aside. This does not mean that he is incapable for industrial activity, but only that he is less capable than his successful competitor. (p. 243)

Keller explained how "In the majority of cases there is no relation between unemployment and ability. A factory shuts down, and all the operatives, the more competent as well as the less competent, are thrown out of work" (p. 244).

A hundred years since Helen Keller wrote her essay, we find education reduced to a commodity, and housing as a site of speculation and rent collection by a handful of capitalists and landlords. Furthermore, we also find ourselves in an unemployment crisis that is threatening to close down many businesses.

There is no denying that the fact that a disproportionate number of people with disabilities lack access to shelter, employment, education, and various other social amenities must

be viewed as a gross violation of human rights. And certainly, their rights to accessibility must be fought for at various levels. But at the same time, in terms of conceptualizing a model of disability, the denial of human rights to people with disabilities must not be treated merely as an accidental oversight, and that which can be mitigated through focusing on this hitherto excluded social group.

From the lens of the social model of disability, we see that the current form of violation of human rights and discrimination against people with disabilities is historically contingent, and is symptomatic of larger political economic processes that also produce rising amounts of poverty, unemployment, homelessness, etc.

Amartya Sen is famous for, among other things, asserting that “no famine has ever taken place in the history of the world in a functioning democracy” (Sen, 1999, p. 16). From a social model perspective, it could be argued on similar lines that in a proper functioning democracy, no person should find themselves excluded and disabled. And as a corollary, the fact that vast numbers of people find themselves disabled from participating in society, whether as workers or as students, indicates a political problem. Stating this, as a mathematics teacher, does not, in any way imply that individual sufferings of, say, our blind students should be relegated to a secondary position in view of a larger political battle against neoliberalism or fascism.

It is therefore rather incorrect and also problematic to accuse the social model of devaluing “individual embodied experience” (as was done by Shakespeare). Because defining disability terms of individual pathology and “associated functional limitations and culturally determined deficits” (Oliver and Barnes, 2012, p. 11) suggests that irrespective of how society is organized, disabled people, irrespective of their class location, will always face the kinds of disadvantage they face under capitalism. The relational model (as advocated by Shakespeare) thus absolves capitalism not only of creating disabling conditions for people with physical and mental impairments, but also of placing barriers to realizing the very fundamental rights that the HRM strives to offer to people with disabilities.

The internal contradictions of capitalism lie at the root of rising unemployment (among ablebodied as well as disabled people), homelessness, increased inaccessibility of education, etc. These problems cannot simply be mitigated through providing legal “Rights” to the affected people. “Focusing on a rights route to emancipation as an end in itself rather than as a means to an end was always likely to be counter-productive. It is becoming

increasingly apparent that having legal rights does not mean that they will be enforced and even if they are, that enforcement will achieve the desired aims” (Oliver and Barnes, 2012, p. 151).

The Human Rights Model is reflected in the *Rights of Persons with Disabilities Act of 2016* (RPWD, 2016) which, in the context of education, emphasized discrimination, barriers, accessibility, accommodation, appropriate languages and modes and means of communication, offering transport facilities to students with disabilities, etc. In this regard, the HRM, which shares some insights with the social model is a progressive departure from comparatively more individualist models of disability. However, the HRM is limited in its scope considering that it has to fit within the prevailing structure of a schooling system within a Capitalist society. The HRM is structurally limited in its scope given how it is fundamentally about providing rights within the confines of a capitalist social order that values profit over people, and sees workers as a disposable population, and thus cannot afford to challenge the structural nature of this economic mode of production in which exclusion is an inherent part.

The HRM does not provide a worldview that differs from the prevailing individualist worldview under capitalism. This makes the HRM inapplicable to issues that are not immediately obviously related to disability, for example, mathematics education.

2.1.9 Postmodernism, Psychoanalysis and Ableism

Campbell (2009) called to shift focus away from disability “to a more nuanced exploration of epistemologies and ontologies of ableism” (p. 3). Referring to her earlier work, Campbell (2001) defined Ableism 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” (p. 44). Goodley (2012) theorized the concept of dis/ableism by referring to Lacanian psychoanalysis that explored the “imaginary and symbolic elements of culture” in order to “analyse the precarious *cultural* foundations of ableist society” (p. 179, emphasis mine). Goodley’s central argument was that “disabled people come to occupy a prominent position of disavowal through which the processes of ableism can seep into everyday subjectivities.” Goodley introduced the

notion of the “psyche” that he described as “a complex tightened knot of the person and the social world, the self and other people, the individual and society.” And in the context of disablism, Goodley described the concept of psyche as a “cultural artifact of contemporary society that individualizes social problems” From this standpoint, Goodley critiqued “individual, medical, bio-psychological, traditional, charity and moral models of disability” for locating “social problems in the heads and bodies - the psyches - of (disabled) people” (p. 181).

Through a psychoanalytic framework of dis/ableism, Goodley emphasized oppression as an internalised experience of disablism which is felt “psychically, subjectively and emotionally” although it is culturally and sociopolitically produced from which arises questions about the ‘disabled psyche’ rather than how ‘non-disabled people construct disability in ways that subjugate disabled people. Goodley’s developed his psychoanalytic perspective on disability based on the concept of the ‘Lacanian triad’ that comprises of the *real*, *symbolic* and *imaginary*:

Ableist society upholds the *imaginary* autonomous, self-sufficient, whole-functioning citizen; promotes signifiers of ableist achievement, mastery and competence in *symbolic* culture; and crucially, denounces those who fail to match such ableist images and signs as *really* uncivilized, dis-abled, fragmented, dis-coordinated shells of humanity. ...Ableist cultures are staffed by individuals whose jobs are to correct the monstrous *realities* of disabled people. (p. 186)

In his earlier work, [Oliver \(1996\)](#) critiqued postmodern psychoanalytical approaches towards disability and argued that oppression “is ultimately due to [disabled people’s] continued exclusion from the processes of production, and not because of society’s hatred (real or imagined) of [us]” (p. 50).

Ableism therefore needs to be explained in terms of its materiality, its history and its interconnections with various aspects of society. Forms of oppression that are rooted in social political economic structures are not merely outcomes of individuals disrespecting differences. Ableism, like other forms of discrimination is rooted into the material political economic conditions of the society where it is produced. The problem of attempting to dismantle ableism without addressing the material forces that produce disability is

analogous to attempts at decolonization, annihilation of caste and patriarchy without addressing their historical and material causes. For example, a market economy that imposes scarcity, and forces individuals to compete for jobs, leads to instances of ableist practices among workers.

It is therefore important to recognize the politics behind liberal attempts at dismantling ableism that do not address the economic roots and conditions that produce them. [Agostinone-Wilson \(2013\)](#) states how “many major corporations have strong antiracist and antisexual harassment policies, and require yearly training workshops for employees on multiculturalism, not because they are inherently generous in spirit, but because they view racism and sexism as bad for business” (p. 75). In other words, while at a systemic level, racist and sexist institutions, and ideologies that are embedded in politics and culture, may certainly be good for business, having openly racist and sexist bigots in the workforce whose ideologies stem from that very system may not be so economically viable. And the same is the case for ableism.

2.1.10 Critique of Ableism in Mathematics Education

Ableism, or rather, an ableist culture, operates in mathematics education often in subtle forms that make it difficult to identify. Among those who may agree that visuonormativity is a social problem may not readily critique research claims that advocate visual ways of teaching. In the field of education and cognition, it is not unusual to find statements that rationalize the claim that blind children also “visualize.” [Arcavi \(2003\)](#) argues how “Vision is central to our biological and socio-cultural being” and locates the experiences of even blind people as a visual experience by stating that “visualization may go far beyond the unimpaired (physiological) sense of vision.” Making vision central to learning mathematics, he states as though it is a good thing that, “the centrality of visualization in learning and doing mathematics seems to become widely acknowledged. Visualization is no longer related to the illustrative purposes only, but is also being recognized as a key component of reasoning (deeply engaging with the conceptual and not the merely perceptual), problem solving, and even proving.” Arcavi’s work adds further support to the understanding that “mathematics ...relies heavily (possibly much more than mathematicians would be willing to admit) on visualization in its different forms and at different levels” (p. 216-217). On the one hand, such a statement appears hopeful

considering that it tells us that blindness need not hamper visual reasoning. And therefore we need not worry about reconsidering how we define mathematics education so as to maintain its universal character. But on the other hand, Arcavi ends up creating a new kind of normativity that involves visualizing rather than seeing. The problem with this new normativity is that, just like how not all people have vision, similarly, not all people can visualize. I had argued in an earlier work (D'Souza, 2017) that when “discourses surrounding mathematics define it as a visual activity, on the one hand it constructs blind students as naturally and biologically less capable of pursuing mathematics, and on the other hand, it constructs (and privileges) sighted students capable of visual reasoning, as being more capable of doing mathematics.” Although such discourses do not directly define deficiency based on normality, “there underlies an assumption of what constitutes ‘normal’ thus implying, as a corollary, the definition of the deficient.”

To assume that visualization is universal is problematic even from a purely “biological” perspective. A BBC news article by Gallagher (2019) reported the case of two individuals, Ed Catmull and Glen Keane who had the condition called Aphantasia, which is characterized by the inability to generate mental images (Zeman et al., 2015). However, these “impairments” did not stop Ed from becoming the chief of Pixar who developed a method of animating curved 3D surfaces, and Glen from creating the cartoon character named Ariel (from *The Little Mermaid*). Therefore to assume that all children visualize runs the risk of reifying the inability to visualize, as a biological deficiency located within the student that would explain the cause of the student’s failure in a mathematics exam that demands the ability to visualize.

The concept of ableism is often cited by mathematics educators who argue for shifting focus away from the presumed disabilities of individual students, and towards ways in which social environments and beliefs about difference exclude disabled students from learning mathematics. In the context of science and mathematics education in India, Palan (2021) describes how “Ocularcentrism, a variant of ableism, . . . renders the study of subjects like . . . mathematics and science as a fundamentally visual experience, with ocularnormativism dictating that vision is a necessary condition for success in these subjects” (p. 216). Using the notion of Ableism, Borgioli (2008) refers to individual and medical models of disability as a “modernism view” and contrasts it with, and advocates, the postmodernism view that explains disability as a social construction based on “incorrect, immoral assumptions regarding difference” (p. 134). Implicit

in the postmodernist view of disability is the idealist and individualist corollary that, the problem of disability related problems can be rectified through changing ideas and assumptions regarding difference. Borgioli advocates a postmodernism view of disability as opposed to the individual and medical view but does not consider the social model view which sees disablement as structural. In fact, postmodernism rejects structures altogether thereby reinforcing individualist ideologies.

Borgioli illuminates how ableism operates in mathematics education in the context of special education, for example, when teachers are recommended to “uncomplicate” mathematics for disabled children which reinforces the idea that certain students are incapable of, and need not participate in activities that involve mathematical inquiry, etc. [Hehir \(2002\)](#) from a similar standpoint argues that the root cause of inequalities stems from *assumptions* about what it means to “walk, talk, paint read or write” (p. 35). To this [Borgioli \(2008\)](#) adds that there is also more than one way to “do mathematics.” However, a postmodernist framework of ableism fails to address why is it that mathematics education took on and maintains a particular form in which all students are expected to do mathematics in one way. It is not merely due to the ignorance of teachers or researchers or any individuals for that matter, that lead them to impose an alienating exam-centric mathematics curriculum on a diverse range of students and make them compete against each other. Among the most cited definitions of Ableism, the political economic dimension of disabling material conditions remain largely ignored and the problem of ableism is reduced to merely the discrimination against disabled individuals. For example, Hehir refers to ableism as “deeply held negative attitudes towards disability analogous to racism” (p. 10). Ableism indeed has similarities with racism. However, simplistically comparing ableism to racism portrays an ahistoric image of racism (and ableism). It ignores the political and economic history of human society underpinning the rise the various forms of racist practices and policies and glosses over the material economic interests served by racism. For example, the racism of the US and Europe have their roots in colonization and slave trade. Similarly, there is also a historical, political and an economic dimension to the racism faced by the various communities from Manipur, Nagaland, etc., in mainland India. [Malemnganbi \(2020\)](#) criticizes a particular understanding of racism which is prevalent in mainland India in the sense that,

... instead of addressing the problem of racism in its entirety, it only sees the tip of the iceberg of the idea of racism. In this way, the symptoms of the

malaise are being equated with the malaise itself. It not only hides from view the origin of racism but the social and systemic nature of racism sustained and supported by the existing institutional powers as well.

The varied forms and manifestations of racism cannot be done away with merely by appealing to or educating racist settler colonizers to respect diversity and difference. By reducing racism to its symptom namely, the discrimination against people of African descent, a solution to the problem takes the form of a call to change our beliefs and make our Capitalist society and its racist institutions more inclusive to the needs of all people irrespective of class, race, caste, gender and disability.

Likewise, ableism also has material roots. Ableist biases derive from social relations of production, thus evincing that remedying the oppressions of disability is not possible within a capitalist economy (Jaffee, 2016; Russell, 2011). Ableism is ideological and a reflection of certain material economic conditions, and its materiality lies in practice which is influenced by structural factors, rather than merely having incorrect ideas and mindsets. Postmodernist discourses on discrimination ignore the political economic basis of ableism, and also “fails to expose either the way society is organized for the production of the material conditions of its existence or that the mode of production plays the chief causal role in determining oppressive social outcomes” (Russell, 2011, p. 87).

In a way, theories about disability can be categorised on the basis of whether they are more materialist or more idealist. This distinction is based not just on whether they are more concerned with material or cultural forces, but whether material or cultural forces are taken to be more basic with regard to causes and effects. In this regard, Priestley (1998) groups various theories of disability under two sets of categories Idealist/Materialist and Individual/Social. The perspective I adopt falls in the category of what Priestly categorizes as Realist Materialist which sees social relations being derivative of “the development of a mode of production within a specific historical context” (p. 78).

By taking into account historic and material economic factors that influence the exclusion of blind children, the social model of disability offers an alternate framework to individualist and postmodernist models of disability, and thereby raises an entirely different set of research questions, not limited to disability. The social model offers a different insight into the question of the causes of disablement, and it’s relation to the exclusion of blind

children. Looking through the lens of the social model we realize that the question of exclusion is far more nuanced. By including the political economy of capitalism into the equation of disability, the social model brings into question what is otherwise taken for granted or considered out of the purview of disability studies and makes us rethink what are the underlying causes behind the failure and exclusion of blind children in schools.

Dominant discourses on disability and exclusion play an ideological role in obfuscating the economics of exclusion and hindering the raising of questions thereof. For example,

- Why are students with disabilities underrepresented in schools in the first place?
- Why aren't schools equipped to include students with disabilities? Is India too poor to provide such facilities? Why do we have budget cuts in education?
- Can money which is otherwise used to subsidize big businesses be used instead to fund public schools to equip them to cater to the needs of students with disabilities? Why are special education teachers forced to develop "low cost" teaching tools for their blind students in a country whose public sector banks can afford to waive off loans of its defaulting capitalists to the tune of tens of billions of dollars? ([Sharma \(2020\)](#), [IANS \(2020\)](#))
- Is there a relationship between budget cuts in education, overcrowded classrooms, low teacher student ratios and exclusion of blind children?
- Is there a relationship between the prevalence of high stakes tests and disablement? Who are the powerful stakeholders that benefit most from such an industry?

While the above questions may appear unrelated to inclusive education, they cannot be ignored in our efforts to make mathematics more inclusive to all learners. Furthermore, mathematics education itself plays a central role in sociopolitical processes ([Skovsmose and Borba, 2004](#)) by, for example, providing means and justifications for certain forms of inclusion and exclusion ([Skovsmose, 2005](#)). Furthermore, as [Pais \(2014\)](#) points out, failing students is an inherent property of a schooling system that is actively involved in social stratification. In a similar way, [Burris \(1988\)](#) highlights through the concept of reification, that although schools function as "a social process of selection for an already stratified social order," they take the reified appearance of an institution aimed

at providing productive skills. Subsequently, “Poverty and inequality, . . . appear as the consequence of personal deficiencies in the capacity to acquire technical skills, rather than the normal outgrowth of capitalist economic institutions.” And this appearance “lays the foundation for the meritocratic legitimation of class inequality” (p. 17). Although Pais and Burris do not talk about disability, they highlight how schools need to produce a few students who excel and many students who fail. As a consequence, the “ability” or “disability” of a student come to be fetishized as an inherent property of a student rather than a historically specific way of sifting students based on the likelihood that of an individual to be well suited to carry out certain kinds of labour. The problem of equity is therefore not exclusive to people who are disadvantaged owing to their race, socio-economic position, gender, abilities, etc. but a generalised problem of the school system, that affects students as a whole. The disabling aspect of schools is therefore structural, and not contingent upon the physical impairments of individual students. A theory of disability that is applicable to concerns of students with disabilities must therefore be capable of addressing, or being further developed in order to address, how structural economic factors create disabling conditions in schools. And in this regard, the social model proved most suited for my study.

A social model understanding of disability helps us see contradictions within the institution of schooling that on the one hand has a commitment to provide useful education to all while on the other hand, is actively involved in producing exclusion and disablement. This compels us to think of questions concerning teaching mathematics to blind children, all the more critically. Also, as [Lambert and Tan \(2016\)](#) observed, there is a “divide between research in mathematics education and special education using Disability Studies in Mathematics Education” (p. 1057). In this regard, Critical Mathematics Education (CME) offers some useful insights that help handling these contradictions.

2.2 On Critical Mathematics Education

Analogous to the how the social model questions taken-for-granted assumptions about disability, Critical Mathematics Education (CME) questions what we take for granted as mathematics education. CME and the social model of disability share a common feature of trying to understand society as a whole, while locating the particular object of analysis

(disablement or mathematics education) in a dialectical relationship with society. CME as a sub-field of research in mathematics education arose out of the recognition of the importance of taking into account the sociopolitical, cultural and economic dimension of mathematics education. The development of CME was influenced by Critical theory as conceptualized by the Frankfurt School, and the radical pedagogy of Paulo Freire.

While disability studies studies began with formally addressing the concept of disability from a social perspective, in mathematics education research too, a shift was seen from a predominantly positivist and cognitive research (that focused on the mathematics learning of individual child) to a focus on the social aspects of learning (that inquired into for example, the forms of power manifested in social interactions among learners). As [Gutiérrez \(2013\)](#) puts it, “the concern for the individual (and related cognitive functioning) no longer is the central point of learning” (p. 38). In addition to the social turn, mathematics education also witnessed a sociopolitical turn with a growing number of mathematics education researches addressing questions of domination and power in society. The sociopolitical turn in mathematics education research involved researchers taking into account, as [Gutiérrez \(2013\)](#) stated, “the fact that mathematics is a human practice means it is inherently political, rife with issues of domination and power, just like any other human practice”. Subsequently, mathematics education researchers took a political commitment to “not just to better understand mathematics education in all of its social forms but to transform mathematics education in ways that privilege more socially just practices” (p. 40).

CME is underpinned by the understanding that the aim of (mathematics) education should not be merely about producing (mathematically) competent *individuals* but rather, to contribute to creating a different (more equitable and democratic) *society* altogether. In this sense, CME shares a philosophical and political worldview with the social model of disability in terms of its premise and implications for education.

CME arose with mathematics education researchers taking into account the fact that education in general and mathematics education in particular can play contrastingly different roles - on the one hand it can serve to prolong existing social relations while on the other hand, mathematics education can contribute to political struggles for changing prevailing social relations. Certainly any attempt to strive towards the latter is undoubtedly an uphill task. Nonetheless as [Skovsmose \(1994\)](#) states, “Even if it is an illusion

that education can prevent social and political catastrophes, education cannot set aside a responsibility to try to fight for human rights. If this responsibility is overlooked, education runs a risk of being a follower” (p. 37).

Historically, CME drew its inspiration from Critical theory as developed by scholars like Horkheimer, Adorno, Marcuse, et al. belonging to the Frankfurt school, and the critical pedagogy of Paulo Freire. [Frankenstein \(1983\)](#) described CME as involving reinventing Paulo Freire’s critical education theory and pedagogy in the context of mathematics education. As opposed to Positivism that views knowledge as “neutral, value-free, and objective, existing totally outside of human consciousness” ([Frankenstein, 1983](#), p. 316), Freirean epistemology is dialectical in terms of how knowledge is understood to be “continually created and re-created as people reflect and act on the world”.

The importance of CME in addressing special education becomes apparent when we recognize disability as a form of oppression and look at what Paulo Freire had to say about oppression. In *Pedagogy of the Oppressed*, [Freire \(1970\)](#) highlighted how the dominant forms of education ease the job of oppressors by leading the oppressed to adapt to a system that oppresses them. Although not speaking of (and perhaps, not including) disability (in his analysis), Freire argued how the oppressed are treated as “individual cases, as marginal persons who deviate from the general configuration of a ‘good, organized, and just’ society. The oppressed are regarded as the pathology of the healthy society, which must adjust these . . . folk to its own patterns by changing their mentality.” Freire remarked how the oppressed are perceived to be marginals who “need to be ‘integrated’, ‘incorporated’ into the healthy society that they have ‘forsaken’.” However, far from being “marginals living outside society” the oppressed “have always been “inside” . . . the structure which made them ‘beings for others’ ” (p. 55). And subsequently, the solution to the problem is not, as he states, “to ‘integrate’ them into the structure of oppression, but to transform the structure so that they can become ‘beings for themselves’.”

Even with recognizing disablement as a “structural” problem requiring a structural solution, the implications of a Freirean pedagogy are certainly not directly applicable to the question of teaching blind children and that too, mathematics. Rather as is expected of a Freirean pedagogy, an educator along with their students must reinvent his praxis to “(re)make their own history” ([Gutstein, 2012](#), p. 24).

Skovsmose (2016) speaks of CME as being synonymous with “mathematics education for social justice” (p. 139). Skovsmose describes CME as being concerned not only with how mathematical literacy can be used for the purpose of empowerment (Skovsmose, 1994) but also about “how mathematics education might be stratifying, selecting, determining and justifying inclusion and exclusion (Skovsmose, 2016, p. 139).” Gutstein (2012) who describes his work as “mathematics for social justice” and “critical mathematics education” perceives CME as holding a potential of mathematics to be used a means of investigating and critiquing injustice and oppression.

CME can be argued to be the mathematical aspect of Freire (1970)’s pedagogy in which he speaks of *reading* (critically interpreting and understanding) and *writing* (politically engaging with and changing) the world (Skovsmose, 2016; Gutstein, 2012). Gutiérrez (2013) describes one of the main goals of CME as developing within learners what Freire (1970) called as “conscientização”. As Gutiérrez elicited, in the context of mathematics education, conscientização entails that learners be “able to make sense of data in ways that help them see the humanity behind the numbers and to use mathematics as a tool for exposing and analyzing injustices in society and as a means for convincing others of a particular (often nondominant) point of view” (p. 41).

2.2.1 Mathematics and Exclusion

CME recognizes that Mathematics education plays a central role in standardized testing which, as Foster (1997), who draws from Gould (1981), argues “hinges on two fallacies, reification and ranking” Foster articulates how “the fallacy of reification has enabled test makers to develop and market abstract concepts of ability and intelligence as if they were hereditary, unitary, measurable commodities.” And “having reified the concepts of ability and intelligence in this manner, those who construct scales then raise the question of which individuals and groups have more or less of these commodities” (p. 164). The reification of ability also produces a reification of disability, with the help of mathematics education. Mathematics Education can hence be seen as playing a crucial role facilitating exclusion and further reifying disability.

Subsequently, to recognize the exclusionary forces within mathematics education and society at large makes us ask, is inclusion even possible? Or is it merely a *regulative ideal*

that drives research in inclusive and special education in mathematics? Answering this question, entails rethinking what we understand by inclusion/exclusion. [Marccone and Skovsmose \(2014\)](#) problematize common discourses on inclusion by arguing for inclusion and exclusion to be understood as an integral concept, a discursive duality and an explosive problem, rather than part of a binary concept where inclusion can be looked at apart from exclusion.

2.2.2 Vygotsky and Social Learning

The social model of disability laid the foundation for the field of disability studies that in turn impacted allied disciplines including mathematics education. Disability studies significantly influenced special education that was otherwise dominated by individual and medical models of disability and also added a further impetus to learning interventions based on the works of Vygotsky, who in the early 20th century differentiated the biological from the social dimension of disability. [Vygotsky \(1925\)](#) stated that:

“It goes without saying that blindness and deafness are biological facts and not at all of a social nature, but the teacher has to deal not so much with these facts as with the social consequences of these facts. When we have a blind child as an object of education before us, we are compelled to deal not so much with blindness in itself, as with the conflicts which arise therefrom within the child when it enters life. . . . Blindness or deafness, as a psychological fact, is not at all a misfortune, but, as a social fact, it becomes such” (p. 228).

Vygotsky’s emphasis on the social learning of children with special needs proved influential in the mathematics education research community with educators adopting his sociopsychological approach to teaching mathematics to blind children (For example, [Radford \(2013\)](#); [Healy and Fernandes \(2011\)](#); [Fernandes and Healy \(2013\)](#)).

However, while a substantial amount of research work may be found in the field of special needs education, and some significant work that uses the lens of Ableism, one finds a dearth of empirical research that addresses the political economic dimension of disability or looks at disability as a social justice concern while addressing the question of teaching mathematics to blind children. In fact, disability itself is underrepresented in mathematics education in the larger research community ([Tan and Kastberg, 2017](#)).

In the context of mathematics education, perspectives other than the historical materialist Social Model and Postmodernism have been used to address the sociopolitical dimension of disability related issues through the route of mathematics education. For example [Marcone \(2015\)](#) critiques deficiency perspectives about disability from a poststructuralist perspective through the notion of what he calls as *deficiencialism* which refers to *deficiency* as a construction of *normality* ([Skovsmose, 2016](#), p. 3). Mathematics educators have also critiqued the very notion of inclusion for taking for granted “the order of things” into which students are expected to be included/ integrated ([Figueiras et al., 2016](#)).

However, I adopted the social model of disability as a framework since it offered an alternate (and useful) worldview that portrayed society in its entirety, thereby highlighting interconnections between mathematics education and disablement, in material terms.

2.3 Disablement in India

Contextualizing disability within a larger political milieu, Anita [Ghai \(2015\)](#) theorized disability in the Indian context and highlighted the urgency for engaging in social movements by pointing out how India is “a country which finds itself immersed in multiple issues, such as decreasing sex ratios, violence against women, increasing fundamentalism, the menace of HIV, unavailability of education, and the continuous withdrawal of the state support from public health programs” (p. xviii). Through providing her own autobiographical account of her growing with a disability, Ghai elucidated the various aspects of how a disabled person is dealt with in a Hindu family thereby illuminating how disability is predominantly addressed in India. Ghai speaks of these encounters from the standpoint of how it seeded her resistance against the dominant ideology. From a feminist standpoint, Ghai also shed light on how society deals with the mother of a disabled girl child, by citing instances of women being “divorced, abandoned, or tortured because they have given birth to a disabled child” (p. 150).

2.3.1 *Divyangization* of disabled people in India

To define the model of disability that dominates in India is rather complicated given the socio political economic milieu within which disablement is produced. From a historic

perspective, the construction and experience of disability in India is quite different from “the West” considering India’s unique history and its caste system. As Buckingham (2011) puts it, “The experience of disability in India is historically distinct from that of the western Judeo-Christian tradition. While there may be similarities between the western and Indian high culture traditions of exclusion and stigmatisation of people with disabilities, particularly in the pre-modern period, these cultures are grounded in different concepts of social inclusion. The Brahmanic textual traditions which were written by and for the higher levels of Hindu caste society tended to disinherit those who suffered some form of disability” (p. 421).

To understand disablement in India necessitates understanding some contradictions underlying the Indian political milieu. On the one hand, India is home to the largest number of malnourished children with 38.7 percent of its children under the age of 5 years who are stunted due to malnourishment (D’Mello, 2018) while on the other hand, India is also the leading exporter of beef (Cook, 2019). The neglect and privatisation of public transport services has added to the number of accidents of working class people who are also denied the right to safe working conditions in factories. Economists Dréze and Sen (2013) described the state of affairs of India’s public institutions including its health and education systems by lamenting how,

... the general state of public services in India remains absolutely dismal, and the country’s health and education systems in particular have been severely messed up. While the privileged are able to take refuge in private arrangements (expensive as they tend to be), the rest are deprived of essential facilities that ought to be available to all as a matter of right. ... India’s highly privatized and compartmentalized health and education systems (with different opportunities for different social groups) also perpetuate social disparities - instead of reducing them, in contrast with what health and education systems as well as other forms of public support have tended to do around the world (p. xi).

In 2014, a far right political party, the *Bharatiya Janata Party* (BJP) led by Narendra Modi as the Prime Minister, was elected in India. In 2015, the University Grants Commission (UGC) under the Ministry of Human Resource Development (MHRD) announced a

decision to scrap fellowship to a huge number of students who were pursuing their M.Phil and PhD degrees (Nawani, 2015).

Also in 2015, Modi gave a call to officially refer to disabled people as *Divyang*, which means “Divine body” (‘*divya*’ meaning divine and ‘*ang*’ meaning body). The term *divyang* came as a replacement for the earlier term *viklang* which meant, deformed body. The granting of a divine status to the bodies of disabled people by the Indian government led by a right wing leader has a political and an economic dimension. India has historically followed a trend of conferring a divine status to the most violated people (and even animals like the cow), with the ulterior motive of facilitating their exploitation and denying them of their rights. Furthermore, the deifying of certain people also fits well within the political project of *Hindu rashtra* (i.e. A hundred year long and on going reactionary struggle aimed at transforming India into a Hindu theocratic nation founded upon the principles of the Brahmanical caste system with the Manusmriti as the guiding principle). India has witnessed the naming of the labouring castes of people as “Harijans” meaning God’s children, by Gandhi. India has also deified the “Holy cow,” the most violated and exploited animal in India (the second largest milk producer and beef exporter in the world). India’s history is rife with examples of childless widows of land-owning caste-Hindu men being burnt alive through the practice of Sati and thereafter conferred the status of a Goddess referred to as *Sati Devi*. The ideology underlying the official renaming of disabled people in India as “divyang” has a similar economic dimension in terms of serving as a politically convenient alternative to allocating funds to make spaces accessible to people with disabilities. I derive my interpretation of the term *divyangization* from Ilaiah (2010)’s concept of *Harijanization*.

Divyangization becomes visibly a politically convenient move when one considers the sheer number of disabled people in an overpopulated country like India. India leads the world in the number of malnourished children, has a complete disregard for the safety of its working class citizens who are routinely killed or incapacitated by accidents either at the workplace or while traveling to work in overcrowded trains, etc. According to a World Bank (2007) report, India had an estimated 80 million people with disabilities. Through divyangization, their rights to access public amenities along with decent housing, healthcare, higher education, etc. can be conveniently denied to them.

[Khetarpal and Singh \(2016\)](#) speak of the label *divyang* as “a cliché born out of ableism” (p. 163) and locate it’s underpinnings on the “supercrip model” :

the word ‘*divyang*’ derives its strength from the supercrip theory. . . . The implication is that persons with disabilities automatically get converted into a “human - angel hybrid”.

Although Khetarpal and Singh present a valid critique of divyangization, they too present a rather problematic perspective on disability by comparing the supercrip image with their image of “a person affected by a disability or illness as helpless, tragic and powerless”. Nonetheless, they highlight how the ideology of divyangization has some overlaps with the supercrip model that views a disabled person “as a hero who is active and independent if he/ she is able to “overcome” the disability, succeed as a meaningful member of society and live a “normal” life” (p. 163).

Another notable feature of the “supercrip model” is that as [Shapiro \(1993\)](#) highlights, “a disabled person commands respect only to the extent that he or she can be an object of inspiration” (p. 40). Of course, this form of inspiration is a vulgarized one. For example, Helen Keller was a communist and a prominent member of the radical socialist organization, *International Workers of the World* (IWW). But we rarely find Keller used as a figure to “inspire” working class people to join an international workers’ solidarity group against capitalism. [Young \(2014\)](#) used the phrase *inspiration porn* to describe this phenomena “because they objectify one group of people for the benefit of another group of people. So in this case, we’re objectifying disabled people for the benefit of nondisabled people.”

The conceptualizing of disabled people as “angels with extraordinary powers” consequently creates the perception that, as Shapiro puts it,

. . . the disabled do not require the same public access as everyone else. They need to be kept in an infantile state, not being allowed to grow up, and so they do not require education. They do not need to live independently or interdependently and do not need to be financially independent. The meager financial benefits granted them by the government would be sufficient for them to survive and live on the margins, so they do not need gainful employment

opportunities. This approach to disability suggests that these people must be admired, patted and talked about, but that they do not need to be addressed (p. 164).

To understand Disability in the Indian context, it is necessary to look at the present as history. India's history is also a history of class struggles. And the history of education in India is no exception. Although India was declared a politically independent nation in the 1947, references to the people and regions of the Indian subcontinent have been made since centuries. However, despite the various empires and economies that have come into being in India, the caste system has survived. The concept of Caste may be thought of as a highly strict system of organizing a people based on ideals of endogamy (where members of different 'castes' are forbidden from marrying each other), exclusion (of, women and people from certain castes from accessing knowledge), untouchability (where people from the 'lowest caste' get penalized for being in contact with higher castes), graded inequality (of castes and professions based on caste), purity of blood (for example, a baby born from an inter-caste marriage is perceived to have their blood polluted from the lower caste parent, especially if the father is of the lower caste), division of labour based on caste, and ossified in a religious form namely, Hinduism, and operationalized in the religious text, the *Manusmriti*. The ideology of Hinduism frames popular understandings of and responses to disability and disabled people. For example, as [Ghai \(2015\)](#) explains:

For a Hindu, the focus is on Karma with the implication that adequate provisions for a child are a duty, whether a child is abled or disabled. Karma is the concept of 'action' in contradistinction to 'faith' advocated by religions such as Christianity and Islam, which view all human predicaments as the will of God . . . in the Hindu worldview, humans have free will to choose their own actions, which require only the will of God to implement karma's consequences . . . the understanding of parents with disabled children is that the karmic effects of all deeds are viewed as actively shaping past, present and future experiences (p. 3).

The Hindu social order also has detailed instructions for how education is to be regulated among people. In India, exclusion is thus built into our social fabric which is woven by the Hindu social order or the Brahmanical caste system. In the *Manusmriti*, a text considered

sacred by Hindus, [Ambedkar \(2013\)](#) showed how it commands that only “Brahmins, Kshatriyas and Vaishyas can study the Vedas” and of these, only Brahmins “have the right to teach the Vedas” (p. 39). The Shudra is forbidden to even hear it being read. Through the Manusmriti, access to education was made completely out of reach and even criminalized with dire consequences for Shudras, Dalits and women. It is therefore not surprising even today to find a disproportionate number of Brahmins occupying faculty positions in educational institutions while a significant number of teaching positions reserved for Scheduled castes continue to remain vacant ([Gaikwad, 2012](#)). And even among the few scholars who secure a teaching position in university, we find many cases of blatant discrimination (for example, read [Mohanty \(2019\)](#)). A glimpse into the history, as well as the present condition of Indian education reveals that the ideals of Manusmriti still command power in deciding who receives education, whose knowledge is considered legitimate, who gets to teach, etc.

2.3.2 On India and the History of its Education

While speaking of the history of India, one generally refers to the Indian Subcontinent which comprises of the India nation state, Bangladesh and Pakistan. This region referred to as India is defined by its boundaries that comprise of the Indian ocean to the south, the Arabian sea to the south west, the Bay of Bengal to the south east and the Himalayas in the north and spanning across the north east and north west. However, even within this subcontinent one finds numerous cultures, religions, religious sects, languages in addition to the thousands of castes and subcastes. And different communities often conflict with each other. The Hindu-Muslim conflict and the subsequent ghettoization of muslims in India is well known even if not in great detail. Even after Independence, the question of Indian Nationalism has been very tricky. India has been conceptualized as a union of nationalities ([Guha, 1982](#)) and even “a country of castes” ([Ilaiyah, 2001](#)). Caste still structures the nature of knowledge, power, exclusion and discrimination in school classrooms, and so it cannot be ignored while speaking of exclusion and disablement.

The first school for *shudratishudra* (Dalit) girls in Maharashtra was started by Jyotirao Phule in 1848 ([Deshpande, 2002](#)), and two more in 1851-52. In 1855, Phule opened an evening school for working people. He taught his wife Savitribai Phule who began teaching in their schools amidst severe resistance from the orthodox Hindus. Jyotirao

Phule emphasized the importance of educating women. Phule contended that women had been kept uneducated by men in order to preserve their superiority (Rao, 2002).

Phule highlighted the problematic nature of education prevalent in the nineteenth century as well as the distribution of funding for education which “tended to educate Brahmins and the higher castes only,” and “leave the masses wallowing in ignorance and poverty” (p. 103). Through his memorandum to the Education Commission (then known as the Hunter Commission), Phule (2002) initiated the debate on the Right to Education in India (Sadgopal, 2010) by expressing how the system of education “was imperfect in so far as it does not prove practical and useful in the future career of pupils” (p. 106). In the memorandum, Phule wrote:

The teachers now employed in the primary schools are all Brahmins; a few of them are from the normal training college, the rest being all untrained men. Their salaries are very low, seldom exceeding Rs. 10., and their attainments also very meagre.

In addition to demanding higher salaries and allowance to be paid to teachers, Phule argued that teachers must have a background and training in cultivation among other kinds of labour:

I think teachers for primary schools should be trained, as far as possible, out of the cultivating classes, who will be able to mix freely with them and understand their wants and wishes much better than a Brahmin teacher, who generally holds himself aloof under religious prejudices. These would, moreover, exercise a more beneficial influence over the masses than teachers of other classes, and who will not feel ashamed to hold the handle of a plough or the carpenter’s adze when required, and who will be able to mix themselves readily with the lower orders of society. The course of training for them ought to include, besides the ordinary subjects, an elementary knowledge of agriculture and sanitation (p. 107).

In addition to having a caste system that denied education to a vast majority of children, India was also impoverished by British colonial imperialism. As Parenti (2007) describes,

“British imperialism did two things: first, it ended India’s development, then it forcibly underdeveloped that country. The massive poverty we associate with India was not an original historical condition that antedates imperialism” (p. 271-272).

In 1937, two years since the passing of the Government of India Act of 1935, Gandhi began to theorize on education (although he had written earlier on education in the course of his criticism of British Colonialism). At the Wardha conference of October 1937, Gandhi led the passing of the resolutions that free and compulsory education be provided for seven years on a nationwide scale and that children receive education in their mother tongue (Bhandari, 2009). The primary contention of Gandhi (1953) was to rid education from the influence of British Colonialism that served to turn India’s children into “counterfeit Europeans” (p. 28), as well as reject the caste system under which children “learn to despise labour” (p. 45). Gandhi formulated the concept of “Basic Education” whose core pedagogic idea was, as Dréze and Sen (2013) described, that “children should learn through self-financing handicraft” (p. 24).

2.3.3 Education in Post Independence India

When India attained political independence on the 15th of August 1947, the condition of education was pitiful. As Dréze and Sen (2013) highlighted, “when the British left, the adult literacy rate [for the bulk of India] was only around 18 per cent.” And “this neglect of school education continued solidly through post-independence years until quite recently. . . . About 20 per cent of Indian children between the ages of 6 and 14 years were not attending school even in 2005-06, and about 10 per cent of children of that age group had never been enrolled in any school at all.” Indian girls were particularly neglected, “nearly half of whom were out of school in large parts of India (e.g. Bihar) in the same year” (p. 112-113).

On the 26th of January 1950, with the passing of the Constitution, India was officially declared, a Republic. The Indian Constitution outlawed untouchability while safeguarding the rights to education of people of all communities. The Article 46 of *The Constitution of India* (1950) made it the directive of the State to “promote with special care the educational and economic interests of the weaker sections of the people, and, in particular,

of the Scheduled Castes and the Scheduled Tribes” and to “protect them from social injustice and all forms of exploitation” (p. 23).

The economic planning of the newly politically independent India was structured through the framework of “Five Year Plans” which would be formulated and executed by the Planning Commission. The first Five Year Plan was initiated in 1951. With regards to the model of education to be followed, while the Planning Commission supported university education, it also argued against regular schooling, in favour of Gandhi’s model of Basic Education. Furthermore, it argued against opening up of new primary schools in favour of concentrating resources “on basic education and the improvement and remodeling of existing primary schools on basic lines” (Planning Commission, 1951, quoted from Dréze and Sen, 2013). Despite a broad public disagreement to the concept of Basic Education, the model was reasserted even in the second Five Year Plan of 1956.

In 1964, the government of India setup their first education commission (EC) to recommend guidelines and policies aimed at the development of education from primary schooling to Higher Education in India. The commission was headed by D S Kothari, the then chairman of the *University Grants Commission* (UGC). The EC has since been popularly referred to as the Kothari Commission.

As Kumar (1996) pointed out, the Kothari commission was premised on an American model of modernization that regarded education as a means of “national development,” and thereby sidelined “Basic Education,” in favour of general elementary education. Nonetheless, the *Kothari Commission Report* (1966) recommended the introduction of work-experience including manual work, production experience, etc. and social services as integral parts of general education at broadly all levels of education. It also recommended the creation of the common school system where children could learn free of cost so as to provide “equality of access to all children. This system [would] include all schools conducted by government and local authorities and all recognized and aided private schools. It should be maintained at an adequate level of quality and efficiency so that no parent would ordinarily feel any need to send his child to the institutions outside the system such as independent or unrecognized schools” (p. 251). It also observed that considering the political milieu of India, it should be the responsibility of the educational system “to bring the different social classes and groups together and thus promote the emergence of an egalitarian and integrated society.” Furthermore, the commission

expressed how instead of the expected goals of education, “education itself is tending to increase social segregation” thereby perpetuating and widening class distinctions due to, for example, the government’s neglecting of public schools while expensive private schools provide better quality education. The EC emphasized that universities “must learn to encourage individuality, variety and dissent, within a climate.” It argued for social justice to be a constitutional commitment by referring not only to caste hierarchies but also to the education of [sic] “handicapped children”:

Social justice also demands it: it has to be remembered that the Constitutional Directive on compulsory education includes handicapped children as well (p. 123).

In the context of disability, while recognizing that handicapped children must compulsorily be educated, the EC, took a rather uncritical approach towards the concept of “normal.” For example, it stated that “the primary task of education for a handicapped child is to prepare him for adjustment to a socio-cultural environment designed to meet the needs of the normal” (p. 123). For [Ghai \(2015\)](#), the “analysis of the education of the ‘handicapped’ by Kothari Commission was at best conventional and conservative” and “understood disability as an individual problem” (p. 113).

2.3.4 Arrival of Neoliberal Policies in Indian Education

The political changes of the 1980s witnessed the entry of neoliberal policies into India beginning with the International Monetary Fund (IMF) approving of their largest ever loan of \$5.8 million which was granted to India in 1981 ([Rowen, 1981](#)). The mid eighties saw the introduction of “National Policy of Education - 1986” which although were grounded on the “goals of socialism, secularism, democracy and professional ethics” ([NPE, 1986](#), p. 2) did not find it necessary to demand making higher education freely accessible to students from marginalized communities.

The late eighties also saw education gradually transform into a marketable good, and students reduced to consumers in a knowledge industry. With the entry of Neoliberal policies in Indian education in the early 90s, privatization of schools increased and profits became more internationalised. With the coming of the new millennium, public

education in general and higher education in particular turned into a site for profitable investment opportunities for transnational corporations. The Indian government opened the gates for private investment into education by bringing higher education under the General Agreements on Trade in Services (GATS), a multilateral trade agreement under the World Trade Organization (WTO), so that education as a commodity could be, as Sharma (2010) described, “traded to the highest bidder” (p. 91). Some of India’s richest capitalists expressed their vested interests in the education market in the form of “A Policy Framework for Reforms in Education” (also known as the Ambani-Birla Report) which was submitted to the Prime Minister’s Council on Trade and Industry. As Sharma put it, “These two industrialists made a case for full cost recovery from students and immediate privatisation of several segments of higher education. The Ambani-Birla Report sought to convert the entire system of higher education in the country into a market where profit making would be the only consideration” (p. 92). Hiranandani and Sonpal (2010) highlighted the interconnection between disability and the economy in the context of India, where a “mounting burden of debt and balance of payments crisis led India to adopt economic reforms on the lines of IMF-World Bank structural adjustment programs.” Hiranandani, et al. point out the contradictions of Neoliberal globalization wherein on the one hand, the World Bank’s discourse on “education for all” has emphasized the inclusion of the disabled community, but on the other hand, privatization and the globalization of capital has led to state withdrawal from the service sector, thereby making it increasingly difficult for people with disabilities to access education, healthcare, employment, etc.

In India, up until the 1970s, the question of education of persons with disabilities was still officially considered a matter of charity rather than a question of rights. Social attitudes towards disabled people was predominantly influenced by moral and charitable approaches arising out of the Hindu notions of *karma* and *dharma* (Chander, 2013). Through sustained advocacy, the National Federation of Blind Graduates was formed in 1970, which was renamed as the National Federation of the Blind (NFB), in 1972. The radical movements carried out by the NFB along with other advocacy organizations in addition to international pressure “paved the path for the disability law in India” (Chander, 2013, p. 71). Alongside neoliberal changes taking place in the 90s, India also witnessed the passing of the landmark *PWD Act, 1995 (Persons with Disabilities (Equal opportunities, protection of rights and full participation) Act, 1995)* by the Ministry of Law, Justice and Company Affairs. With regard to education, the PWD Act mandated

that “The appropriate Governments and the local authorities shall (a) Ensure that every child with a disability has access to free education in an appropriate environment till he attains the age of eighteen years; (b) Endeavor to promote the integration of students with disabilities in the normal schools; (c) Promote setting up of special schools in Government and private sector for those in need of special education, in such a manner that children with disabilities living in any part of the country have access to such schools; (d) Endeavor to equip the special schools for children with disabilities with vocational training facilities”. In India, writings on disability began to take up a disability studies perspective only in the 90s. Certain technical shortcomings of the PWD Act of 1995 were later addressed in the Rights of Persons with Disabilities Bill, 2016 which replaced the PWD Act and included 21 forms of disabilities (as opposed to 7 in the PWD Act) and also ensured that people with disabilities “have [the] right, equally with others, to own or inherit property, movable or immovable, control their financial affairs” (Narayan, 2014, p. 411). In 2012, the Right of Children to Free and Compulsory Education (Amendment) Act, 2012 was passed which explicitly included “child with a disability” while granting the right to education to all children.

2.3.5 Education under a Politically Far-Right Regime in India

With the coming of the Hindu-nationalist government, under the Bharatiya Janata Party (BJP), in 2014, the condition of education worsened. Education was subjected to what Sadgopal (2016) referred to as a “Neo-liberal-cum-Manuwadi Assault.” The Ministry of Human Resource Development (MHRD) uploaded on their website a document titled, *Some Inputs for Draft National Education Policy 2016* (Draft NEP 2016). The Draft NEP 2016 was the basis of what the Prime Minister called, the “Skill India mission.” Emphasizing on “employability and skills,” and attributing growing unemployment on “the lack of unemployable skills,” the Draft NEP (2016) suggested that “young people (15-24 years) and adults (15 years and above) who are outside the formal education system, including those working in the informal sector of the economy, be “provided with opportunities to attain skills for employability” (p. 9). As Sadgopal critiqued, the Draft NEP 2016 proposed to “replace education with ‘employable skills’ tailored for the global market. The overarching framework will be of Skill India, whose camouflaged agenda is to promote ‘Make in India,’ in order to facilitate investment by global capital. This

policy will be aggressively pursued to exclude more than 80% of the Indian population comprising SCs, STs, OBCs and Muslims from education, and push them into skill shops, with women in each of these social categories facing much greater exclusion” (p. 34).

In 2018 Universities like the Tata Institute of Social Sciences witnessed a sustained protest among students when a scholarship scheme called the *Government of India–Post Matric Scholarship* (GOI-PMS) offered specifically to students belonging to the Scheduled Caste was scrapped on the pretext of reduced funding by the UGC. Furthermore, the already marginalized students were demanded to pay a disproportionately increased fees if they desired to pursue their research and education at their universities (Nagarajan, 2018). In June 2019, soon after the far right-wing Prime Minister was re-elected, a Draft of a National Policy on Education (DNEP) was released by the Human Rource Ministry that reflected the Neoliberal and Brahmanical character of the regime.

The DNEP preferred to use a corporate language by describing early childhood education as a business “with an expected return of Rs. 10 or more for every Rs. 1 invested” (p. 46). The document proposed a new system in which there will be multiple ‘exit points’ after Class VIII, thus facilitating systematic exclusion of (blind) students at various stages. While educational policy documents in the previous regime were handled relatively more sensitively (for example, The Position Paper of the National Focus Group on Education of Children with Special Needs (NCERT, 2006) took into account the *Salamanca Statement* published by UNESCO (1994), the various social models of disability, etc), the DNEP completely disregarded the sociopolitical dimension of disability while offering suggestions aimed at privatisation. While the DNEP claimed to provide facilities like “ramps, handrails, disabled-friendly toilets, and suitable transportation for CWSN,” it did not indicate that these facilities would be supported by the government. Also with regard to the inclusion of CWSN, the DNEP claimed to make available, interventions which would include “functional and formal assessment, appropriate educational placement, and preparation of Individualised Educational Plans (IEP)” albeit without assuring that these interventions would be state funded. Finally, the DNEP suggested offering scholarships to “talented and meritorious” students supposedly to “enhance participation of differently-abled children in school education” (p. 156).

In the context of mathematics education, Subramanian (2019) pointed out that the DNEP disregards “inputs from mathematics education research engaging with the complex

Indian reality as important for shaping education policy and curriculum frameworks in mathematics education.”

The year 2020 brought about major political events significantly impacting education in India, and thereby making apparent, various other economic dimensions of exclusion and disablement. These events included the sudden imposition of a strict lockdown announced on the 24th of March 2020 that would come into force within four hours. The lockdown caught millions of working class people off-guard with neither food nor shelter nor income. With no means of transportation to return to the very villages they were forced to leave in the first place in order to eke out a living in cities as daily wage or contract labourers, they were forced to travel hundreds of kilometers on foot, leading to the deaths of hundreds of workers (including school going children) due to road and rail accidents, exhaustion, etc. Even state governments were caught unaware by the lockdown ([Adhikari et al., 2020](#)).

The lockdown forced working class people (more than 50% of who, don't have internet access!) to somehow shift towards using digital education services offered by online learning companies, to provide for their school-going children. It needs to be pointed out that the phenomena where working class people were forced to purchase expensive laptops and smartphones, and avail of services offered by private online communication companies like Zoom to provide access to schooling for their children, and depend on expensive online coaching companies for additional guidance, was also not entirely an accidental outcome of the pandemic.¹ In mid 2019 itself, months before the Coronavirus was detected in China, the [Draft NEP \(2019\)](#) had already over-emphasized on getting teachers, students and educational institutions as a whole to move towards online learning. The lockdown took a major toll on the lives and livelihoods of working class people. In India where around 90% of working class people are employed in the informal sector, on the one hand, as [Gokhroo \(2021\)](#) reported how, “80 percent of workers from the informal sector lost their jobs as the lockdown progressed.” But on the other hand, “Indian billionaires increased their wealth by 35% during the lockdown to 3 trillion” [Chandra \(2021\)](#). Chandra put this into perspective by pointing out that “Mukesh Ambani ... earned 90 crore an hour during the pandemic when around 24% of the people in the country were earning under 3,000 a month during the lockdown. The increase in his wealth alone could keep 40 crore informal workers out of poverty for at least five months ...”

¹Also, in the midst of the pandemic, a loan of \$500 million was granted to India on the 24th of June by the World Bank, with the aim of taking control of public schooling in six Indian states.

On the 29th of July 2020, the Union Cabinet of India implemented the National Education Policy 2020 (NEP 2020).² At an online panel discussion the disability rights activist, Shampa Sengupta (2020) shared her perspectives on the implications that the NEP 2020 would have for children with disabilities. Sengupta prefaced her critique by referring to a report by UNESCO (2019) which highlighted that “Among 5 year olds with disabilities, three-fourths do not go to any educational institution. Nor do one-fourth of the CWD population aged between 5 and 19. The number of children enrolled in school drops significantly with each successive level of schooling. There are fewer girls with disabilities in school than boys. The proportion of children with disabilities who are out of school is much higher than the overall proportion of out-of-school children at the national level. Thus, although the schemes and programmes have brought children with disabilities into schools, gaps remain” (p. 13).

Sengupta explained how various features of the NEP 2020 would serve to further legitimize the exclusion of children with disabilities. Sengupta highlighted section 6.12 of the NEP (2020) that spoke of assisting “parents/guardians” of “children with benchmark disabilities” achieve “high-quality home schooling and skilling” and provide a choice of “Home-based education ... for children with severe and profound disabilities who are unable to go to schools” (p. 27). As Sengupta argued, the NEP 2020 puts pressure to educate children with disabilities on the family, and more specifically, the mothers, many of who had to quit their jobs during the pandemic, to help their children attend online classes. By treating mothers as a default (and politically convenient) safety net for their excluded children, the NEP 2020 thereby absolves state actors of their responsibility of providing a meaningful education to children vulnerable to facing exclusion.

The NCF (2005), despite its limitations, at least took a stand against “commercialisation of education, ... inadequate public funding for education and the official thrust towards ‘alternative’ schools,” the “shifting of responsibility for education from the state to the family and the community” and “the pressures to commodify schools and the application of market-related concepts to schools and school quality” (p. 9). In contrast, the DNEP blatantly used market-related concepts to describe schools, treats disability as an individual problem and emphasizes “mainstreaming.” While the DNEP 2019 professed taking a

²The Draft National Educational Policy (DNEP) 2019 was a 484 page document released by the Human Resource Development ministry in May 2019, with the stated aim of inviting suggestions from the general public. By July 2020 the final policy (the NEP 2020) was announced in the form of a 66 page document.

stand against privatization, as pointed out by Rampal in [Mathew \(2019\)](#), it encourages “lot of low-cost private schools to come up, which is a big market and is completely unregulated. These policies are also being promoted by leading corporate organisations and those like Central Square Foundation, Pratham, etc.” Expectedly, the final policy document (the NEP 2020) clearly expressed their agenda of encouraging private capital in education, for example, through the use of the term, “Public Philanthropic Partnership” ([Menon, 2020](#)).

2.4 Political Economy of Schooling & Disablement

Various scholars have expressed the antagonistic relationship between social justice and schooling under capitalism. They however expressed differing perspectives on the role of schooling and education. On the one hand, for authors like Michael Parenti, Louis Althusser, [Bowles and Gintis \(1976\)](#), schools are essentially sites of reproduction of the dominant sociopolitical and economic order. On the other hand, Giroux, Connell, et al., argue that education, and by extension, schooling is essentially about liberation, and involves “equipping people with the knowledge and skills and concepts relevant to remaking a dangerous and disordered world” ([Connell et al., 1982](#), cf. [Giroux, 2001](#), p. 114). Agreeing with this perspective, [Giroux \(2001\)](#) expresses his concern about the gap between the “promise” and the “reality” of schooling.

However, as [Parenti \(1999\)](#) pointed out, no such promise was ever made, and schools indeed fulfil their purpose:

To say that schools fail to produce an informed, critically minded, democratic citizenry is to overlook the fact that schools were never intended for that purpose. Their mission is to turn out loyal subjects who do not challenge the existing corporate-dominated social order. That the school has pretty much fulfilled its system-sustaining role is not accident. The educational system is both a purveyor of the dominant political culture and a product of it (p. 22).

Louis Althusser described the school as an ideological apparatus of the State, characterized by the way it disseminates normative practices and ideas to students not by

explicitly stating those ideas but rather, by taking for granted those ideas and practices (for example, an uncritical obedience to authority) as a premise behind whatever may be stated. Subsequently, by producing an obedient workforce, schools contribute to the reproduction of the conditions necessary for a Capitalist mode of production:

... children at school also learn the ‘rules’ of good behaviour, i.e. the attitude that should be observed by every agent in the division of labour, according to the job he is ‘destined’ for: rules of morality, civic and professional conscience, which actually means rules for respect for the socio-technical division of labour and ultimately the rules of the order established by class domination. ... the school (but also other State institutions like the Church, or other apparatuses like the Army) teaches ‘know-how’, but in forms which ensure *subjection to the ruling ideology* or the mastery of its ‘practice’.
(Althusser, 2006, p. 89)

Bowles and Gintis (1976) point out how, “the educational system mirrors the growing contradictions of the larger society, most dramatically in the disappointing results of reform efforts” (p. 5). They dismiss the advocates of “liberal social reform” on the pretext that they “mouth old truths and trot out tired formulas for social betterment in the vain hope that the past decade has been a quirk, a perverse and incomprehensible tangle in the history of progress which will - equally incomprehensibly - shake itself out” (p. 7). Bowles and Gintis point out how through the use of meritocratic means, schools legitimize inequality by allotting students in distinct positions within an occupational hierarchy. Schools therefore,

create and reinforce patterns of social class, racial and sexual identification among students which allow them to relate “properly” to their eventual standing in the hierarchy of authority and status in the production process. Schools foster types of personal development compatible with the relationships of dominance and subordinacy in the economic sphere, and finally, schools create surpluses of skilled labor sufficiently extensive to render effective the prime weapon of the employer in disciplining labor - the power to hire and fire. (p. 11)

Recognizing the “deep relationship between school, work, and the social system as a whole,” Luis Radford (2016) stated that “in practice, education has become an applied political branch of the current global capitalist economy and its forms of production” (p. 262) and the school operates like a “teaching factory” where “Teachers are expected to teach creativity or to do whatever it takes to manufacture it” (p. 258). By using the concept of alienation, Radford argues that, just as under capitalism the product of a worker’s labour “is no longer the individual’s expression,” so it is in the case of acquiring mathematical knowledge that “students have to work hard through drill and repetition” to possess, and which “is considered as a commodity that teachers deliver” (p. 258). Radford also critiqued the so-called “child-centred” or “progressive” model, that although “have often equated the principles of freedom and autonomy with the goals of education,” merely shifts the “locus of power and agency” (p. 262) from teacher to student does not contribute to structural change.

In the context of special education, Skrtic (2005) highlights how schools, being bureaucracies function as “performance organizations, standardized, non-adaptable structures that must screen out diversity by forcing students with unconventional needs, out of the system. And because they are public bureaucracies charged with serving all students, special education emerges as a legitimating device, an institutional practice that, in effect, shifts the blame for school failure to students through medicalizing and objectifying discourses, while reducing the uncertainty of student diversity by containing it through exclusionary practices” (p. 148-149).

Giroux disagrees with Althusser and Bowles and Gintis by arguing that they “fail either to define hegemony in terms that posit a dialectical relationship among power, ideology, and resistance, or to provide a framework for the developing of a more viable mode of radical pedagogy.” The views of Althusser and Bowles and Gintis, according to Giroux, “relegate human agency to a passive model of socialization and overemphasize domination while ignoring contradictions and forms of resistance that also characterize social sites like schools and the workplace” and thus function to “mystify rather than explain how people resist, escape, or change the “crushing” weight of the existing social order” (p. 86).

However, as Michael Parenti (1999) argues, schools operate “in order to better secure cultural orthodoxy and politico-economic hegemony” which results in the production of “Bored, uninformed students” as a symptom, “a small price to pay” (p. 26). Similarly,

Jaffee (2016) shows how schools function to reproduce the social relations of production which are “inherently disabling for those whose bodies it renders insufficiently exploitable, . . . including disabled students . . . [and] serves to reproduce the conditions of their disablement” (p. 5). In other words schools qua ideological machinery of the State, produces bored, uninformed and disabled children. The fact that students’ learning occupies a secondary position only becomes apparent under conditions where the contradictions of capitalism are heightened. For example, in central India, a constant class struggle persists between tribal communities and mining corporations for the former’s land. In this region school buildings are, as Roy (2011) describes, “built like concrete bastions, with steel shutters for windows and sliding folding steel doors” since they “double up as barracks and bunkers . . . so that [the paramilitary forces who work in favour of the mining corporations] can fire [at the people] in all directions” (p. 37).

The nature of the differing positions with regard to the place of schooling within capitalism are also found in the context of mathematics education. For mathematics education researchers like Lundin (2012) and Pais (2014), the “gap” between the promise and the reality of schooling is an “inherent property of mathematics education itself” (Lundin, 2012, p. 73). Pais and Valero (2012) argue that mathematics in fact contributes to the “*de-politicisation* of issues of equity, social justice, economy and, ultimately, politics itself” (p. 19). Gutstein (2012) on the contrary prefers to look upon mathematics education “as a weapon in the struggle.”

Tuning our gaze to how schools certify students as either successful or failures, we see that the idea of failing students is taken for granted as inevitable and even justified. And there are real material interests involved in the failing and exclusion of students. Through the use of entrance exams in which a large number of students fail, a justification is provided for their unemployment. Even teachers have not been spared from the ideological aspect of examinations. In India, where the MHRD laments about having a shortage of qualified teachers, qualified teachers need to pass “Eligibility” tests if they wish to practice. Entrance exams thus create divisions among those waiting for employment, and thus suppresses dissent among qualified teachers who will not get a job or would have to settle for being hired on a contract basis. While exams are often rationalized through the notion of merit, this excuse does not hold water when one considers the case of how the sudden imposition of the National Eligibility cum Entrance Test (NEET) as an admission criteria for undergraduate medical and dental courses systematically drove

many students, including a state board topper, to suicide (IANS, 2017; Ranjan, 2019). The existence of examinations and failure has created a market for the billion dollar coaching class and e-learning industry. An education system based on examinations and assessment is therefore very profitable (for a handful) and also very costly (for the majority). As I argued in D'Souza (2020), in India, it is often claimed that the fear of failing will get students to study harder and stay out of political struggles, thereby improving learning conditions in the (often underfunded) school. Examinations have in fact been quite successful in suppressing student dissent.

In India, where caste has served even to define what constitutes as valid knowledge, a disproportionate number of failed students comprise of “lower caste” students. Sowjanya (2016) stated that, “In our society, knowledge is not power but what constitutes knowledge and becomes acceptable to the upper-castes determines power. Hence the current education system could successfully prove dalits to be unmeritorious.” Sowjanya cites the example of her dilemma of having to choose between appreciating either the students who attended her class or those who skipped her class to protest the institutional murder of her student-comrade:

When assessments strictly fall under mere examinations conducted in a classroom with a couple of invigilators walking between the rows hoping to catch “the thief,” it would be much easier to appreciate the former group: students who remained indifferent to the injustice in order to be “good” students whose learning is confined to the four walls of the class room. . . . The meritorious groups of the country choose to be indifferent to everything that happens in society. Yet the merit of the meritorious groups is not questioned because it is the caste position that brings legitimacy to their acts.

In India, exclusion is built into our social fabric woven by the Caste system. Caste forbade women from accessing education, and criminalized it with dire consequences for “lower” castes (Shudras) and “untouchables” (dalits) who comprise a majority of India’s population. Although caste discrimination is officially criminalized, schools continue to provide meritocratic legitimations for casteist practices. Sowjanya (2016) argued how, “the victimhood of a dalit can be diluted by invoking merit - or lack of it - or bad conduct.”

Failing students can therefore be seen as a quick fix solution to rising unemployment and justifying the caste structure. Therefore, rather than treat exclusion as a problem to be fixed through better pedagogical practices, taking a cue from [Pais et al. \(2012\)](#), we must “posit them as a window into the entire contradiction of schooling” (p. 28).

Within a political milieu that actively and consciously produces exclusion, the discourse on inclusion is ideological. [Sadgopal \(2019\)](#) highlighted how “the term *inclusion* came into Indian political discourse for the first time with the 11th Five Year Plan Report in 2010-11.” Under “Neoliberal Brahminical Capitalism,” inclusion “allows the ruling classes to not just continue with inequality but also to increase it at all levels and in all facets of national life and then ‘Include’ a miniscule proportion from SCs/STs/OBCs/Muslims ... on selected parameters.” Sadgopal argues that the notion of Inclusion goes against the ideals of Equality and Social Justice as enshrined in the Constitution:

The Constitution rejects Inclusion outright while fully provides for Equality with Social Justice. Yet, Indian polity (including the Hindu Rashtra forces) and the progressive sections get away with “*Inclusion of the handful and exclusion of the masses*” while rejecting Equality with Social Justice for 130 crore Indian citizens on the ground of being impractical and hence, dubbed utopian.

An education system that produces mass exclusions cannot be made compatible with liberal ideals of inclusions. Exclusion, which is facilitated through the process of failing, provides a fertile ground for the mushrooming of private tuitions around every corner of the city. Through capitalizing on the fear of failure generated by the examination system and the reducing of knowledge to a digitizable and marketable body of knowledge, the ICT tycoon, Byju Raveendran raked in billions of dollars ([Raghunathan, 2019](#)) by partnering with corporate giants such as Disney and Facebook ([BT Online, 2016](#); [Paresh, 2019](#)). As of 2020 Byju was India’s third most-valued unicorn ([Soni, 2020](#)), and boasted of having investments from transnational corporations based in countries such as China, Canada, Qatar, US, etc. While coaching classes were initially considered supplementary to regular schooling, today they have taken a more cardinal position in higher education and by tying up with the education department, and setting up colleges and awarding degrees (for a price ranging from 2 to 6 lakhs) ([Bhatande, 2018](#)), they have almost reduced junior

colleges (i.e. the two years of higher secondary education) to training programmes aimed at “cracking” high stake entrance examinations.

Identifying the various economic forces that shape education in ways that serve entrenched interests at the price of exclusion and marginalization of various groups of children highlights the complexity of problems associated with schooling as well as the limitations of quick fix solutions. Therefore, a hope for a transformation must necessarily be accompanied by a more critical and holistic perspective on schooling. “In concrete pedagogical terms, this means that educators need to situate the school, curriculum, pedagogy, and the role of the teacher within a societal context that reveals both, their historical development and the nature of their existing relationship with the dominant rationality” (Giroux, 2001, p. 195).

To illuminate the political economic role of a school is not to relegate teachers to a passive role in carrying out the job they are assigned by a schooling system that in one way or the other is controlled more by market demand than human need. Like the various State institutions like the Church, the Army or the prison system which are built by the ruling elite to satisfy their class interests, they may also be spaces where ruling class interests are subverted. “Fortunately,” as Helen Keller (1920a) pointed out, “education does not depend upon educational institutions any more than religion depends on churches” (p. 46). Also, schools need not succeed in serving as a barrier to emancipatory learning. Radford (2016) argued in a similar manner, that “education should not be an engine of societal reproduction - quite the contrary. If there is a central place within social institutions to start making changes, this place is education, and in particular the school and the classroom” (p. 263). The fact that schools produce an uncritical bigoted workforce is not a failure of a school in terms of fulfilling their promises. As Giroux emphasized, schools contain “ideological and material spaces for the development of radical pedagogies” (p. 116). The ‘failure’ if it can be called as such exists but only in our collective effort to subvert the classroom environment.

Chapter 3

Research Framework & Methodology

“the best educated human being is the one who understands most about the life in which he is placed, that the blind man, however poignantly his individual suffering appeals to our hearts, is not a single, separate person whose problem can be solved by itself, but a symptom of social maladjustment. . . . Society is a unit; the parts depend on one another; one part of the world suffers because the rest is not right.”

- Helen Keller

3.1 Introduction

My research study was aimed at answering two main questions, namely, 1) ‘what are the underlying causes behind the exclusion and disablement of blind mathematics learners in schools?’ and 2) ‘what can we do about it at the level of pedagogy, curriculum and political struggle?’ These questions were explored using a Case Study research methodology at a study centre for blind children in Mumbai, India.

The previous chapter provided a comparison between largely three perspectives on disability. And based on their underlying philosophical premises, I classified them into three categories - the individual model, the social model and postmodern perspectives on disability. These three views differed on their focal points of analysis as follows:

1. The focal point of “individual model of disability” is the *individual*. The problems associated with disability are subsequently attributed to the qualities of the individual person having a disability.
2. The “social model of disability” as conceptualized by Michael Oliver (1983), Vic Finkelstein (1981) and the UPIAS, theorized disability from a Marxist perspective. For Marxists, the entry point into disability is the political economy and *class structure* of society. Under capitalism, firstly, as ability is reduced to one’s exploitability as a worker (Jaffee, 2016), the oppression of disabled people stem from their exclusion from exploitation as wage labourers (Russell, 2011) by an economic system that depends on creating a class of ‘disabled bodies.’ Secondly, with reference to living in a “developing country,” the globalizing and imperialistic nature of corporate capitalism creates *disabling* conditions for working class people with physical and mental impairments located in third world countries.
3. Postmodern perspectives on disability shift the lens away from both, the individual as well as the class structure of society and towards *Culture*. The violence faced by disabled people are seen to be an outcome of the dominant culture of ableism (Goodley and Runswick-Cole, 2011).

In my research work, I adopted the social model of disability mostly because the problems faced by the students proved to be structural, and only the social model proved well-suited for the task of providing a structural analysis of these problems. My research work demanded that my theory be capable of being carried forward to make it applicable to answering the question of how structural economic factors create disabling conditions in schools in a third world country impacted by neoliberal development policies.

Through the lens of Critical Mathematics Education (CME) I also showcased the ways in which mathematics education (under a capitalist mode of production) is itself used as a means of producing and justifying exclusion, thereby bringing into question the idea of resisting forces of disablement using the tools that are designed to produce it in the first place. Mathematics education and disability therefore should be seen not as isolated and independently existing reified things but interconnected social processes.

The final two sections of Chapter 2 were included so as to shed some insights into the historical and political economic contexts of my field observations.

3.1.1 Against Dominant Research Paradigms

The social model helps us recognize disability as, “a symptom of social maladjustment” (Keller, 1920a, p. 38), and a form of oppression rooted in the mode of production of a society (Abberley, 1987; Oliver and Barnes, 2012). It thus demands a critical understanding of the material social processes that (re)produces disability. Through reasoning how “disability is socially produced”, Oliver (1997) argued that, “Disability cannot be abstracted from the social world which produces it; it does not exist outside the social structures in which it is located and independent of the meanings given to it” (p. 101). However, social research on disability has been dominated by frameworks underpinned by medical and individual ideologies that limited themselves to “classify, clarify, map and measure” the different dimensions of disabilities (Oliver, 1997). Oliver described this research paradigm through the concept of “social relations of research production” that referred to “the structure within which research is undertaken” where “social relations are built upon a firm distinction between the researcher and the researched; upon the belief that it is the researchers who have specialist knowledge and skills; and that it is they who should decide what topics should be researched and be in control of the whole process of research production” (p. 102). Oliver attributed such a way of doing research as a product of “positivistic consciousness and a hierarchical social structure which accords experts an elite role”. Oliver gave an example of research within such a paradigm in which “Disabled people either filled in a postal questionnaire or were interviewed, not by the principal [researchers] but by part-time interviewers” (p. 104-105). Oliver described such a paradigm as *alienation* in the Marxist sense of the term because the actions of people (with disabilities) are treated as fragments used for someone else’s ends. In a positivist research paradigm, the researcher and the “researched” are both alienated, which is actually “symptomatic of a wider crisis” between disabled people and the research community, which in turn is a subset of a wider “research crisis” (p. 105). Oliver also expressed his disillusionment with the interpretivist paradigm which strives towards creating “a backdrop against which policy makers make decisions” and “helps them to decide what questions to ask rather than to provide specific answers” (p. 109), and so on, for failing to produce meaningful social change. Through rejecting positivist as well as interpretivist paradigms, Oliver argued for an “emancipatory paradigm” that aimed at facilitating a “politics of the possible by confronting social oppression at whatever levels it occurs” and recognizing and confronting “power which structures the social relations

of research production” since research has hitherto “been and essentially . . . an activity carried out by those who have power upon those who do not” (p. 110).

Feenberg (2015) explains through the concept of reification that, “Practices establish a world within which reified objects appear” and a reified standpoint “standpoint contributes to the reproduction of the world that the practices sustain” (p. 490). Research practices that derive from a reified standpoint also contribute to the reification of disability and consequently serve to reproduce the social relations between (ablebodied) researchers and (disabled) researched participants. A research method that seeks to transform social relations must therefore be underpinned by what Lukàcs (2016) called, “dialectical conception of totality” since “only this conception dissolves the fetishistic forms necessarily produced by the capitalist mode of production” (p. 13).

The social model of disability therefore highlights the fact that the problem of teaching mathematics to blind children, who are essentially a socially excluded group of students, is more of a political issue than merely a pedagogical problem.

3.1.2 Towards a *Dereifying* Research Method

A research methodology that is concerned with social processes that produce illusory reified “things” must firstly, be capable of capturing the complexities of the research problem hidden behind the veil of reification. Secondly, as the research is based on the assumption that no one is free from ideology, the research design must account for the ways in which ideology functions and is manifested through actions of the researcher as well as the participants. The respondents’ approach towards the researcher will certainly be mediated through the dominant ideology as well as the ideology of the respondent which will in turn affect the kinds of responses recorded for purposes of data collection. Also, if the research aims to address matters of oppression then it must acknowledge that people, including students, resist. Subsequently, the research methodology must be capable of capturing, the various forms of resistance that may either not fit into the frame of pre-formulated interview questions or may challenge the premise of the questions altogether. Thirdly, the research design must account for the fact that the researchers’ political and ideological consciousness is shaped by their class position as well as the ruling ideology and would likely espouse a hegemonic ideology. The researcher might therefore

underestimate the different layers of the problem being researched. This would impact for example, the kind of interview questions asked, the way the responses are interpreted, the taken for granted assumptions behind framing specific interview questions, the manner in which the questions are framed, the attitude towards the research participants, the presumptions about the (lack of) agency and critical consciousness of the “subjects” as well as the nature of the research as a whole, etc. Fourthly, given that the research problem is recognized as a product of a historical process and shaped by capitalism, the research method must take into consideration how the political economy of capitalism may be contributing to producing the observed problem.

In keeping with the concerns of the research problem, my methodology borrowed from the work of [Agostinone-Wilson \(2013\)](#) who described what she called *Dialectical research*.

3.1.3 On Dialectical (Marxist) Research

In her book *Dialectical Research Methods in the Classical Marxist Tradition*, Agostinone-Wilson begins by stating that dialectical research addresses two primary questions: “How did things get this way?” and “What are we going to do about it?” Agostinone-Wilson clarifies the meanings of the words that she used by saying that:

“Things” can refer to a wide range of phenomena, from the use of standardized testing to the unpaid labour of women. “Get” because the way things are is not natural or enduring; things become the way they are through a combination of historical forces, under the constant shadow of capitalist social relations. “We” is deliberately invoked because individual, narrow solutions do not work for the kinds of things we are now facing, . . . (p. 6)

To understand how things got this way, it is also important to critically understand what is the nature of the aforementioned “things”. In the case of my research problem, “things” refers to the marginalization of blind learners. And from a dialectical perspective, an exploration into the question of how things got this way must look into the various interconnected including historical factors that led to the present social condition. Recognizing the various political economic forces that produce exclusion and disablement also forces

the researcher to consider the various form of resistance that the excluded people engage with even if we may not recognize them immediately.

Coming from a privileged location of being non-excluded and non-disabled, the attempt to develop a dialectical conception of exclusion runs the risk of being problematic in the sense that the researcher might effectively end up trying to fit the experiences of the marginalized students within a framework and vocabulary developed by researcher based on a rather superficial conceptualization of exclusion. Such a framework would be significantly shaped by the prevailing ideology of a discriminatory society in which the researcher was encultured. Also, it is likely that the researcher might overlook certain instances of subversion and resistance carried out by blind children against certain material and ideological forces that serve to disable and exclude them. Theory certainly tells us that oppression begets resistance, but to develop a fuller understanding of the various forms of resistance carried out by the people requires a genuine engagement with the people involved in the struggle in whatever forms. Unless the research is participatory, we researchers may be the ones whose “white man’s burden” is what is being resisted.

Dialectical research stands in opposition to what [Agostinone-Wilson \(2013\)](#) referred to as *pragmatic* research, which claims to address “the need to take action and solve problems, but in reality seeks to never offend prominent stakeholders” (p. 6).

3.1.4 Political Commitments of Dialectical Research

Agostinone-Wilson presents six characteristics of Dialectical or Marxist Research. I prefer to refer to these characteristics as the political commitments of dialectical research. These include the following.

a) Taking a stand against capitalism and imperialism - Dialectical Research “does not seek to make capitalism kinder or more workable, or to reform it in any way” (p. 64). While conducting dialectical research, the researcher must not overlook the role of corporate globalization, or Imperialism, in creating conditions of scarcity of quality public education, especially in countries like India with a history of being impoverished by British imperialism, and currently, whose neoliberal governments have opened public infrastructure to global private investors.

b) Dialectical research rejects Hyperrelativism - While Marxist research “recognizes that individuals and situations have unique aspects ...it rejects radical relativism as an antitheoretical path to impeding the ability of researchers to comprehend the world in order to change it” (p. 67). While rejecting Hyperrelativism may not be specific to Marxism, it is indeed an important aspect of its materialist philosophy.

c) Directly addresses class - Marxist research places class structure at the centre of inquiry rather than regarding class as “one of several equally weighted factors such as race, gender, sexuality, or ability to conceptualize the world.” Marxists speak of class structure not merely in terms of the class of individuals and groups, but rather as an overarching structure within which individuals find themselves belonging to either the class of labouring producers or passive appropriators of value, or completely excluded from the labour process.

d) Recognizes interdependency of factors under class - Marxist research explores the interdependency of social factors such as race, gender, etc. albeit in historical materialist terms, and the class structure that tends to reify such social relations into naturalized things or “identities.”

e) Research as not just description but also praxis - The aim of dialectical research is not merely to interpret the world but to change it. And such changing includes social relations produced by capitalism (and caste).

f) Recognizes necessity of collectivity in analysis and solutions - Dialectical research emphasizes on collective action since the problems we are faced with cannot have individual, narrow solutions.

Standing true to the political commitments of dialectical research may not have directly obvious implications for education research and at times may conflict with the demands of the agency funding the research program. Nonetheless, to whatever extent possible, the research program must not take capitalism for granted, but must question its various material and ideological dimensions.

3.1.5 Philosophical Characteristics of Dialectical Research

The concept of dialectical research is derived from the Hegelian notion of Dialectics which was further revolutionized by Karl Marx. Although Marx never got to formulating the concept, Dialectics or the Dialectical method is still considered foundational to Marxism. Engels however attempted to expound the philosophy of Dialectics in his book *Anti-Duhring* (Engels, 1877b) and later in a manuscript that would posthumously be published as a book titled “Dialectics of nature.” Various Marxist philosophers after Engels worked on the concept of dialectics. The principal features of dialectics are as follows:

- **Political commitment to understand (and struggle to change) phenomena from a materialist perspective**

Dialectical research rejects idealist explanations of a problem under investigation, and demands that in order to have a sincere understanding of a phenomena the researcher must look at and examine the various material forces that are responsible for its production and development. Dialectical research regards material conditions (for example, a mode of production geared towards private profit) to be more basic than ideas (eg. incorrect ideas about blind children) that arise in people’s minds. This is not to deny that ideas cannot become a material force. While ideas exist in a dialectical relation with the material world, materialism considers material conditions to be more basic than ideas.

- **Understand objects in terms of totality and its interconnections:**

Dialectical research seeks to understand problems (as processes) in their totality. Lukàcs (2016) states how “In Marx, the dialectical method aims at understanding society as a whole.” Marxism stands opposed to “Bourgeois thought” that “concerns itself with objects that arise either from the process of studying phenomena in isolation, or from the division of labour and specialisation in the different disciplines.” Marxism “simultaneously raises and reduces all specializations to the level of aspects in a dialectical process” (p. 28). Giroux (1999) describes that the meaning of dialectic “is based on the insight that for any fact, issue, or phenomenon to become meaningful it must ultimately be examined within the context of the social totality” (p. 13). In the context of education, “the category of totality in the dialectic allows educators not only to become more critically interpretive, it also suggests new ways

of acting in the world. It helps teachers and students alike to link knowledge with specific frames of reference” (p. 14).

For a dialectical researcher an investigation into questions concerning, for example, the exclusion of blind children from schools, has to take into account, the various interconnected factors that are inextricably linked with schooling. For example, unemployment, wages, high stake testing, the coaching class industry, the budget and the various stakeholders who profit from decreased spending in education, etc. and even the history of the caste system.

- **Social phenomena as being in a state of continuous motion and change:**

“The dialectical method . . . requires that phenomena should be considered not only from the standpoint of their interconnection and interdependence, but also from the standpoint of their movement, their change, their development, their coming into being and going out of being” (Stalin, 1938). In the context of disability studies and mathematics education, a dialectical researcher looks upon political economic processes that engender exclusion and disablement as historically contingent rather than an immutable feature of human society.

- **Contradictions in the essence of objects:**

Dialectical research focuses on the underlying contradictions that shape the dynamics of a phenomenon. As Lenin (1915) stated, “Dialectics in the proper sense is the study of contradiction in the very essence of objects: not only are appearances transitory, mobile, fluid, demarcated only by conventional boundaries, but the essence of things is so as well.” Contradictions that underlie a phenomena often remain latent but reveal themselves under certain situations.

- **Negation of negation**

A social model perspective on disability locates disablement within social relations of production and also within history. To recognize, as Slorach (2016) stated, that “It wasn’t always so” (p. 42), implies that the humanity of disabled people was negated at some point in history. As Helen Keller stated, “Human nature proved itself capable of equal cooperation . . . in early communist societies” But they were “primitive in their methods of production” (p. 16). To regain that lost society and its social relations is not to suggest a restoring of a supposedly egalitarian pre-modern past but rather, striving to negate (or rather, sublimate) the negation and

create a new form of society in which, for example, our technological developments aim to serve people rather than capital. In her essay titled, *The hand of the world*, Keller (1920a) stated that “the labour-saving machine does not save the labourer. It saves expense and makes profits for the owner of the machine. The worker has no share in the increased production due to improved methods” (p. 10). Through alienation and the negation of equal cooperation, the machine “hurts the very life it was intended to serve” (p. 10). But the solution to problem is not to restore a past devoid of machinery but in a “commonwealth” that grows “out of the state in which we now live” (p. 16). This is not to say that one must expect social change to automatically move towards an egalitarian society but to participate in a struggle that involves creating conditions for the second negation to become possible.

The implication for applying a dialectical method in the particular context of teaching mathematics to blind children is not at all straightforward. However, Dialectical Materialism offers a theoretical lens which compels us to take a step back and question our premises based on which we teach mathematics to blind children - premises such as the nature of mathematics, education, disability, etc. Dialectical logic demands that, as Lenin (1921) puts it, “Firstly, if we are to have a true knowledge of an object we must look at and examine all its facets, its connections and ‘mediacies.’ That is something we cannot ever hope to achieve completely, but the rule of comprehensiveness is a safeguard against mistakes and rigidity. Secondly, dialectical logic requires that an object should be taken in development, in change, in “self-movement” (as Hegel sometimes puts it).” While a dialectical research method does not offer a readymade framework within which one might fit data, it provides a lens through which we see reified objects like schools, the curriculum, etc., as functioning to mask social relations and facilitate capital accumulation.

3.2 The Research Methodology

The theoretical grounding of the research design was based on the social model of disability as conceptualized by Michael Oliver, Vic Finkelstein, Roddy Slorach and Laura Jaffe, and critical mathematics education (CME) as articulated by Ole Skovsmose and Alexandre Pais. The broad goal of my research study was to explore the question of what the social model of disability could mean for critical mathematics education through

a case study of the study centre for blind children in Mumbai. The primary research methodology was therefore Case Study.

However, given the particular nature of the research, the study drew from Participatory Research method in which, as [Cohen et al. \(2011\)](#) described, the researcher does “research *with* people ...rather than doing research *to* or *for* people” (p. 37). The research study also involved Participant Observation which [Bogdan \(1973\)](#) described as being “characterized by a prolonged period of contact with subjects in the place in which they normally spend their time” and based on the recognition that “the only way to understand the complexity of social life is to immerse oneself in it” (p. 303).

3.2.1 On Case Study Research

[Adelman et al. \(1976\)](#) describe case study research as involving “the study of an instance in action” although the “instance” contains the relationship with the “class” from which it is drawn. As Adelman, et al. discuss, case study research can be set up in two ways. In the first, the hypothesis is defined and the researcher draws an instance or “case” from a general “class”. The researcher subsequently reveals some features of the case in order to make a generalization about the class. The research study presented in this thesis concerns the second kind of case study research in which the case is given, and within such a “bounded system” issues are studied in order to understand the class. However, this is not to say that the study stays within the boundaries of the system. As Adelman et. al. cites an example,

We cannot answer questions about the effects of [an] innovation without reference to the history of the school, local authority politics, or the self-images and career aspirations of the teachers. Each case turns out profoundly embedded in its real world situation. (p. 142)

To understand what constitutes case study research, it helps to demarcate it from other research methodologies. For example, case study is different from an experiment, although the case study may include experiments as part of the study. As opposed to an experiment, a case study does not isolate a phenomena from the context but regards the phenomena in terms of how it is embedded into a context. [Yin \(2009\)](#) described case study

research as, “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18). And since phenomena and context are inextricably linked, case study research involves coping with the “technically distinctive situation in which there will be many more variables of interest than data points” and as a result, “relies on multiple sources of evidence, with data needing to converge in a triangulating fashion” and as another result, case study inquiry “benefits from the prior development of theoretical propositions to guide data collection and analysis” (p. 18).

Case study also differs from ethnography and participant observation even though they share similar forms of data collection. Bogdan (1973) describes the purpose of participant observation as, “to develop an understanding of *complex social settings* and *complex social relationships* by seeing them holistically” (p. 303, emphasis mine). What made my research methodology a case study was the fact that the focus of the inquiry was not on the participants, nor on the social setting but rather, on the *phenomena*, in terms of how it manifested in the *case* of the social setting and among the participants. Similarly, case study research is different from ethnography in terms of how the focus of the latter is on the *culture* of a group. Ethnography may certainly include participant observation, but as Preissle and Grant (2004) explain, “What makes ethnography separate from other participant observation studies is the emphasis on culture” (p. 164).

The research methodology I adopted in my investigation was a case study which used participant observation, employed ethnographic techniques and also included (teaching) experiments. With regards to the political economy of exclusion and disablement of blind learners, I drew insights from Dialectical Research in terms of uncovering and illuminating dialectical contradictions that were revealed by critical situations in the course of my study, and how these situations seen from the lens of these dialectical contradictions revealed interconnections between the various problems associated with mathematics education at the pedagogical as well as the structural level. By adapting dialectical research to the context of a case study of the study centre for blind students, the research also served to highlight how structural factors work to reify social relations and processes of disablement into the “learner with a visual disability.”

To explore implications of the social model of disability in the context of mathematics

education, the research included an exploratory pilot study which led to certain hypotheses which were explored during the teaching sessions. However, the experimental aspect of the study was only a small part of the research with the larger goal of exploring the phenomenon of disablement and its various aspects, in the context of mathematics education.

3.2.2 Limitations of Case Study Research

A significant limitation of case study research lies in the fact that, as Adelman et al. point out, the researcher “will be party to many inside stories not all of which will be negotiable currency in discussions outside the group under study. [The researchers] know more than [they] should tell [since] *others* must live with the consequences of [the researcher’s] findings” (p. 146). Adelman et al. thus suggest “anonymisation” of reporting as a way of handling such problems. While anonymisation is limited in its scope in that it serves, as Agostinone-Wilson put it, “to never offend prominent stakeholders”, it is still a price worth paying. Because firstly, case study research is about generalization of an issue, rather than the case. Secondly, anonymisation protects the relatively powerless participants from the relatively powerful stakeholders of the problem under investigation. As the intended audience of my research study were predominantly “outsiders,” namely the mathematics education research community, I found it as a best bet to opt for anonymisation.

My research design also included aspects of research methodologies such as Critical Ethnography (Anderson, 1989; Trueba, 1999), Participant Observation (Bogdan, 1973) and Participatory Research (Cohen et al., 2011).

3.2.3 On Critical Ethnography

Given the nature of the research problem, the research design adopted aspects of critical ethnography owing to its commitment to praxis (Trueba, 1999) and being “sensitive to the dialectical relationship between the social structural constraints on human actors and the relative autonomy of human agency” (Anderson, 1989, p. 249). Madison (2005) describes how critical ethnography “begins with an ethical responsibility to address processes of

unfairness or injustice within a particular *lived* domain. . . . The critical ethnographer also takes us beneath surface appearances, disrupts the *status quo*, and unsettles both neutrality and taken-for-granted assumptions by bringing to light underlying obscure operations of power and control” (p. 5). The research study aimed at adopting a critical ethnographic stance that “moves beyond ‘what is’ to a state of ‘what could be’ ” (Thomas, 1993, p. 20). In critical ethnography the researcher has an explicit agenda to strive for the liberation of people. It therefore strives to move from “describing a situation, to understanding it, to questioning it, and to changing it (Cohen et al., 2011, p. 243).” The role of the critical ethnographer is to “use the resources, skills, and privileges available to her to make accessible - to penetrate the borders and break through the confines in defense of - the voices and experiences of subjects whose stories are otherwise restrained and out of reach” (Madison, 2005, p. 5).

3.3 Theoretical Perspective

The theoretical framework of the research study was developed by drawing critical insights from the fields of disability studies and mathematics education, in addition to the field observations I gathered during my pilot study at the study centre. The research design was therefore grounded upon certain premises, the first and foremost being that disablement is not a direct outcome of physical or mental impairment. Therefore, in the context of my work with blind mathematics learners, the implication was that blindness need not disable a student from learning mathematics. But this claim needed to be empirically demonstrated to justify the soundness of this theoretical perspective on disability.

Furthermore, as argued earlier, the rejection of prevailing view that disability is a natural outcome of physical/mental impairment, is merely the starting point of the social model. The social model goes deeper in terms of providing a different worldview altogether. The social model entails looking society as a whole and recognizing how institutions, individuals and their problems are interconnected, and embedded within a social structure which is influenced by capitalism. By viewing human society in terms of a dialectical conception of totality, the social model sees certain aspects of the phenomenon of disablement as a dialectical outcome of the contradictions internal to capitalism.

This perspective raises additional implications for investigating the phenomena of disablement in the context of blind mathematics learners in view of how mathematics education, exclusion, disablement are interdependent with each other and the market economy. However, such a perspective on disablement is not a common view in academic research, and this fact, the research study considers, is a part of the problem under investigation.

The premises which characterize the theoretical perspective framing the research design (as discussed in length in Section 2.1.4) can therefore be summarized as follows.

1. Disability is not a direct outcome of physical and mental impairment.
2. Certain aspects of disablement are outcomes of contradictions internal to capitalism.
3. In the context of education, disablement is predominantly conceptualized from an individual model perspective from which society is understood as being comprised of individuals.
4. However, as individuals are embedded in society, disablement is a social phenomena, and is an outcome social practices and material relations of production (Jaffee, 2016; Oliver and Barnes, 2012). Therefore social problems faced by individuals cannot be understood merely by studying individuals, and one must take into account the functioning of human society and its history as a whole, and how individuals and their problems are embedded within a social structure.
5. In addition to what was discussed in Chapter 2, I add here that students do resist material and ideological forces that serve to disable them. But such forms of resistance may not be directly noticeable especially if the researcher comes from a position of relative power and privilege.

3.4 Research Objectives

The broad objective of my research was to explore the implications of the social model of disability for mathematics education through a case study of the study centre for blind children. This exploration involved developing my understanding of disability by, among

other ways, interacting with the students of the study centre, volunteering to help them during their exams, conducting sessions on mathematics, etc. Some initial aims of my exploration were as follows:

1. To understand which aspects of mathematics are visual (including those that depend upon visual processing), spatial, purely symbolic, discursive, etc.
2. To understand how the different economic forces operate in disabling and excluding blind students.
3. To develop a critical perspective on the social model of disability through interaction with students from the study centre for blind children located in Mumbai.

The research study also aimed at informing practice at the level of policy, pedagogy as well as philosophy and politics. While beginning my study my primary concern was to address, what I referred to as a “visual hegemony” in mathematics education. The research objectives concerning practice included the following:

1. Develop a pedagogy of mathematics, through critical dialogue with students, that challenges the dominant method of teaching mathematics, which presents it as inherently visual.
2. Deuniversalize dominant mathematics and uncover the cultural politics within it.
3. Theorize about how the developed pedagogy contributes to challenging the visual hegemony in mathematics education.

However, as the research study progressed, the specificities of the research objectives were broadened so as to make room for various other aspects of disablement in mathematics education that needed to be taken into account, but were not related to the dominance of the visual in mathematics education. The broader objectives of the research study are articulated in the latter part of the section on Research Questions.

3.5 Framing my Research Questions

The overarching research question guiding my investigation was, *What can the social model of disability mean for mathematics education?* However, I did not word it in this way during the initial stages of my field study. My early assumption was that the disablement of blind mathematics learners stemmed from the dominance of the visual in mathematics education. Furthermore, I found Freire's radical pedagogical approach to addressing oppression insightful. Subsequently, in my quest to apply Freire's radical pedagogical insights to disability qua a form of oppression, I had raised the following questions.

1. What are students' perceptions about the causes of certain topics in mathematics being difficult?
2. How does the visual hegemony operate in mathematics education?
3. What problems in mathematics are due to visual methods of teaching and defining mathematical concepts?
4. What teaching methodology would be best suited for developing a pedagogy in mathematics that could counter visual dominance in mathematics?
5. Would a shift from mathematics to (the process of) mathematization be effective in terms of learning, and liberation and empowerment?
6. How does critical dialogue change perceptions of disability oppression and mathematics education among dialoguers?

The research study involved the following activities:

1. Collaborating with students and designing a mathematics summer camp in the study centre.
2. Conducting a discussion on a mathematics topic.
3. Recording the classroom interactions with consent of all the participants.

4. Recording informal conversations with students with their consent.
5. Analysing the recorded data with fellow researchers.
6. Analysing the recorded data alone while reflecting on my own biases and uncritically accepted beliefs about mathematics education and disability.
7. Discussing my observations with the students.
8. Maintaining a rapport with students through weekly sessions on music, activities and discussions.
9. Volunteering to tutor the students for their exams.
10. Following up with the students when they finish their schooling
11. Analysing recorded data of the graduated students
12. Collating the various kinds of data to present the larger picture.

However, through subsequent interactions with the students and teachers of the study centre in addition to engaging further with literature related to the social model of disability and critical mathematics education, I realized that addressing visual hegemony through materialization strategies was not sufficient. Beyond that, one must have strategies that acknowledge and act against social conditions.

My interactions also furnished empirical evidence, consistent with the theoretical framework of the research, that blindness need not disable students from learning mathematics. While the study demonstrated that pedagogy could contribute to addressing the problem of exclusion and disablement, it also pointed towards some limits, and raised questions of a more fundamental nature that challenged my ideological beliefs about the causes of disablement of blind students.

3.5.1 The Research Questions

To address these fundamental questions without disregarding the initial aforementioned research questions I sought help from [Agostinone-Wilson \(2013\)](#), and worded the overarching research questions of my study as follows:

1. What are the underlying causes behind the exclusion and disablement of blind mathematics learners in schools?
2. What can we do about it at the level of pedagogy, curriculum and political struggle?

As these questions were framed from a social model perspective, implicit in the first question was the contention that blindness need not disable students from learning mathematics. However, this claim needed to be empirically demonstrated in order to add weight to the argument that the real causes of disablement lay not in the body but elsewhere. In fact, a failure to demonstrate this claim would have meant adding support to contending “interactional” view as advocated by [Shakespeare \(2014\)](#), et al. Speaking from a Marxist perspective, “underlying causes” refers to the internal contradictions of capitalism, of which, exclusion and disablement is a dialectical outcome. Therefore the first question, in effect, demands of the researcher to uncover the underlying contradictions that produce exclusion and disablement of blind mathematics learners.

I found these two aforementioned questions as a useful framework for explicating and addressing the central question driving the research study, namely *What can the social model of disability mean for mathematics education?*

3.6 Research Settings

My field work involved interactions with students of a study centre for blind children. The centre was located in a middle class locality. The centre aimed to provide educational support to partially/non-sighted students most of who attend regular schools. Some of the students did not attend any regular school but were preparing for their open schooling exams. Although a total of 45 students were registered with the school, around fifteen attended regularly. The students were all children from working class backgrounds.

Prior to beginning my field observations, my pilot study was carried out by interacting with fifteen students who regularly attended the centre on Saturday mornings. Every student had a different history with regard to their eyesight. Five students were congenitally blind, one lost her eyesight due to glaucoma, another was losing sight due to the same condition. The other students had either retinal or optic nerve related problems.

The instruments used for data collection depended upon the nature of the data collected. In this thesis, I present five sets of data in Chapter 4 (within the classroom) and two sets of data in Chapter 5 (Beyond the walls of the classroom).

3.7 Corpus of Data

The corpus of data collected during the course of my study included the following:

1. Video recordings of teaching experiments conducted at the centre accompanied with hand-written notes.
2. Audio recordings of interactions with individual students while tutoring them for their school exams.
3. Audio recordings of interviews of students.
4. Audio recordings of interview with teachers of the study centre.
5. Written notes of my reflections on experiences related to disability oppression and the political economy of exclusion and disablement.

The first data set was of an interview with a teacher, and presented in Chapter 4 in the section, *History of the centre from a teacher's perspective*. The interview was open ended and collected along with my colleague. We used a video camera, an audio recorder along with a notebook to note down any striking observations.

The following two sets of data (in the sections titled, *Exploring the image of a cube* and *Comparing two schools*) were collected with the help of an audio recorder. In each of these two settings, I was interacting alone with a student. In both scenarios, we were facing each other while I was reading from a textbook while the audio recorder was running.

The fourth set of data as presented in the section titled, *Can blindness really not mean disablement?*) was collected from a mathematics summer camp we organized at the study centre. Three researchers were involved in the study. The sessions were held in a room of 15 students aged between 9 and 20 years. The mothers of two of the students

also participated. All the children were either partially or completely blind. Almost all the children were primarily Marathi speaking with Hindi as their second language. We carried an audio recorder and notebooks to document our observations. In each session one researcher was assigned to note down observations. The fifth data set, presented in the section titled, *Authentic mathematization in the classroom*) was collected by me alone with a video recorder.

The sixth data set (presented in Chapter 5, in the section, *Beyond the walls of the classroom*) was noted largely from memory as the study was unplanned. However, to triangulate the data observations a seventh set of data was gathered through the use of an open-ended interview of an ex-student of the study centre. I conducted the interview alone using an audio recorder and a notebook.

3.8 Sampling

While my research study was primarily a case study, it shared a similar form of data collection with ethnography in the sense that it involved gathering a wide database over a long period of time.

LeCompte and Preissle (1993, as cited in [Cohen et al. \(2011\)](#)) elicit why ethnographic methods rule out statistical sampling; one of the reasons being that generalizability is not necessarily a goal of ethnography. They also enlist other forms of sampling, specifically: convenience sampling, critical case sampling, extreme case sampling, typical case sampling, unique case sampling, reputational case sampling, snow-ball sampling, and explain in what context each would be appropriate.

Owing to the sensitive nature of the research, convenience sampling was used, since I needed to work with all, and only, those students who wanted to visit the centre and participate in our sessions during the vacations when the mathematics camps were held. During the mathematics teaching/learning sessions the sample included all the students present along with the mothers of those who accompanied the students. The second part of the study (as presented in Chapter 5) dealt more with “beyond the walls of the classroom” in which the study focused on an interaction with two students, one of who was part of the earlier study.

Owing to the huge amount of data amassed, only a subset of data, that highlighted salient features of the phenomena under observation, was selected for publishing. Data gathered from certain episodes of my field observations that challenged, rather than supported, my taken-for-granted assumptions about disability and mathematics education were particularly selected.

3.9 Ethical Considerations

Recognizing the social dimension of disability brings in additional ethical considerations for research in disability studies considering that in addition to the fact that the research participants are children of working class parents, they are also socially and systemically excluded from mainstream schooling and society. The fact that the researcher came from a more socially privileged background added to the need for handling the research in a more sensitive manner lest the researcher add to the disempowerment of the participants.

However, handling a sensitive research topic by following all ethical protocols does not remove dilemmas from the mind of the researcher. For example, as [Cohen et al. \(2011\)](#) point out, “In interviewing students they may reveal sensitive matters about themselves, their family, their teachers, and the researcher will need to decide whether and how to act on this kind of information” (p. 170).

3.9.1 Access, Consent and Confidentiality

While gaining access to a study site is generally a serious problem, and reasonably so, I was rather lucky considering that I was offered a fixed time slot on Saturdays in the study centre to engage the students with music and recreational activities, and was later requested to tutor them for their school examinations. The gaining of access into the student community in the study centre thus evolved organically rather than formally.

The research study as presented in chapter 4 was conducted through a discussion with the students, the parents who were present and the teachers and the manager of the study centre. With regard to the tutoring sessions, while the students (Faiz and Rina) requested that the lessons be recorded for their personal use, I took their consent along

with permission of the centre manager, the teachers and owner of the study centre to use the recordings for my research study. In addition to getting the informed consent of all participants, pseudonyms were used to ensure privacy and confidentiality.

The idea for the mathematics summer camp was given by the centre manager and the students who wanted to spend their vacations doing some learning activity at the centre. The mothers of the children were present while the sessions were carried out. Precautions were taken to ensure that the study was inclusive. The material in chapter 4 was submitted to an international journal prior to which I showed a draft to the study centre owners and the teachers who were involved in the study.

Addressing the ethical concerns with regard to the data in chapter 5 was more challenging as it contained certain sensitive information concerning the site of the research study. Precautions were thus taken to ensure that people spoken about were not identifiable, more so because the particularities of the hidden information was not central to answering the research questions.

Broadly, the research was conducted at the study centre where the participants felt most at home. One interview with an ex-student of the centre (who I had known for six years, and was a college graduate at the time of the interview and wanted to visit my research centre) was conducted at HBCSE while she was accompanied by my female colleague with whom she felt even more comfortable.

Chapter 4

Study 1: Inclusive learning - Within the walls of the classroom

“We have been accustomed to regard the unemployed deaf and blind as victims of their infirmities. That is to say, we have supposed that if their sight and hearing were miraculously restored, they would find work.”

- Helen Keller

4.1 Introduction and Overview of the Chapter

To summarize the previous chapters, in Chapter 2, I presented an overview of literature in the fields of Disability Studies and Mathematics Education with the aim of highlighting the social and political economic dimension of disability and mathematics education. Within Disability Studies, I made an argument for a Marxist analysis of disablement, which in the context of my research topic translated into looking into how failure, exclusion and disablement are intrinsic to the economics of how schooling works in a caste and capitalist society. The literature although insightful did not however offer any blueprint for the concrete question of teaching mathematics to blind children in a way that does not reify and individualize disablement. And this led to the question that guided the research study: *What can the social model of disability mean for mathematics education?*

In Chapter 3, I described the research design which I developed in order to sharpen and investigate the questions that arose in the course of my field explorations.

This chapter accounts for the first part of my study and contains the bulk of the data I collected during my field study over the course of six years “within the walls” of the study centre. In this chapter I emphasize what I refer to as “authentic mathematization” and “collective learning,” and their pivotal role in contributing to creating an inclusive learning environment. The chapter is therefore organized in the following manner. Section 4.2 provides background of the study. In Section 4.3, I share an example of an interaction with a student in the context of teaching him a topic in geometry. I share this particular episode as it serves as an example of what I mean by “mathematization.”

In Section 4.4, I share an interaction with a student who I refer to using the pseudonym Rina. In this interaction, Rina narrated how she experienced severe discrimination in her school and compared it with her experience in her previous school where she claimed to have not been made to feel different. By emphasizing how in her previous school, the support of her teacher and her peers enabled her learning on par with everyone else, Rina located the cause of her disablement in the discriminatory environment which was characteristic of the school in which she had just shifted.

The tutoring episodes presented in Sections 4.3 and 4.4 indicated that mathematization and collective learning facilitate inclusive learning. Subsequently, the teaching sessions which are described in the Sections 4.5 and 4.6 provided empirical weight to this claim. While this chapter presents what may be described as a teaching experiment, it is part of the larger argument regarding the phenomenon of disablement, whose second part is discussed in the following chapter.

The theoretical and pedagogical implications are shared in the Section 4.7 which is followed by the concluding section in which I discuss the concept of inclusion.

4.2 Background of the study centre and the students

As presented in first chapter, my research was carried out at a study centre for blind children in Mumbai, India. The centre catered to partially/non-sighted students most of who attended “normal” schools (with blackboards and teachers with no knowledge of

Braille). A few students were not registered with any school and enrolled in the study centre to prepare for the tenth grade level examinations offered by the *National Institute of Open Schooling* (NIOS) ¹.

As of 2013, 45 students were registered with the centre. The number rose to 56 in 2019. The students were predominantly from working class and marginalized backgrounds. The centre also worked towards getting the children admitted into the nearby school albeit amidst severe resistance from school authorities.

To understand the background of the study centre, in addition to conversing with the centre owners and staff, we also spoke to one of the teachers, Ms. Kanak (pseudonym) who had a long history with some of the children since even before the setting up of the study centre. Kanak was employed by National Association for the Blind and assigned to work at the centre, and had been with the study centre since its inception. Kanak often expressed insightful perspectives towards matters of oppression and was quite vocal about how inaccessible “normal schools” were for blind children.

4.2.1 History of the centre from a teacher’s perspective

With Kanak’s permission to record her narrative, my colleague, Harita and I took her interview. I translated it from Hindi to English. Asking her about experience in working with blind children, Kanak’s responses proved helpful in contextualizing our field experiences. Kanak articulated how during the initial years of her work, blind children used to be confined to their homes and did not even go to school. NAB had around 200 students registered with them and 18 teachers to cater to those children by teaching them in their homes.

Kanak: We first took home visits (to teach the children). Now (there are) so many, 200 children, and 18 teachers, what would we do? So in a week 1 visit or 2 visits we get. In a week 2 visits means in a month only 8 visits or 6 and

¹The NIOS which is an Open schooling system is an autonomous institution under the Ministry of Human Resource Development of the Government that offers course materials and conducts examinations. The NIOS offers a flexible model of giving subject-wise examinations while providing course material even in audio format thereby enabling students who might have dropped out from regular schools, to continue with their education.

in that we get holidays, or children get sick so 4-5 happens. So in 4-5 visits we have to give 2 hours to the children. In those two hours what would they learn? So much is there no? [We have to] teach Braille, teach Taylor frame, Abacus is there. And if the child, is older then full geometry kit is there (to learn), how do they use it, all this to teach doesn't happen.

Kanak's narration of the initial years of her work shed light on the nature of exclusion faced by the children prior to being a part of the study centre. The children used to be isolated in their homes, denied any exposure to the world outside their houses, and barely received any education. Such a negligible exposure to education was clearly insufficient given that in addition to learning the regular curriculum, they needed to learn Braille, the use of an Abacus, a tactile geometry kit, etc. Kanak also highlighted how the children faced exclusion even in their homes, and the emotional effects it had on them, and compared that to how the children were in the study centre:

Kanak: ...the children ...were very reserved ...because all were sighted and there was no one to play with them. Their brother and sisters also were [sighted]; how much could they attend to them? ...They felt if we play then they would get hurt. So they kept them separate only. But on coming here, ...there has been better friendship. ...Their mobility has become good.

In the course of her conversation Kanak found it noteworthy to highlight how having a disabled child affected a mother in a joint family, and Kanak's help in attending to the disabled child provided some relief to the mother:

Kanak: ...joint families are there so they give trouble to their mother that, "You don't focus on your work, you're always focusing on your child" so like that to help the mother we go for a visit because they don't get to study outside.

Kanak's expression of concern for the mothers of children with disabilities resonated with that of [Sengupta \(2020\)](#) who in Section 2.3.5 argued how the mothers of children with disabilities are treated as a default (and politically convenient) safety net for their excluded children.

Kanak stated that all children can and should learn. She spoke of how her motivation to work in special education stemmed from her concern towards mentally challenged children who she saw were being neglected by their families who considered them “mad and would not understand anything.” Kanak said that if she taught them, “Why wouldn’t they learn?” Though her interests initially lay in teaching mentally challenged children, due to some mix-up during admission time, she end up specializing in teaching blind children.

4.2.2 Background to the study

Our weekly visits to the study centre started in June 2013. On our first Saturday visit, there were eleven students present. We began with me teaching the children the song, “Doe a deer” and after an hour, we played a game called *nim game*, based on mathematics. As part of the game we divided ourselves into two teams. The game began with a given number of *jodo blocks*TM. The team that began, could remove either one or two blocks and pass the remaining stack of blocks to the other team who could also remove either one or two blocks. The team that is left with the final block wins. My intention in suggesting this activity was that firstly, it was a game based on mathematics which could provide the conditions for constructing possibly novel mathematical concepts in the process of developing a strategy for winning the game. Secondly, having better eyesight did not offer any advantage in winning the game. Also, the process of developing a strategy for defeating the other team involved creating a mathematical model and engaging with addition, subtraction, multiplication and division.

4.2.3 More songs and more activities

Our weekly visits continued in this form with music followed by a group activity designed to facilitate the learning of science or mathematical ideas. In the beginning, the songs were all English since the teachers wanted the children to learn English. Also, I was fluent in English and wasn’t well versed in other languages and genres.

During certain occasions like teacher’s day, Diwali, Christmas, etc. the children would present a dance, a play and a song for visitors who included the other volunteer teachers. The *National Association for the Blind* (NAB) often organized programmes for children

from different NAB centres from across Mumbai where the children presented songs or a dance or some cultural activity. For these events, we would prepare a song that we would sing together. The children also performed plays and dances that were choreographed by some of their fellow students.

As time progressed we met the other volunteer teachers. On some occasions there were visits from esteemed guests and potential patrons. The visitors often shared their opinions on careers for blind children. I found it quite common to hear from some visitors how banking was supposedly the best option for the children. The children's aspirations however ranged from mathematics, science, law, to radio jockeying, etc. For example, a student, who I will present under the pseudonym Rina, wished to pursue law specifically to fight for farmers' rights.

In the course of time, as our rapport strengthened (more so owing to the informal nature of our interactions with them), our involvement with the students extended well beyond our roles as teachers. For example, among many other activities, we organized outings, trained the students for music performances during events, etc.

Our interactions also compelled us to think more deeply about certain fundamental aspects of mathematics which we otherwise took for granted. More importantly, these interactions highlighted how the vulgarization of mathematical concepts through school textbooks contributed to students' disablement. And the conditions that forced us to change our perspectives about the nature of mathematical concepts also illuminated the role of having a more materialist approach towards mathematics in helping create an enabling environment for children to construct mathematical knowledge.

4.3 Enablement through Mathematization

Our interactions helped me identify two aspects of mathematics learning that I found important and missing from mainstream teaching practices. I refer to these as, "authentic mathematization" and "collective learning". In this I will demonstrate what I mean by "authentic mathematization" through the following teaching episode.

This episode centers around an interaction that took place in October 2014 with a student who I refer to with the pseudonym, Faiz who was preparing for his 9th standard first

semester exam. In the 9th grade, mathematics is split into Algebra and Geometry. Faiz wanted to revise his geometry.

Geometry, as many blind students and their teachers had often pointed out, is a visual subject. While blind students are trained to use a tactile geometry set, as Kanak had expressed, it was challenging for them to use the set to construct straight lines, among other geometric figures. Being confronted with the task of communicating textbook exercises based on diagrams revealed a contradiction. The mathematics textbook is a teaching/learning aid aimed at empowering students by making mathematics learning accessible to all students. But the same textbook now served to construct blind students as less capable of learning mathematics.

We began with chapter 1: Lines and Angles (MSBSHSE, 2013). I used an audio recorder to record my teaching so that Faiz could listen to it on a later occasion. The chapter began with Euclid's postulates which was followed by axioms followed by definitions and solved examples. The exercises included figures made using straight lines, and involved identifying parallel and perpendicular lines in the diagram. This specific task did not turn out to be a major hurdle since we had what are called as *Wikki Stix*TM, a set of sticky strings that could be stuck on a flat clean surface to make tactile shapes. The *Wikki Stix*TM, helped Faiz answer questions about parallel lines by making diagrams tactile ². However the section that immediately followed was Parallel planes (Refer Figure 1). The image of Parallel planes in the textbook was drawn using straight line segments, which could certainly be drawn using the *Wikki Stix*TM. But “drawing” a tactile image on a 2D surface did not reveal it's 3D structure. Being confronted with this problem made me realize that underlying the textbook's representation of the figure of the parallel planes was the assumption that a student who “looks” at what appears to be two identical parallelograms with corresponding vertices connected, sees a cube.

The immediate solution to this particular problem was to use a 3 D block. But that would not really overcome the general question of being expected to possess a graspable version of any given abstract mathematical object. Moreover, high school geometry requires students not only to see (which is challenging enough), but also construct, geometrical objects. However, with regards to the particular task at hand, we were somewhat lucky, since, incidentally, I had happened to be engaging with the *Tower*

²Official information about *Wikki Stix*TM can be found here: <https://www.wikkistix.com/what-are-wikki-stix/>

Parallel Lines :

The lines in a plane which are not intersecting are called parallel lines. Parallel lines are always coplanar. We write line $l \parallel$ line m . (see fig. 1.13)

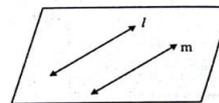


Fig. 1.13

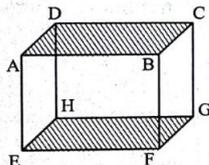


Fig. 1.14

Parallel planes :

Two non-intersecting planes are said to be parallel. In fig. 1.14 planes ABCD and EFGH are parallel planes.

Write the remaining pair of parallel planes.

***** EXERCISE 1.1 *****

FIGURE 4.1: 2D image of 3D cube

of *Hanoi* puzzle for my personal interest due to which I chanced upon a book which contained a theorem that spoke of an n -dimensional cube (n -cube, for short). The write-up presented a mathematical approach towards constructing an n -cube that proved useful in communicating a 3-dimensional cube to Faiz - We defined an n -cube as a unit of an n dimensional space. Beginning with a point, which was a zero dimensional unit, we constructed a 1 dimensional unit, or 1-cube by constructing another point a unit distance away, and then joined the corresponding vertices. In general, an n -cube can be drawn by constructing an $(n-1)$ -cube and then another identical $(n-1)$ -cube a unit distance away, and joining the corresponding vertices.

I asked Faiz if he could, continuing in this manner, trace a 3-cube on my palm (using his fingers). He began:

Faiz: First I will draw a 2-cube, which is a square. And next to it I will draw another square. And I will join the points.

Having constructed the 3-cube on my palm, Faiz easily pointed out which planes were parallel and which were perpendicular. For fun, I asked whether he could draw a 4-d cube. Without hesitation he began drawing a 3-cube on my palm and said:

Faiz: First I will draw a cube and next to it I will draw the same and join the points.

I did not anticipate that Faiz would manage to communicate a 4 dimensional hypercube to me, let alone do it with such ease.

4.3.1 Discussion: On Mathematization

To overcome the contradictions of communicating 3 dimensional abstract objects entailed redefining how we understood mathematical ideas as a whole. The mere making of diagrams tactile did not solve the problem of non-tactile diagrams. The lack of tactile diagrams proved to be a small symptom of a larger problem of Ableism. To overcome this hurdle entailed rethinking what it means to “learn” the concept of a cube. And in doing so, not only did we develop a deeper and broader understanding of the concept but also realized that questioning a given concept and changing our perspective on the learning of mathematical concepts could also contribute to creating an enabling learning environment.

I describe this process as an instance of “authentic mathematization,” by which I refer not to the final outcome of our exploration (in this case, of the cube) but the exploration itself. The fact that this exploratory process did not arrive at an expected outcome indicated something authentic about our investigation, due to which I refer to the process as “authentic mathematization.” I would therefore define “authentic mathematization” as a mathematical investigation without the expectation (whether conscious or unconscious) or compulsion to arrive at an expected or “correct” outcome.

While the exploration did not lead to an expected outcome from Faiz, the outcome was not something that could be characterized as a misconception. Had the interaction been with some other student, the outcome would have been something completely different. But the common factor would have been an authentic exploration of a mathematical concept that involved looking into the various properties of a cube and perhaps certain properties of other mathematical objects that shared some properties with a 3 D cube.

My interaction with Faiz indicated that this change in perspective on mathematics education holds a potential to facilitate inclusive learning.

In addition to mathematization, another aspect of teaching that I identified as central to facilitating inclusive learning is what I refer to as collective learning.

4.4 On Collective Learning

In order to demonstrate what I mean by collective learning, in this episode, I share an interaction with a student who I refer to using the pseudonym, Rina. In fact, my interaction with Rina played an important role in helping me understand the social model of disability more concretely, especially with regard to the relationship between exclusion and disablement.

At the time of recording this interaction, Rina was in the 9th standard and was studying for her on-going exams. I had volunteered to read out her textbook to her while having the audio recorder running so that she could have the mp3 recording of the lesson. In the midst of reading her book, Rina narrated her experiences of being discriminated against in the school. As the device was recording, her narrative too got recorded.

Rina had only recently been transferred into the school in question. While Rina's experience of discrimination did not come across as unusual at first considering that a visually challenged girl was discriminated against, she contrasted her experience with that in her previous (public) school in which she claimed to not face such discrimination. Both schools were "normal" schools (with blackboards, teachers without knowledge of Braille or Sign language, etc.). With Rina's permission, I share her narrative below.

Rina began sharing her perspective on how society treats blind people and connected it with what she experienced in school.

Rina: Society has not, till even now, accepted blind people. ... Meaning, from the top/superficially (उपर से) they show that "Yes, we help them" but from "the inside/within", their thoughts, mindset is not there, to help. ... I don't play with them, (They think that) "this will happen to her, that will happen to her." That's why I'm made to sit separately. ... I have received (sports) medals; meaning everyone, blind as well as normal children would receive medals. ... I showed that in school. Even still [the school teachers] would not know that in her also there is talent. ... till now, their thinking hasn't changed.

Rina expressed how although society claims to be helpful to blind people, it is all a pretence and merely superficial ("from top/surface") and which becomes evident in how

they treat blind people. In other words, while society may profess an egalitarian ideology, the real ideology (“from inside”) is revealed in practice where discrimination actually takes place whether knowingly or unknowingly. Despite having received medals Rina was not considered talented enough to be included.

Had Rina ended her narrative here, it could have been argued that Rina’s experience of discrimination might have been an inevitable outcome of being a blind girl. However, Rina continued by stating that she was not discriminated against in the government school in which she studied till class 8th. Also, as Rina expressed, neither was her friend, Ravi (pseudonym) who also studies at the centre, discriminated against.

Rina: ...my school before this, ... was very good. I did not at all feel different. ... And even Ravi (another student of the centre), they cooperate. ... And right in the front they keep me. Like in sports, etc. Yes, Anytime if anything happens then [the teacher] tells me. In this school so much discrimination doesn’t happen.

Rina used the term “include” to show how she was not discriminated in the government school. Rina claimed to not feel different at all and attributed the reasons to her friends and her teacher for cooperating with her. It was clear to Rina that her ill-treatment was not an outcome of her blindness but rather of how society deals with blind people. Referring back to her current (semi-private) school, she continued narrating how she was discriminated against by being excluded from participating in every activity.

Rina: But this private school, they [discriminate], very much ... keeping me separate. ... it might be with me also, meaning that I also didn’t manage to be involved.

Rina then spoke of a specific incident that had occurred the previous day during her exam in which she and her writer were made to sit on broken benches outside the classroom without a fan on a hot day, on the pretext that her writer would be a distraction to the other students. Rina expressed her concern for the writer and said that she would try to do something about it on the next day.

Rina: Now yesterday ... [for] the exam in which I sat to write. So all the children were inside, where they sit daily for class. So for writing the exam, there was no place there, so the teacher was saying that everyone will be disturbed [due to the writer] so I was made to sit outside. That I would get disturbed, that no one considered. ... Many questions like this come to me that, to me, why do they do this. Yesterday was also like this only. Yes, if it happened to me then it's fine. But my writer. What would she think? Today she came, tomorrow she won't come then whose loss would it be? My loss only, right? For me it is ok, make me sit anywhere, just let my exam happen. But that writer should be treated nicely ... there was no fan, if she felt hot then what would she think? bench may have broken, if she would get hurt then she wouldn't come to write. ... the writer was little nice, I said "sorry sister (didi) that because of me, so much happened to you." Tomorrow, I will see to it that something is done about it...

The school which Rina referred to as a "private school" was a government aided school, but unlike her previous school in which she studied till the 8th standard, here Rina had to pay fees. Also, since she was in the 9th standard, the "no detention policy" (which stipulated that no child can be held back till the 8th standard) as introduced by India's Right to Education (RTE) Act of 2009 no longer applied. Also, the school had overcrowded classrooms with an average teacher-student ration of 1:65, and broken benches. Rina's was in fact even denied admission in the private school on the pretext of her blindness. Only after a relentless struggle by the centre teachers was Rina finally admitted.

Rina's narrative concretely illuminated the social dimension of disablement as well as enablement. Rina's experience indicated that *exclusion was not the result of disability but rather, the cause of disablement*. But this observation indicated a radical corollary that blindness need not disable students from learning mathematics.

The opportunity to explore this corollary was presented to us when, as the exam were coming to an end, the centre manager inquired whether we could take some extra classes during the forthcoming vacations. Subsequently, at the end of the children's exams, through a discussion with the centre teachers, I proposed the idea that we have a

mathematics summer camp. The centre teachers and students were happy with my proposal.

4.5 Can blindness *really* not mean disablement?

We returned to the centre a few days later after having read some basic texts on teaching elementary mathematical concepts. We were three researchers and 15 students aged between 9 and 20 years. The students were either partially or completely blind. All spoke Marathi, and Hindi was their second language. The sessions were audio recorded and observations were noted. The discussions were carried out in Hindi (since we found Marathi difficult). The mathematics camp lasted for a total of 15 days.

We sat in a circle on the floor and I began by asking the children which topic they found difficult. I expected them to mention topics like fractions, decimals, long division, etc. and also expected them to complain about how these topics were taught in a visual manner. However, most of the students said “steps.” On asking them to clarify what they meant, they said that in school, they were expected to show all in-between steps while solving a mathematics problem. The children expressed how by using their tactile mathematical tools like the Taylor frame, they could indeed solve a problem but not show all the in-between steps that could fetch them their deserving marks. The students also wanted to learn multiplication tables among other topics. Through the course of the discussions, we decided that our session would be around the topic of divisibility.

We began discussing multiplication tables and followed by exploring rules for division by 2. Even after figuring out the rule (of seeing the units place), on asking if a number is even, the students still preferred to actually divide the number by 2. Not wanting the children to do so, I presented a bigger number: 3333333330, while emphasizing the reason for doing so. Although the children understood my question they found it more exciting to actually divide the number.

Rina translated and clarified my question in Marathi to her friends. However, instead of answering the question regarding whether the number is odd/even, the children preferred to discuss the number (for example, how big it was). One of students named Mona (pseudonym) was diagnosed with [sic] mental retardation (an outdated and problematic

term), and used to remain silent during our group interactions. I used to attribute her silence to her diagnosis. However, to my pleasant surprise, during the mathematics sessions, Mona often spoke to Shikha who in turn presented Mona's views to the class.

Often, the children ignored my attempts to proceed with the topic if they saw that some student was unable to catch up. The children ensured that no one was excluded in any way.

4.5.1 Contextualizing Subtraction

Towards the end of the day's session, Faiz explained to me why some students, like his friend Rizwan, did not understand the problems I was posing. Faiz told me that Rizwan had dropped out of school after the third grade. Rizwan, like many other blind students withdrew their admission from school on losing their eyesight. Only after a couple of years did they decide to complete their tenth grade through the open schooling

Faiz: what is odd and what is even, Rizwan doesn't know. We can see that if this goes by 2 and if we takes 4-5 examples then we can say that for bigger numbers it will be divisible by 2. Then only will it come in the definition. But like logically, this will go here, he hasn't learnt.

Faiz told me about Rizwan's background that I needed to take it into account while teaching.

Faiz: Rizwan brother gave his third standard exam after which he went directly to give his tenth, and there too he did not take mathematics. From the basics you will need to teach.

Faiz also shared the backgrounds of other children who had also not gone through the regular schooling route, to get me to consider those factors. But I thought that such details may be irrelevant to understanding basic number operations which we carry out while, say, shopping:

Rossi: That is true but ...you all do use numbers. Like when you go to the shop, then you get some idea that ...

Faiz: It's not a matter of idea. He has the idea. But... because now as per what he remembers ...he will divide and say, yes, it can be divided ... But (in the context of shopping) he has to also count money, ... products (सामान) are also there. Price is also mentioned. So there he can do it. But here you are saying, only this is given. And he wants to count the other. If all three are given then he will be able to do it. In practice, all factors are present, how much should be subtracted, how much (change) should be returned, how much is there with him, all those factors are there.

Faiz was cognizant of Rizwan's familiarity with handling the task of dividing and subtracting numbers in daily life while interacting with shopkeepers. But my reducing an imagined shopping situation to merely two numbers to be operated upon made the mathematical task unnecessarily complicated. Faiz articulated the various factors that needed to be considered while speaking of making a purchase involving "subtraction" - a price is mentioned on the product, the buyer gives some money to the shopkeeper; the shopkeeper hands over a part of the balance, and observing how much money the purchaser has with them, while keeping in mind the price of the product, keeps returning change until the exchange is balanced. Faiz pointed out how by reducing the context into a simple mathematical operation, I made some children feel lost.

4.5.2 A Discussion on Multiplication

The next day 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 42×42 . On deciding to explore the problem, all the children expressed their desire to work it out. Five students used the Taylor frame, a mathematical slate to work out the problem. Four students, who were partially sighted, used their pens and notebooks. But Faiz just gave out the answer. Faiz' explanation was " 42×2 is 84 hence 42×20 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. All the students were fluent in performing multiplication of three digit numbers with either the slate or using their note books or without any tangible objects (i.e. purely through thought). They did however, rely on their peers for explanation of the questions posed. However on asking the rationale behind the procedures they used for multiplication, most children didn't understanding the question. To be specific, I asked whether successive addition would yield the same result as multiplying. Or whether if the multiplication table extended till 42 would the result be the same. A few answered in murmurs. One student didn't understand what it meant to have a multiplication table going beyond 10. Her understanding of the multiplication tables was that it ended at 10, with no relation among the numbers in the tables. It turned out that this understanding was shared by a few other students as well. The rest of the session was used to sort out this issue. 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, due to which the students discussed among themselves. It was quite common for a student 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 capable of multiplying them with as much ease as 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. The students expressed amusement by the observation that multiples of 10 ended with a zero. Much more so was on the divisibility condition for 9. However they did not express much interest in discussing the reason or mathematics behind these patterns, at least not at that time.

They didn't 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. The test for divisibility by 9 proved to be particularly easy since the proof followed directly from the standard technique of calculating using the abacus which the students were familiar with.

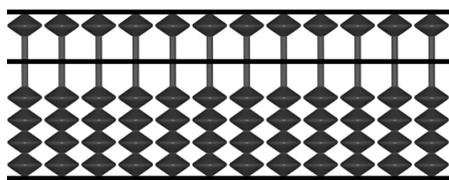


FIGURE 4.2: Abacus representing number 0

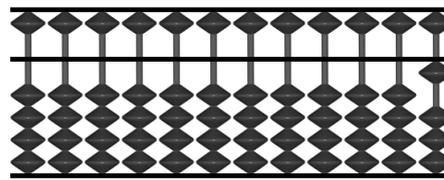


FIGURE 4.3: Abacus representing number 1

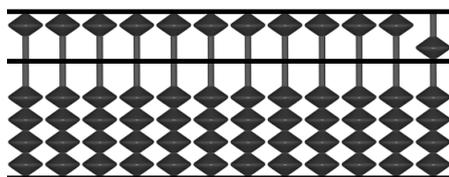


FIGURE 4.4: Abacus representing number 5

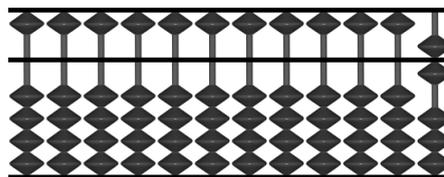


FIGURE 4.5: Abacus representing number 6

4.5.3 Testing Divisibility of 9 using the Abacus

The abacus is a simple mechanical device made up of rods held together by a plastic or wooden frame. Each rod holds a set of beads. In the case of the abacus that the students were trained to use, there were 12 rods, each containing 5 beads. The beads were partitioned horizontally so that the top part of each rod contained 1 bead while the bottom held the remaining 4 beads. A number could be represented on the abacus using the beads. Each bottom bead held a value of 1 while the bead above had a value of 5. The rods represented the place value where the rightmost rod indicated the units place, followed by tens place and so on. In figure 4.2³, the abacus denotes the number 0 while in figure 4.3, the number shown is 1 since a lower bead from the units place is moved towards the horizontal partition.

Any given number can be represented on the abacus by moving the appropriate number of beads from the rod denoting the appropriate place value towards the horizontal partitioning. For example, in Figure 4.4 and 4.5 the abacus denotes the number 5 and 6 respectively since the top bead in the units place moved towards the horizontal partition indicates number 5 and the lower bead has value 1. Similarly, the numbers represented by the abacus in figures 4.6 and 4.7 are 6570 and 6660.

³Abacus images generated from: <http://www.alcula.com/soroban.php>

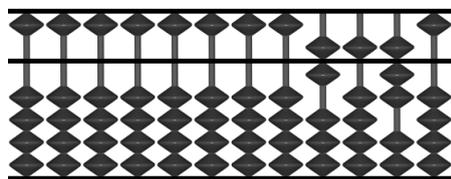


FIGURE 4.6: Abacus representing number 6570

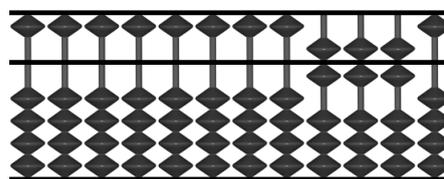


FIGURE 4.7: Abacus representing number 6660

To add numbers 2 and 1 using the abacus, beginning from the zero position (Fig. 4.2) first, 2 beads are moved towards the horizontal partition followed by moving one more bead. Similarly, to add 5 and 3, first the top bead that represents 5 is moved towards the horizontal line, followed by three of lower beads. However, the same method cannot be used to add numbers 3 and 4. For this, 4 is treated as $5 - 1$. Therefore, in order to add 3 and 4, first three beads are moved towards the partition followed by the top bead representing 5 followed by moving one lower bead down, thus resulting in the number 7. A similar method is used to add 9 to a number. 9 is treated as $10 - 1$. Therefore, in order to add 9 to a number, a bead in the tens place is moved up while a bead in the units place is moved down. Since the number of beads moved up and down is the same, the sum of digits of a number remains invariant when 9 is added to it. Therefore, if you begin with the number 9, and keeps adding 9 to it, the sum of digits will always remain 9 until you reach the number 99 or a bigger number whose sum of digits is a multiple of 9. For example, in figure 4.6, the abacus displays the number 6570. Adding 90 to 6570 involves adding 9 to the tens place which effectively means moving a 100s place bead up while a tens place bead down thereby arriving at the pattern as shown in figure 4.7 which we see to be the number 6660. Since the number of beads moved up and down are the same, the sum of digits remains the same.

As the students were familiar with using the abacus where 9 was conceptualized as the action of moving one bead up and another bead down the divisibility rule for 9 followed directly from this knowledge of using the abacus.

In the course of time, most of the students were competent in justifying why a particular number is divisible by another. However, for numbers less than 1000, they performed the division algorithm in their minds and gave out the answer as a justification for divisibility. To test their understanding, I presented an example: “Is the number made of ten 3s followed by 15 (i.e. 333333333315) divisible by 15?”. Since most of the students didn’t

understand the question, I chose smaller numbers: 315 and 3315. However, the students worked out the solution by actually dividing the number (in their minds) by 15 and giving out the answer. Although I was impressed by their mental computing, I didn't know whether they used their understanding of divisibility rules to check 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 answer along with explanations did emerge.

On ending the day's session, one of the students, Binita (pseudonym) gave me some homework. She asked me to solve thousand 3s and 15 (i.e. $333\dots315 \div 15$). i.e. A 1002 digit long number where the first thousand digits are made of 3s followed by 1 and 5 which had to be divided by 15. On the following day I forgot about my homework but Binita reminded me 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 give the correct answer. After a minute, they all agreed that it would. I continued, "So 333333 thousand times followed by 15 divided by 3 would give 111111 thousand times followed by 05. This number divided by 5 would be, let's see, $11 \div 5$ 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." Binita immediately said that I was correct. Being surprised that she was so confident, I asked her to explain. She responded that " $315 \div 15 = 21$, $3315 \div 15 = 221$ Therefore, the answer is a thousand 2s followed by 1." Although I was impressed, I couldn't help feeling a little uneasy over what appeared to be inductive reasoning in mathematics. I articulated my discomfort. And her reply indicated that she in fact didn't use inductive but rather deductive reasoning. Her reasoning was that dividing the first 33 would give 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 thus leaving 15 which gives the last digit as 1 with remainder 0. We discussed few more numbers and ended the day with a homework of thinking of numbers that would divide 3600.

The following day we explored what the children had to say. Each student presented 2 numbers whose product was 3600 and explained to the rest how they arrived at a particular number. The responses included, "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 it by saying that “Since the number is divisible by 100, it must be divisible by 25.” Since it is also divisible by 3, and 3 is not present in 25, 3600 is also divisible by 75. Since we had earlier already agreed 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 topics we covered during the sessions included: Divisibility rules for 2, 3, 4, 5, 6, 8, 9, 10, 11 and numbers made up of a product of those numbers eg. 15, 35, etc., the idea of primes, relative primes, LCM, GCD, the rationale behind writing the number 0 for multiplication, and also developed an intuition of Mathematical induction.

During the final session of the camp, we discussed the nature of mathematics. The students all stated that mathematics is all about calculation. Although the children did a significant number of exercises involving proving, they did not consider the concept of proofs as a significant aspect of mathematics. They also discussed albeit without my intervention, how people who have never even been to school know mathematics, by citing examples of young vendors.

4.6 Authentic Mathematization in the Classroom

A few months later I conducted another maths camp. The new academic year had begun. For this camp, I was the only researcher. 7 students participated in the camp. I planned to quickly revise natural numbers, odd and even numbers, and move on to more difficult topics like fractions. I began by asking the students their difficulties. Since no student responded, I asked, as a leading question, whether they had difficulties with fractions and decimals. Ravi, the youngest student in the room, responded, or perhaps repeated, “fractions.” I asked whether they had difficulties with long division. Faiz translated the term “long division” to the students in Marathi. The students responded that they found long division difficult. Noting down “long divisions,” I asked again what they found difficult. Rizwan replied that he finds all of mathematics difficult, and proceeded to state that he manages to work with 2-3 digit numbers, their addition and subtraction. He said that he was learning multiplication, and would soon be learning division. Rizwan also

said that he has been learning all this on the abacus from a visiting teacher at the centre. Prakash and Ravi both said they found long division difficult.

I asked Faiz what he found difficult to which he replied that he didn't find anything difficult. On probing further, he responded with a disappointed tone that he finds mathematics easy since he has opted for the "low level" mathematics. Faiz was now in the 9th grade but had opted to be tested for 7th grade mathematics for his exams (also referred to as 'easy math')⁴. I was upset on hearing this since Faiz had expressed a tremendous desire and interest in pursuing higher mathematics, and opting for the lower level mathematics would foreclose any possibility of doing so. On asking Faiz the reason for his decision, he replied saying that he planned to pursue the arts stream and give his civil service exams after his 12th grade examination, and pursuing arts or commerce would be beneficial in this regard (it was later revealed to me, which I have mentioned in Chapter 5, that this wasn't the reason).

Faiz was very articulate about the specific topics that I should address, and was quite cognizant of the various difficulties that his friends were experiencing but which they were unable to express to me. Faiz pointed out that for example, rules concerning the multiplication of decimal numbers that involves removing a point, carrying out the operation and then placing the decimal point back into the number gave rise to many problems for students. Hearing this, the other students, especially Ravi nodded in agreement. Faiz suggested that I begin teaching from the basics like multiplication and division. Rizwan also requested that I teach from the basics of mathematics at least with him but expressed his concern that his peers might want to go beyond. I suggested that we could take a topic that may be agreeable to all like multiplication involving smaller decimal numbers. Faiz suggested that I give the students a mathematical exercise to carry out and explore the different methods used by the students:

Faiz: You know what to do? You can give a test type maths sum ... the same will be given and everyone will do it. Who ever does it the fastest ... meaning everyone will tell their method ... and whoever's is the fastest

⁴As reported in a Hindustan Times news article (Pednekar, 2016), "Easy math was introduced by the Maharashtra state board in 2011 for students weak in math, in order to improve the pass rate of the subject. There was only one catch. Students choosing easy math would not be able to take admissions in the science stream in Class 11 or to industrial training institutes (ITIs)." The option to pursue easy/general math was scrapped in 2017.

everyone will use that method because all will find that the easiest. We can make our *own* methods only. It is not necessary that we take the methods from the book. Such a sum will be given to everyone; everyone will solve it; then everyone will have a different method. And whoever solves the fastest, we'll use their method and see.

Rossi: Oh that is a good idea . . .

Faiz: It may also happen that whoever solves the fastest, through their method for everyone else it could be slow also or may be faster also. But we will see what happens. So we'll get to see different methods also and from there what is easiest, that also we will come to know. . . . we will also get to know their views and also know what they will find easy.

Keeping Faiz's suggestion in mind, I asked the students which topic should I begin with. I suggested long division. But Prakash suggested that I begin from basics, after which the other students too suggested that I begin from the basics. On asking for clarification, they referred to addition and subtraction. Since we had covered up basic topics in our previous camp and also since I knew that the students has some familiarity with addition and subtraction, I asked whether they learnt about negative and positive numbers. Rizwan responded by saying that he learned "even and odd numbers". So I said that I would begin with revising even and odd numbers. However, the discussion that followed triggered a deeper discussion on even and odd numbers.

4.6.1 A discussion on even and odd numbers

I began by asking Rizwan whether by "even and odd", he meant, 1, 3, 5, 7, versus 2, 4, 6, 8, etc. And this turned into an insightful discussion on even and odd numbers.

Rossi: Even and odd? You mean like how 1, 3, 5, 7 are all odd? And even will be 2, 4, 6, 8? And 0 is also there in it, no?

Rizwan: How will zero come in it?

Prakash: It will come in both (दोनो मे अएगा).

Rossi: Zero will come in both?

Rizwan: No zero will not come in both. it will come in odd. zero, two, four, six, eight, ten ...

Ravi: eleven, thirteen, ...

Rizwan was confused regarding the parity of zero. At first he thought it is an odd number (like 1, 3, 5, ...) and then agreeing with Prakash, he also said that it will come in both sets (“दोनो मे अएगा”). But then he referred to the set of even numbers as “odd numbers” and included zero with 2, 4, 6, ... But then Ravi continued to say eleven and thirteen. So I asked what are even numbers and odd numbers.

Rossi: So what are even numbers and what are odd numbers? What is the meaning (अर्थ), definition of even numbers? What will be the definition of even numbers?

Faiz: Perhaps (शायद) even is that which (ईवन जो होता है) into two even (समान) parts we can divide. And odd numbers are those that we cannot divide into two even parts. Like it will become $1\frac{1}{2}$ (डेढ़) and it will become $2\frac{1}{2}$ (ढाई)⁵.

Rossi: So, zero. Is it odd or even?

Faiz: It is both. (Faiz laughs)

Rossi: ... because we can divide it into two parts? And in two parts we

Faiz: ... can also not do it.

Rossi: So it's both? Ok ...

The consensus among the children that zero cannot be divided indicated a particular shared understanding of what it means to divide. However, Faiz did not share this particular idea of division considering how he described his idea of odd and even numbers. Despite having a deeper understanding of odd and even numbers, Faiz did not try to impose his understanding of the concepts but actively participated with the discussion.

In order to get the students to arrive at a clearer understanding of even and odd numbers, I asked a rather provocative question regarding the possibility of dividing 3, and also $1\frac{1}{2}$, by 2. I gave an example of dividing 3 cabbages into 2 parts. Faiz said it could be possible by cutting one cabbage. Faiz added that such a task would be extremely difficult since the cutter would need to ensure that the cabbage is cut into exactly equal halves:

⁵in Hindi and Marathi, the numbers $1\frac{1}{2}$ and $2\frac{1}{2}$ have a distinct name, pronounced *Dedh* and *Dhai*

Faiz: Then after cutting if we see that it didn't [get cut exactly into two equal part] then now how much should be cut to make it [equally divided into two equal parts]. So continuing like this it will be difficult. Meaning it is possible for anything to be made half but its very difficult and ...

Rossi: So its coming to my mind that any number can be divided by 2.

Faiz: Yes any number.

Rossi: So any number can be divided into 2. So why do we say that some numbers are even and some numbers are odd. Maybe this question is not important.

After a few seconds of silence, Rizwan expressed his dissatisfaction with the discussion that any number can be divided into two. But it took him some effort to express his discomfort.

Rizwan: Sir, Even and Odd. Now like there is 2, there is 4, there is 6 (दू है, फोर है, सिक्स है). Now we'll take six number. So on dividing six number, equally dividing, if we divide in two two, so we'll have three parts. And if you divide by two you will have three three. Because equal number come right? And if you take an odd number like seven. Seven is an odd number. so if we divide into two parts than what number will come?

Rossi: $3\frac{1}{2}$ (साढे तीन).

Rizwan: $3\frac{1}{2}$ how will it come? We want an equal number no? $3\frac{1}{2}$ $3\frac{1}{2}$ is coming but like 3 and 3. *Sadhe* (साढे) why is being counted? *Sadhe* should not be counted no?

Ravi: Then we will have 3 and 4.

Rossi: Ok let's consider those objects that cannot be halved ...

Rizwan had a difficulty conveying the idea that odd numbers cannot be divided by 2 and leave whole numbers ("like 3 and 3" as a result), as it happens with 6. Rizwan however recognized a distinct property among even numbers that they can be divided *into* (sets of) twos and also divided *by* two.

To provide a context for talking about odd and even natural numbers, I used the example of objects like ice-creams and balloons, since they cannot be halved.

Rossi: If 7 balloons are there and we need to divide them into 2 parts, then we cannot do that. So for odd and even, if we want to take examples then we need to take examples of those objects that we cannot cut into (a quantity) less than one.

The discussion evolved into questioning the need for naming sets of numbers like even and odd numbers. In the process, the topic of prime numbers (मूल संख्या) came up, followed by a discussion on the reason why number 1 is excluded from the set.

The following day we decided to revise the topic.

Rossi: Ok let's begin with even numbers and odd numbers. So can anyone tell me what are even numbers?

(After a few seconds)

Sumanna: 2?

Rossi: Ok. 2 ... Ok, 2 is an even number. Other than that?

Raju: 6

Rossi: 6 is an even number.

Sumanna: 4 is also there.

Ravi: 2, 4, 6, 8

Prakash: 10

All the students: 12, 14, ...

Rossi: So a pattern has come.

The students recognized a familiar pattern among numbers considered even. It wasn't clear at least to me whether the number they were stating were evidently divisible by 2. Also, I wanted to move onto negative numbers and arrive at a clearer consensus that zero is an even number. So I asked whether if we move backwards from 10 till where would we reach?

Rossi: Ok let's begin with even numbers and odd numbers. So can anyone tell me what are even numbers? 10, 8, 6,

Students in unison: 6, 4, 2.

Rossi: So does it terminate here or can we go beyond 2 also?

The students seemed rather confused with the question. So I continued

Rossi: May be we cannot go beyond.

The students were rather confused with my further questioning. So in order to find a ground to proceed from, I tried to understand how did they arrive at their understanding about even numbers. However, in the process, I confused them further.

Rossi: Ok. If you look we see that even number are those numbers that we can evenly divide into two parts. But how do you know this? Is it given in the book or did you look at examples and infer that even numbers are those numbers that can be divided into two parts? How do you know this about even numbers? So how do have the information that even numbers are those that you can divide into two parts? I agree that if we begin with 2 and proceed from there then we can see that from there 2, 4, 6, 8, 10 etc all can be divided into two parts. But it can also happen that possibly some even numbers are there that we cannot divide into two parts. Do you understand what I'm saying? (after a pause) Perhaps I'm confusing you.

Realizing that I was really confusing them, I turned to Faiz (who also visibly yet politely aware of my confusing his friends) and reminded him about how he was participating actively in the previous session. Faiz took over with a rather materialist approach towards the concept of odd and even numbers. His questions and arguments were based on what he observed rather than the "given" ideas as portrayed by the textbook. And the other students were then noticeably more actively engaging with the topic.

Faiz: Yes Sir. Actually even numbers, the definition given and proven also that those numbers that can be divided equally into two parts, those are called even numbers. Like the children said, 2, 4, 6, 8, so if you take 2 you can divide into 1, 1, if you take 4 then 2, 2. Nothing remains, its dividing equally. 6 also 3, 3. 8 also 4, 4. So such things can be divided. These things are getting divided into twos, equally. That is why they are called even numbers. So that is why perhaps a definition type happened, that those numbers that can be equally divided, those can be called even numbers. Nothing remains.

Faiz expressed his guess that the definition came later than discovering the pattern. What Faiz stated was insightful and rarely spoken in a maths classroom. However, I was rather eager to finish the topic quickly and at least get the students to arrive at the conclusion that zero is an even number. But I did not want to merely assert that claim. So I argued in the following manner:

Rossi: Here two things are happening, one is that we can divide by two so that we get 2, 4, 6, 8, and the other is that after dividing, nothing remains. And if we consider the latter, then zero also gets included. So what is the definition, that we can divide by two? Or if we after dividing by two, nothing remains? So are these two definitions equivalent, same? (after a pause) or are they different?

I wasn't quite making sense. So Faiz stepped in with a suggestion of a definition. I tried to continue from there. And on asking Ravi (the youngest student of the group) whether he was understanding, he responded with how Faiz explained the concept.

Faiz: So this is how we should do it. In two parts we divide the number and nothing remains.

Rossi: So we divide into two parts and nothing remains. But if we don't say that nothing remains, ... Is everyone understanding? Ravi? So can you tell me what are even numbers?

Ravi: Even numbers like 2, 4, 6, 8, 10, 12

Rossi: Those are examples, right?

Ravi: Yes.

Rossi: But what is the *definition* (अर्थ).

Ravi: Even number like 2 we can divide into 1-1; 4 we can divide into 2-2

I continued by emphasizing that although we can divide any number by 2, we will focus on the set natural numbers due to which we can speak of even numbers. I explained that if we include 3 in the set of numbers divisible by 2 then we would need to include $1\frac{1}{2}$ as well, citing the example of how even $1\frac{1}{2}$ kg of sugar can be divided into two. I then suggested that if we were to create a definition by looking at the properties of even numbers we

could arrive at a definition. I expected the children to point out that divisibility by 2 is the property. However, Faiz pointed out another property.

Faiz: If you take the product of two even numbers, you get an even number; if you take the product of two odd numbers, you get an odd number. With plus minus also you get even numbers. If you plus two even numbers you get an even number; if you minus also you get an even number; and if you plus or minus two odd numbers, you get an even number. That is why I took the third (Arithmetic operation), multiplication. With this you can find out that both are different.

Rossi: (Repeating Faiz's observation) So if you multiply two even numbers, you get an even number and if your multiply two odd numbers, you get an odd number. Are there any other properties?

As there was no responses, I prompted to Faiz that further patterns could be found

Rossi: So if you multiply odd with and even number, you still get an even number, right? Like 2 and 3 gives you 6.

Faiz: (in surprise) Yes Sir! correct!

Although the other students appeared quiet, they were engaging silently, and paying attention to what Faiz was saying. Ravi interrupted with his observation.

Ravi: Sir, like if you add an even and odd number, you get an odd number.

Rossi: Yes. If you add an even and an odd number, you get an odd number. Are there more properties? ...Let's think, there are so many numbers. Within even numbers, what is it that happens? ...

Sumanna joined in the discussion.

Sumanna: Sir if with even numbers you add or minus then its answer will come in even number only. And with odd numbers (Sumanna stopped).

Rossi: Ok. And with odd numbers?

Sumanna: the answer will come in odd numbers only.

Rossi: Odd number if you plus or minus then you get an odd number?

Can you explain with an example? Like if you have two odd numbers

Sumanna: Like 3 and 3 ... if you plus, you get an even number.

Rossi: With 3 and 3, you get 6

Sumanna: which is an even number.

Rossi: 3 and 5, becomes 8, which is also an even number.

Sumanna: 3 - 3 becomes zero ...

Rossi: 3 - 3 is zero; but zero is giving some confusion. We'll keep that to the side. So we'll take other two numbers.

However, Faiz interrupted:

Faiz: Our (हमारा) definition that we (हम) just made, so in that zero becomes a type of even number, no? Because what happens is, of two odd numbers if we plus or minus, so answer come out even. 3 - 3 is zero so zero is an even number.

On asking the other students if they understood Faiz's point, Faiz repeated his argument in Marathi. The students were now visibly interested in this particular property of odd and even numbers. The discussion moved onto the examples of adding two packets of chocolates, one packet containing 6 and the other containing 7 chocolates, with the total having to be divided among two children. And this example was used to explore the property of addition between odd and even numbers. Faiz proved this property using the example of 5 and 7 objects to be divided among two children.

Faiz: Like 5 is there and 7 is there. Children are 2. First, with 7 we will divide 3, 3, one remains, we keep it to the side, then from 5 we divide 2, 2, one remains, we keep to the side. Now one and one becomes 2 no? Then those you divide 1, 1. Done! I mean you can divide after adding also.

Ravi: 6, 6 will be received by them.

On asking the class if they understood, Ravi excitedly responded that he did. He insisted on explaining.

Ravi: Like there are 5 and 7 chocolates. Two children are there. (In his excitement he forgot that he started with the example of chocolates) 5 ice creams are there and 7 ice creams. So what he did, first divided 3 and 3 between the two children, then 1 remained. Then he divided the 5. With that he divided 2, 2. And then from 7 and 5 what remained those two were divided so it divides into 6, 6.

Faiz' proof of the property that even/odd \pm even/odd gives an even number was well received by the students, the youngest of who (Ravi) was 9 years old.

4.6.2 On the parity of -4

Trying to move on to negative numbers, I asked about -4:

Rossi: -4. Is it an even number or an odd number?

Faiz: Sir, before that if we think that this -1, -2, why did it come?

Rossi: Oh! -1, -2, why did it come?

Faiz: I mean, for what purpose did it come?

Rossi: Ok! For what purpose did it come...

Faiz: Because only after that would we know whether it is an even number or an odd number.

Rossi (to the class): Faiz asked a good question. He asked, where did -1, -2 come from?

Rossi (to Faiz): Why did it come? Meaning...?

Faiz: Meaning, there has to be a reason. Without reason...like we did for even and odd numbers. So then we found out that we can divide things...in two parts...we can evenly divide, *so we gave them the name, even numbers.* Similarly, if they cannot be divided, we gave them the name, "odd numbers." So something might have happened so that this -1, -2 came.

Rossi (to the class): Oh ok...We can think with examples of where -1, -2 could be useful.

Faiz: Sir, like houses are built...like there are storeys on the top... there is a ground floor... below that also they build something, like a basement... Below that also they make two, three floors...like we had gone to the theatre...

Faiz (to Prakash): it was there also right? Basement? for the car park?

Prakash: Yes. Parking lot.

Faiz: Parking lot was in the basement... So we, in the lift... after zero, we saw -1, -2...

The discussion that continued emphasized the need to conceptualize odd and even numbers. For Faiz, it was necessary to know the historical (material) origins of a concept, in order to meaningfully answer questions related to it. I however had simply wanted to complete my lesson plan by linking what a student said, to the concept I wished to teach. So I continued:

Rossi: ...if we look at the different floors of the building, it's necessary for us to have -1, -2. ...if we go to the second floor, and if we go down by even numbers, then through even numbers, we reach zero, which is the ground floor, right?

Faiz: Yes.

Rossi: And below that also, if we go two floors lower, then you reach -2 which is also even ...

Faiz: So this means that -4 is also an even number.

The children were convinced that -4 is best categorized as an even number - These numbers fit into a continuous pattern of alternating even and odd numbers, whether read backwards or forwards. However, Faiz interrupted:

Faiz: Sir, [the concept of even numbers is] very old! So how could those people think that in the future such houses would be built?... They must have made (negative numbers) with something else ... we are coming up with these right now because in front of us we have these made... so they could not have made this -1, -2 after that...

Rossi: we can try to guess how that happened. We may need to look it up in history...

Faiz: Because if we try to fit these into our example, it is fine... but what I'm thinking is that this (-1, -2, ...) is many years old. So that time also houses (like this) must have been there. So why would they have thought that in the future, such houses would be there where -1, -2 ... we need to look at another context...

I posed the question to the other students. But Faiz kept thinking aloud:

Faiz: ... Maybe at that time, ... such advanced technology was not there ... (after a long pause) Aah! It might have happened that at the Harappan civilization houses had wells where ... where water would automatically change ... It was advanced but perhaps negative numbers were even before that, perhaps ... So how could that have come into being... because now, we are advanced ...

Faiz presented a more materialist perspective on mathematical ideas. For Faiz, mathematical concepts were not to be seen as some sanitized collection of undebatable claims existing independently of human mediation. He argued that mathematical concepts are not to be taken as the starting point of a mathematics discussion or as though existing *a priori* and to be fitted into an example, but insisted that they are developed by people for a reason. Faiz's perspective on mathematical concepts seemed to resonate with the philosophy of Engels (1877a) who wrote, "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 man which conform to these principles, but the principles are only valid in so far as they are in conformity with nature and history".

Faiz inquired into the possible history of numbers, developed definitions based on his observations of the properties of numbers and also challenged, for example, the evenness of zero. Faiz effectively transformed the nature of our mathematics teaching sessions in which all the children and rarely approached mathematical ideas from a idealist or reified standpoint. The children took ownership of their mathematical knowledge and redefined

the very norms of mathematics learning by debating and creatively engaging with, and bringing their own mathematization to the learning process. Faiz had also pointed out that the way I introduced a mathematics concept which was new to some students, was alienated from the contexts that they were familiar with, due to which they felt alienated.

4.6.3 Revisiting authentic mathematization

Faiz's questions got me rethinking about my own beliefs concerning the nature of mathematical concepts. For example, if a student considers 0 as an odd number, is it a misconception? If a student invents a crazy concept like "abc-numbers" and "xyz-numbers" and decides to categorize, 3.5 in the set of abc-numbers, does 3.5 become an abc-number? If another student calls 3.5 a xyz-number, would it be a misconception? Similarly, is calling 1 a prime number, a misconception?

The incident also reminded me of a previous incident in which I had discussed the concept of prime numbers with a classroom of students who were selected for a competitive exam. In that session, I began by asking the students the definition of a prime number. The students responded in unison, "... a number that can only be divided by 1 and itself." I then asked about the primeness of number 1 since it fit their definition. However, the students refused to accept 1 as a prime number (possibly because their books said so). In the discussions that followed we decided to redefine the concept of primes as: "numbers *greater than 1* that can only be divided by 1 and itself." Our exercise in redefining the concept was to highlight a common practice among mathematicians that involve establishing a convention in order to make life easier and theorems more elegant. For example, in the context of prime numbers, as stated by the Field's medalist Terence Tao, "It is because of [*Fundamental theorem of Arithmetic* (FTA)] that we do not consider 1 to be prime" (Tao, 2007, p. 3). Had the number 1 been considered a prime number, the factorization of natural numbers > 1 would not be unique because for example, the number 12 would have prime factors,

- 2, 2, 3
- 1, 2, 2, 3
- 1, 1, 2, 2, 3, etc.

In fact, the number 1 was considered prime up until 1940s (For example, [Lehmer \(1941\)](#) introduced the nomenclature for prime numbers by stating that “the letter p designates a prime which may be ≥ 1 , > 1 , or > 2 according to the context”). And this raises the question on whether it even makes sense to ask if 1 is a prime number? Would it have made sense to ask the same, say, during the 1930s in some exam, with the assumption that there is only one correct answer? Is the concept of prime numbers now “finalized”? etc.

To make an argument for contextualizing a mathematical concept is not to suggest that every mathematical concept needs to be contextualized. Rather, it is to acknowledge and take into account that even complex mathematical ideas have their roots in the material world where people invent or conceptualize ideas, as Faiz suggested, for a purpose. For example, Faiz did not object when I asked him to construct a 4 dimensional hypercube on my palm. On the contrary, the fact that a 9th standard student could construct such a non-contextualizable mathematical object as a 4-dimensional hypercube was made possible precisely because the starting point was given a contextual basis.

4.6.4 **Mathematization and the case of the parity of zero**

After a few discussions, we ended the day’s session with the consensus that 0, -2, -4, ... are even numbers. However, this agreement was challenged in the following session when Faiz pointed out that unlike even numbers, 0 has a distinct property - if you keep dividing any even number (2, 4, 6, ...) by 2, you will sooner or later arrive at an odd number. For example, $12 \div 2 = 6$; $6 \div 2 = 3$, which is an odd number. This does not happen with zero. The children now insisted that zero cannot be simply categorized with other even numbers and that it was a special kind of number. The students’ observation, although insightful, made me anxious. Noticing my anxiety, they reassured me that for their exams they will regard zero as a regular even number, but maintained that it is a special number. Only in hindsight did I learn to appreciate how their argumentation served as a form of resistance (even if not consciously intended) against buying into the ideology propagated by a curriculum embedded within an examination system.

Reflecting on my spontaneous reaction to this incident made me realize the ideological nature of ableism. Although I thought I *believed* in following a constructivist approach

to teaching, in *practice* I saw myself getting them to arrive at the “correct” answers and definitions. Furthermore, I was also presenting the idea that the given body of knowledge would be inevitably arrived at even if they freely constructed knowledge based on their observations. Roth and Mukhopadhyay (2012) have pointed out how, “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” and for many this means “symbolic violence to the forms of mathematical knowledge they are familiar with” thereby contributing to “the reproduction of social inequities” (p. vii). Despite knowing that Constructivism should be undermining the idea of (normative) mathematical “ability,” my practice continued to reinforce such a normativity by driving the knowledge construction process towards a given body of knowledge. It was only the children’s, and especially Faiz’s questioning of this given body of knowledge and *normative* practices of mathematics, that served to undermine this normativity.

On the one hand, the episode answered one of the sub-questions of my research concerning whether “a shift from mathematics to (the process of) mathematization [would] be effective in terms of learning, and liberation and empowerment”. But on the other hand, I saw myself being the one driven to prevent mathematization from happening.

The fact that I tried, albeit unsuccessfully, to prevent authentic mathematization among the children evinced the ideological character of ableism. Being ideological, ableism functions not merely at the level of ideas and beliefs but at the level of practice even if the practitioner professes a belief against the ideology. Fortunately, the children’s argumentation served as a form of resistance to my ableist ideology. However, as I had articulated in (D’Souza, 2016), on narrating this incident to some of my colleagues, I observed discomfort at the thought of “poor blind children” having the “wrong” concept. “What if they give such answers in their exams?” and “You finally told them the correct definitions, right?” were typical responses. I “needed” to tell my students the “correct” definition of even and odd numbers, albeit with a disclaimer about the nature of formal curricular mathematics, lest they raise questions or present alternative mathematical opinions in future mathematics exams, and fail.

I theorized the incident using the notion of, what I called as, *ideology of merit* in order to contextualize it in the contemporary Indian context where *merit* through its

interdependence with caste (Brahmanism) plays a defining role in formal school education. By ideology of merit, I meant “the underlying (conscious or unconscious, explicit or implicit) worldview in which “merit” or “excellence” is taken to be the main driving force for learning a body of knowledge. And, in mathematics education in India, “excellence” too often refers to how well a student can follow prescribed (or other) procedures to solve given problems in order to get the one given correct answer to each problem, thus limiting the opportunity for students to investigate answers or ask their own questions. Our investigation of odd and even numbers was restricted through this ideology of merit” (p. 21).

We often do not know what our ideologies are; they can only be revealed by examining our actions. For example, if we profess to have an ideology of peace and non-violence, but go to school and regularly beat our students if they misbehave, then our actual ideology is not non-violence. Similarly, we may profess an ideology of believing in the importance of an inquiry method of teaching, but then not allow students to ask questions—especially systemic questions. By analysing our actions, we can try to understand our ideologies and also work towards changing them. When our ideology is consistent with the ruling or dominant ideology, we tend not to realize that we have it.

I was unsuccessful in unintentionally instilling values of individual merit, excellence and competition in the learning environment that would have most certainly led to some students lagging behind, and probably blaming their inabilities/disabilities. By ignoring me and ensuring that their friends were not left behind, the students effectively exercised a collective resistance to the kind power that I was unintentionally exerting that would have otherwise served to further reinforce the prevailing belief that exclusion is an expected outcome of disability.

The distinctive character of the students’ responses to my teaching can be better understood by contrasting it with, for example, resource-rich mathematics classrooms of unaided private schools in Mumbai. [Khanna \(2017\)](#) presented a sociological study of one such classroom in which he observed an “...eagerness of the boys at the front to contest and answer questions in a flash”. Khanna attributed this to “a strong spirit of competition and rivalry” that might have emanated “from competition among elite schools in the region, as parents from relatively privileged backgrounds prefer to get their children admitted to schools showcasing the best outcomes” (p. 25). In comparison

our sessions were dominated by a spirit of cooperation and empathy through which the students ensured that none of their friends were excluded from participating in our discussions. It is quite noteworthy that the spirit of cooperation and empathy was not an outcome of my intervention. The students' culture resisted my unintentional attempt of getting the children to compete with each other to, for example, get the "correct" answer to my questions.

The spirit or eagerness of competition we see inside classrooms should not be seen in isolation from the ideologies prevailing in the society where the school is located. As I mentioned in [D'Souza \(2016\)](#), (the ideology of) Merit is interdependent with what [Teltumbde \(2008\)](#) referred to as hyper-individualism which stems from Neoliberalism:

[Neoliberalism] atomizes society into discrete individuals, each against the rest of them [...] It legitimize[s] the right of (the) strong to exploit 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 [...] Neoliberalism believes that the world should be [an] enjoyable place for those who deserve it and should be rid of those who do not. (p. 22)

Neoliberalism regards capitalism as an ideal economic system that is stable, and considers the apparent problems of capitalism as an outcome of external interferences that should be gotten rid of in order to maintain its smooth functioning.

[Parenti \(2002\)](#) also argued in a similar fashion how the market economy produces a culture of competition.

Born of a market economy, the capitalist culture is essentially a market culture, one that minimizes cooperative efforts and human interdependence and keeps us busily competing as workers and consumers. . . . People are expected to operate individually but in more or less similar directions. Everyone competes against everyone else but for the same things. "Individualism" in this corporate-dominated culture refers to privatized ownership and consumption. We are expected to get what we can for ourselves and not be too troubled by the problems faced by others. (p. 31)

Neoliberalism is an extreme stage of capitalism which produces the ideological belief that if every individual pursues their own private interests (in competition with other individuals), everyone's prosperity will be maximized. Under Neoliberalism, where competition is the norm and takes on an ideological form, it is not surprising to find a similar ideology regulating inter-student relations within a classroom. To showcase the culture in the study centre was not to say that our classroom was insulated from the ideologies prevalent in our society. Because among other reasons, our learning environment was not the typical mainstream classroom. However, the interactions between the students in the study centre demonstrated that competition is not a natural trait of students, thereby indicating the ideological aspect of the competitive environment in regular classrooms.

4.7 Conclusion, Summary and Reflections

To summarize the chapter so far, the tutoring episodes in first two sections indicated that authentic mathematization and collective learning could facilitate inclusive learning. The teaching sessions at the mathematics camps served to empirically demonstrate and provide further insights to this observation. Therefore, a pedagogical implication of the work presented in this chapter is that *mathematization and collective solidarity facilitate inclusive learning*.

Rina's narrative illuminated the social nature of disablement. Based on her narrative, I claimed that disability, far from being the cause of exclusion was in fact the result of it. And this claim was corroborated during the mathematics camps in which the students ensured that none of their friends would be disabled from learning mathematics by ensuring that none would be excluded.

Moreover, from a social model of disability perspective, we also see that Rina's discriminatory treatment in her new school also had a lot to do with the fact that her school had overcrowded classrooms, and in the 9th standard, students are detained if they fail their exams. Furthermore, girl children with disabilities are particularly affected by neoliberal policies (As was argued by Shampa [Sengupta \(2020\)](#) in Section 2.3.5).

The fact Rina had to pay fees in a government aided school also cannot be ignored. Because, among other reasons, as the nobel prize winning World Bank economist, Joseph

Stiglitz (2012) admitted, “as families in many developing countries [have] to pay for their children’s education under so-called cost recovery programs [imposed by the IMF], [their parents] make the painful choice not to send their daughters to school” (p. 20).

The various economic factors that contribute to a low representation of children with disabilities in schools most certainly contributed to producing, albeit at a subconscious level, apparently ableist ideas in the minds of the school authorities in their dealing with Rina. They quite likely presumed that had Rina taken an admission, sooner or later, she would have been pushed out owing to their school’s teachers’ inability to pay special attention to Rina in an overcrowded noisy classroom, which could have led to her failing in her exams. They also might have felt that their underfunded school’s infrastructure, such as toilets, was quite likely inaccessible to Rina. And without a critical consciousness about disability, they likely located the source of their discomfort (of the idea that a blind girl student will be joining their ill-equipped school) upon the body/disability of Rina, thereby contributing to the creation of a culture of ableism in Rina’s new school.

The tutoring episode with Faiz, and the mathematics camp thereafter, showcased the varied forms in which authentic mathematization could manifest, and how they promoted inclusive learning. Furthermore, the nature of such forms of authentic mathematization, that became a basis for the students’ learning, was connected to practices of materiality rather than being dependent on visualization. For example, discussing mathematical ideas (like a hypercube, etc.) by tracing out figures on a peer’s (or teacher’s) palm rather than looking at the figure, whether with the eyes or with fingers on a tactile diagram. Our discussion of negative numbers was based on a material context (for example, basement of a mall) rather than looking at examples on the board or in a book. Faiz argued that subtraction involved three (rather than two) numbers by recalling a money transaction involving 1) the price of a commodity 2) the paid amount and 3) the change handed. We proved the divisibility rule for 9 on the abacus rather than on the black/white board. We questioned if zero is a regular even number rather than adopt the definition given in some text. We created definitions of mathematical concepts based on observations of patterns among numbers, rather than look at what was said in the book, etc.

One of the initial objectives of my study was, as described in the research proposal, to explore which aspects of mathematics were visual, spatial, purely symbolic, etc., My initial aim was to develop what I coined as “a non-ocularcentric pedagogy” in collaboration with

the students. I had assumed that the problem of exclusion of blind mathematics learners was, in one way or another, whether directly or indirectly, an outcome of the dominance of the visual in mathematics education, and through interactions and discussions, this problem would come to the fore. However, the course of my teaching experiments suggested that the dominance of the visual did not feature as the primary cause of the students' marginalization. While the students and Kanak teacher did acknowledge that the expectation to solve mathematical problems using steps, or constructing geometric figures was a challenge, they stated that such was not their central hurdle, and that these could be overcome through regular practice with the available tactile teaching aids.

My engagement with the children and their learning helped reveal how mainstream schools contribute to producing a culture of competition among their students and how such cultures serve to individualize, alienate and thereby disable all children, not only the blind. The disabling character of schooling was only made apparent while working with blind children.

To speak of inclusion/exclusion and cooperation/competition as a "culture" is not to give a culturalistic explanation which tends to be done in academia but to highlight the complexity associated with teaching practices that serve to disable and exclude.

Only through a materialist perspective that included the lens of political economy could we make sense of the cultural differences between the resource-rich classroom as described by [Khanna \(2017\)](#), and our study centre that comprised of students excluded from mainstream education. Our classroom was in no way "out of the competition." An "out caste" learning environment is very much part of the competition when education is seen in a totality. Nonetheless, the culture within our classroom at the study centre suggested that competition is not a natural attribute of a group of students. Only under certain material conditions do students find themselves pressed to compete against their peers. By contrast, the culture of the students at the study centre was characterized by cooperation and empathy. This is not to imply that cooperation and empathy are natural/biological attributes of a group of children. The struggle of the teachers of the centre (for example, Ms. Kanak) in creating this culture cannot be ignored. This struggle also included getting the children admitted in regular "normal" schools.

The culture that was developed at the study centre served as a form of resistance against the political and economic forces inherent in typical normal schools. Furthermore this

culture created a space for the children to not only belong to a learning community but also to freely question the norms of an unjust society.

At first, the study centre appeared to be a case of mainstreaming and opposed to inclusion. But through sustained interactions, we saw that inclusion is a continuous struggle against individualizing, exclusionary and disabling ideologies that insinuate into learning environments owing to structural economic factors. This inclusiveness of the centre was expressed in the ways in which the diversity among the children was managed by the students themselves through creating a culture of empathy and cooperation.

The inclusive and democratic character of our session had less to do with either my intervention or even with the available assistive tools, and more to do with this culture developed by the students who ensured an equitable distribution of power among all the participants in the classroom. When some children could not cope up with my pace of teaching, they did not end up lagging behind because their friends spontaneously acted to ensure that they were taken along.

4.8 Three Components of Inclusion

A significant aim of our mathematics camp was to explore whether, consistent with the social model of disability, blindness need not disable students from learning mathematics. And certainly the larger education community could gain in some way from insights offered by the teaching sessions.

There were three notable features of the mathematics summer camp that I found to be central to making it more inclusive than most regular classrooms:

1) A variety of available educational aids, 2) A culture of empathy and cooperation that arose from a collective solidarity among the students which facilitated social learning thereby resisting an alienating culture of rivalry and competition, and 3) An environment conducive to authentic mathematizing rather than merely accepting a body of assessable knowledge. I will explain these three aspects in detail.

1. Free access to many educational aids:

Teaching aids such as the abacus, the wikkistix, the Taylor frame, the tactile geometry kit, etc., need to be part of the regular school curriculum, not only for blind students but everyone. This is for two reasons. Firstly, deeming the Braille typewriter as a tool for the blind only reinforces their otherness. And secondly, the affordances offered by such educational aids like Braille and the abacus serve to enrich mathematics learning for everyone. For example, Braille does not depend upon ambient light for reading. And the abacus opens a window into a different world of mathematics. Furthermore, normalizing such learning resources will also open up possibilities for critically looking into their limits, and perhaps raise pertinent questions about the nature of school mathematics.

2. **Collective and social learning**

One of the main reasons why we could say that our classroom harboured values of inclusion was because the students behaved in a collective manner in their approach to learning. The students' collective behaviour was not *because* of but rather *in spite* of my intervention. The study thus indicated that only under certain conditions are students driven to act in a competitive manner. But, by putting in efforts to facilitate social and collective learning it is possible to make classrooms inclusive and democratic while enriching the quality of mathematical discourse within it.

3. **Mathematization for democratizing mathematics learning**

Faiz's materialist approach to mathematics learning played a salient role in democratizing our teaching sessions. Due to authentic mathematizing, the nature of the mathematics knowledge shared in the classroom took a form that was incompatible with assessment and grading, and thus contributed to democratizing the mathematics learning. More importantly, the mathematization that occurred in our study sessions was a byproduct of the collective nature of learning that prevailed.

Although the culture of empathy and cooperation played the most important role in creating an inclusive and democratic learning environment, my study was limited to the four walls of the classroom. However, the duration of my PhD programme that lasted over six years gave me the opportunity to follow up on some of the students, like Faiz and Binita, who finished their schooling and were pursuing higher education and employment. I discuss this part of my study in the following chapter titled, *Limits of Inclusive education: Beyond the walls of the classroom*.

Chapter 5

Study 2: Limits of Inclusion - Beyond the Walls of the Classroom

“When a liberal sees a beggar, he says the system isn’t working. When a Marxist does, he says it is.”

- Bill Livant

5.1 Overview

In this chapter I present the second part of my argument which is based on data I collected outside the classroom towards the end of my field study. The aim of this chapter is to highlight the political economic aspects of schooling, exclusion and disablement which became more apparent when my ex-students finished their schooling and sought higher education and a job. One of the conclusions drawn from the data presented in this chapter is that exclusion is structural and inherent to the economics of how schools function in a capitalist society, and is not contingent upon the disabilities of individual students. By highlighting the limits of inclusive pedagogies, the study indicates the need to think beyond inclusion.

In the following section (Section 2), I present a summary of the previous chapter, and a background of the study. In section 3, I share an episode in which I volunteered to

be the scribe of a student during an entrance exam. This episode highlights certain dilemmas we faced which revealed the economic dimension of curricular mathematics in terms of how examinations mask the underlying causes of rising unemployment by portraying unemployment as an outcome of personal failure to have studied hard enough or be smart enough. The data also demonstrates how entrance exams contributes to shaping social relations between sighted and blind people, and reinforcing stereotypes about the capabilities of blind people, thereby leading to unjust consequences.

In the concluding section, I discuss the Marxist notion of *contradictions* by recounting the various contradictions that were revealed in the process of my study. As the research identifies exclusion of blind mathematics learners as a symptom of the economics of the schooling process, my aim of emphasizing contradictions is, in the words of [Harvey \(2014\)](#), “to unmask what is truly happening underneath a welter of often mystifying surface appearances” (p. 5). In this case, the surface appearances concern the schooling and examination processes whose economics operates behind fetishistic disguises such as certificates, etc.

5.1.1 Inclusion through collective learning and mathematizing

In the previous chapter, I contended that the disablement of blind mathematics learners is largely an outcome of an ideology of individualism and a culture of competition that is imposed into a learning environment. But inclusive learning is achievable by facilitating collective learning and authentic mathematization. As I presented in chapter 4, the inclusive and democratic character of our mathematics session had less to do with either my intervention or the availability of tactile teaching/learning aids, and more to do with an inclusive culture created by the students themselves. And this environment also facilitated creative expressions of students’ mathematical ideas, leading to what I referred to as authentic mathematization. The culture of empathy and cooperation that characterized the learning environment suggested that students are not naturally inclined to compete. And without an externally imposed drive to compete and show off assessable mathematical skills, the children demonstrated a keen interest in learning and critically engaging with mathematics.

However, on following up with some of the students who demonstrated exceptional mathematical capabilities, we saw that they were systematically made to give up their ambitions of pursuing higher mathematics. I share the example of Faiz and Binita in the backdrop of my interaction with another student, Sunny (pseudonym).

I narrate my interaction with Sunny in the context of my volunteering to be his scribe for an entrance exam for a job. I choose to highlight this particular episode since it served to highlight how the dominant form of mathematics content plays a major role in serving the economic demands of the labour market by producing justifications for the unemployment of job seekers.

5.2 Examinations and the economy: Looking beyond the classroom

Sunny joined the study centre in 2018 when he was in the 12th standard ¹. He was 100% blind and had applied for a job in the Indian Railways for a post of a medical assistant against the physically handicapped quota.

5.2.1 Accompanying Sunny for his exam

The entrance exam for the job had four sections - Logical Reasoning, Science, General Knowledge and Mathematics. Hundreds of candidates, most with writers, had reported at the exam venue. Although the exam was for a government job, it was outsourced to a private agency that owned hundreds of computers in their office space. After the security check, we were assigned a computer, and a young examiner was assigned to watch over us. However, this could not have stopped me from cheating (i.e., using my mathematics knowledge to answer his questions) since we were allowed to talk. Hypothetically, we could have developed a code wherein if Sunny did not know an answer, he could have asked me to click on a “random” option and proceed. This would not appear to be cheating even if all the “random” clicks turned out to be the right answer.

¹Sunny was not a part of our mathematics summer camps which were held between 2013 and 2016

There were hundreds of candidates in our centre alone. Examination centres were all across the country indicating that thousands of candidates had applied for the government job. Vacancies were however only for a hundred candidates irrespective of the nature of their physical impairments.

Most of the mathematics questions clearly indicated that whoever framed them had a complete disregard for the fact that a significant proportion of prospective candidates were blind students (or else they had explicitly wanted to sift out blind students). In addition to word problems involving compound interest and complicated algebraic equations, even the exercises related to arithmetic was framed in a way to make it impossible for a blind candidate to solve. It was not that the questions were difficult - there are many difficult problems that blind students could do as well as sighted students. A few questions were of the following form (only the digits are different with no observable pattern that could make the problem simpler):

$$190 + \{45 + [17 \times (14 - \overline{6 \times 7})]\}$$

Sunny who was rather politically conservative in terms of professing ideals of honesty among other virtues found himself asking me, “Sir, can you simplify the question?” to which I replied, “If I solve the bar bracket first and continue like that, I get the answer, -241.” “Is that in the options?” Hesitantly, I responded, “Option C is -241.” “Then select option C.” That felt really awkward and scary considering it was happening below an examiner’s nose. We ended up cheating in an exam (even if it was not more than 3 - 4 questions) in which the consequences for malpractice was supposedly severe.

However, as the exam ended, conversations with a few other candidates revealed that such cheating was quite the norm, and by the looks of the design of the question paper, it was expected that blind candidates cheat. Further, as Sunny let me know, the entrance exam was not followed by any interview but was in itself the deciding factor behind getting the job. Furthermore, the opening was for a low level unskilled profession that obviously did not require any knowledge of mathematics. It was evident to both of us that the only reason such difficult questions featured in the test was so that a random set of hundred candidates could be selected from among thousands of applicants which was necessary owing to the gross unemployment in our country. But through the use of an entrance exam with mathematics in it, the onus of getting an employment was put on

the disabled candidates. And a “failure” to find employment could easily be attributed to the candidate’s inability to reason logically and possess basic general knowledge.

This incident was not exceptional as was revealed by Binita who finished her schooling a few years ago.

5.2.2 Banality of cheating and it’s ableist implications

Binita was studying for her 10th standard exams during the first summer camp which we organized in 2013. Binita was sighted till her 9th grade, and used to attend regular school. She began to lose her eyesight 15 days into entering her 9th standard. Following her blindness, Binita dropped out of school and resumed 2 years later, and registered with the study centre. In 2013, Binita topped her 10th standard exams in the physically handicapped category. Binita, like Faiz, had expressed her desire to pursue higher mathematics. From 2013 onwards, Binita used to visit the centre often, especially during special occasions like children’s day, teacher’s day, Republic day, etc., and also kept in touch with us on facebook and whatsapp. In 2018 after Binita graduated with a Bachelor of Arts degree, she dropped by HBCSE to meet Shikha and me. I took her visit as an opportunity to further explore, the issue of “cheating” among writers of blind students.

The discussion with Binita began with her sharing her experience and bond with mathematics. Binita loved mathematics and was very good at it, as was evident during our mathematics sessions. Binita insisted that her interview be taken in English. With Binita’s permission, I audio recorded her interview.

Binita: I have done 8th and 9th ka² maths. So maths was really very close to me. And I loved to do maths. Basically from childhood. . . . I have given entrance exam . . . in which I have done much well in maths. Like I didn’t face main problem because I had good contact with my maths. My basics of maths is really very good because I was in normal school I was sighted at that time till 9th. And my habit was to study one class ahead (laughs). So if I’m in eighth class I will study 9th class.

²In Hindi, the word *ka* roughly translates as “of.” So 9th ka maths meant, maths of the 9th grade.

Although Binita attributed her expertise to the fact that she was sighted till the 9th grade, even after two years since losing her sight, she demonstrated proficiency and a keen desire to pursue higher mathematics.

However, Binita was dissuaded from pursuing mathematics by one of the stakeholders of the study centre (who I will refer to using the pseudonym, Ms. Preethi). While Binita studied the same mathematics as her peers till the 9th grade, Preethi convinced Binita's mother to make her pursue lower level mathematics for her 10th grade exam, citing the Binita's depression following her father's untimely demise as a reason.

Rossi: But then why didn't you pursue mathematics?

Binita: Because ... it was not my choice to have 7th class mathematics. It was Preethi ma'am's choice. She said that ... I was suffering from that ... because I have lost my father at that time. And she was thinking that I'm not mentally matured that time. So she thought that if I do 10th wala³ maths then I ... would lose my marks. ... And she was thinking that I should score really very well. That's what she asked my parents to take 7th wala maths. Otherwise I was thinking to take higher maths. ... My bond with maths was really very good; I don't think so, that maths would be a problem for me.

Binita then narrated her interaction with a sighted friend who proudly spoke about how he cheated when he volunteered as a writer for a visually challenged candidate.

Binita: Some of my friends who are sighted who became writer of some people, they gave me their experience that he was writing all the paper ... so I said how can it be possible like no one sees at that time? looked at that time? So he told, No. No one care about those all things ... he told me then I was in shock. ...

Binita shared her concern of the far reaching implications that cheating can have on other blind people whose abilities would be brought into question owing to the pervasiveness of cheating.

³In colloquial Hindi, *wala* roughly translates to "associated with," although it can have multiple connotations.

Binita: it gives wrong impression of blind people; that people are using their writer only to get good marks. It will give this kind of indication only. So I got panicked; I told him that from the next time just don't do that. . . . Next time I will pass something, then everyone will say that "*arre writer use kiya hoga na?* (Oh, You used a writer, no?), *Haan tab toh paas hona hi tha!* (Yes! then you would pass only!)" It gives a really wrong impression on blind.

Binita's fear was certainly not unfounded. After taking Binita's interview, a student let me know (when it was too late to intervene) that she was failed and made to leave her school on the pretext that she made her writer answer her examinations. I was one of the writers. And in the exam, the questions were such that no writer who hadn't studied the specific text book could have possibly cheated. All her other writers also affirmed that they did not, and in fact could not have cheated since she was the only blind student in the relatively small air conditioned classroom with less than 20 students and two invigilators.

On a later occasion, one of the visually challenged teachers of the study centre revealed another layer to the problem of cheating by divulging an open secret about the existence of a market for scribes who charge upto lakhs of rupees with a guarantee of success in such entrance exams.

To further contextualize her argument, Binita cited the case of Faiz who is now employed as a phone operator in a hospital ⁴.

Binita: Faiz is doing job as phone operator in [a nearby] Hospital. . . . If they will give job also, for the visually challenged or handicapped children, they won't make you to do more work. . . . One of my friends who has passed BSc IT, from [a prestigious college], he got placed in [a prestigious software firm]. He has done with his training in Kerala and he has been shifted in Chennai. But, it is three weeks he has been there. He is not doing anything, he said. They are till now figuring out what can he do. . . . Big industry . . . they will take a visually challenged or they will take any handicapped person, but they will not, they won't give them work.

⁴At the time of writing this thesis, Faiz was also studying to pursue a degree in Law

Like Binita, Faiz was also discouraged from pursuing higher mathematics. While Faiz was given the job of a telephone booth attendant (“phone operator”), Binita’s other friend was more fortunate to be employed in IT in a prestigious firm. But he too found himself without an opportunity to utilize his expertise and knowledge.

Faiz had often expressed his desire to pursue higher mathematics so long as I would tutor him along the way, to which I happily agreed. However, Faiz was discouraged from pursuing higher mathematics and ended up having to settle for a low paying unskilled job (of a phone booth attendant). His underemployment was justified owing to his having a high school certificate that indicated a “lower level⁵” mathematics.

5.3 Dialectical Contradictions beyond the classroom

Faiz’s journey from school to college, and thereafter, to the competitive labour market revealed a dialectical *contradiction* between *producing* a mathematically capable workforce and *realizing* that competence albeit in an economy that does not offer adequate employment opportunities to facilitate such realisation, and thereby highlighted the myth of the notion of “ability.”

By “contradiction,” I do not mean it in the formal or Aristotelian sense but rather in the Marxist (or Hegelian) sense of a dialectical contradiction, in which opposing forces coexist within a particular entity - forces that although remaining latent, often reveal themselves and become obvious during a crisis (Harvey, 2014) or difficult situations (D’Souza, 2018).

5.3.1 Contradiction of production and realization of ability

One of the motives of creating an inclusive mathematics learning environment, at least as we would want to believe, is to help children attain a certain degree of proficiency in mathematics, or in other words, develop an “ability” to do mathematics. But this ability remains latent until it is expressed through mathematical practice or put to use (whether directly, to solve a maths related problem or play/develop mathematics puzzles

⁵As mentioned in Chapter 4, students with disabilities had the option of being exempted from being tested for 10th standard mathematics content in their SSC examinations and could opt instead for 7th standard math exam paper

for leisure, or indirectly, to provide a mathematical solution to a client, etc). However, under capitalism, the opportunities for expressing one's mathematical creativity or ability are severely inhibited either because of lack of meaningful employment opportunities in the market where mathematical creativity may flourish, or because the increasing length of the working day eats into the time one might reserve for leisure. Furthermore, since the market employs only a handful of mathematically "able" workers (with that number being influenced by the health of the crisis-prone market), the greater number of mathematically proficient workers produced translates into a greater competition for job opportunities where developed capabilities could be realized. In fact, even the few companies who do employ youth for jobs involving mathematics, spend some months training their selected candidates to make them "able" inasmuch as they can carry out their required jobs. Increased competition for jobs creates a demand for more difficult questions in entrance exam papers which in turn presses the schooling system to keep raising the bar for students to be considered mathematically successful or "able."

Under capitalism, the *production* of a mathematically abled workforce, and the *realization* of that ability, forms an antagonistic unity that influences the mathematics education process including school exams, curriculum, pedagogy, teacher training, special education as well as mathematics education research. And this contradiction is dialectically interconnected with the various contradictions that keep capitalism in a state of continuous motion and change.

While Faiz had successfully overcome ableism in mathematics education at various levels, and developed a certain proficiency in mathematics, his proficiency could not find expression beyond the high school classroom and into college and thereafter, in the labour market. Faiz's experience of being unable to pursue mathematics was not a unique case but a general trend. As students leave the sphere of learning and enter into the labour market, they find themselves confronted by a different set of challenges and contradictions created by the market that prevent the realization of their mathematical potential. With regards to blind students who are "encouraged" to pursue lower level mathematics, their underemployment is legitimized through their high school certificate that displays their having completed only a lower level mathematics exam.

5.3.2 Fetishism of a Certificate and Reification of Ability

The contradiction between producing a mathematically proficient workforce and realizing that proficiency in a competitive market economy, subsequently highlights the significance and value of a certificate. A certificate is just a piece of paper with something printed on it. But it is fetishized as a magical object: it appears to provide employment. But there are a number of contradictions here: A certificate does not actually mean that a person has any particular “ability,” but only that they somehow passed a test at some point in the past. The test may have nothing to do with the probability of doing what the certificate is supposed to claim that the holder will do in the future. In fact, the certificate may not even provide employment, simply because there are not enough jobs for all who are qualified.

A characteristic feature of fetishism is that the fetishized object is treated as though it has a power of its own. In the context of the fetishism of a school certificate, decisions about what to teach, how to teach, etc., are made based on what kind of learning will help students fetch this important certificate. Students too desire certificates: a piece of paper. But actually, they do not desire the piece of paper as such but the power that the certificate is socially believed to confer upon the certificate holder.

Like most of us, Faiz, Binita and Sunny pursued education in the hope of getting certificates that would have some exchange value, in enabling them get jobs. They achieved the objectives of getting education, passing the exams, and getting certificates. And they actually did do some interesting mathematics at the centre, if not at their schools. But they did not get jobs or admission to higher education in which they might continue to do mathematics (although Faiz got a job as a phone operator which he might not have gotten without his high school certificate. But the job did not involve any application of his mathematical knowledge). Perhaps it was because their certificates indicated only low-level mathematics, rather than higher-level. But actually, whatever the certificate, it may not provide employment, because there is a shortage of jobs. So we see that actually a certificate has another magical quality: that of ‘proving’ that a person is not sufficiently qualified for a job. In other words, the certificate that *enables* inclusion into the economic system, simultaneously functions to exclude and *disable*.

The “ability” that the certificate appears to indicate that the certificate holder possess, is not a physical attribute of the certificate holder, but a reification of social relations.

However, from a reified standpoint (in terms of what was discussed by [Feenberg \(2015\)](#) in Section 2.1.4), “ability,” and its illusory opposite, “disability,” appear to be physical attributes located within the bodies of the individuals, and are seen to be the cause of problems like unemployment, poverty, etc. Reification thereby obfuscates the real causes of the aforementioned problems, and contributes to the reproduction of social relations and the social practices that give rise to such reified “things” as “ability” and “disability.” As Val [Burris \(1988\)](#) wrote,

The social relations responsible for the reproduction of class inequality have, in effect, been incorporated within (and disguised behind) the technical processes of skill acquisition ([Bowles and Gintis, 1976](#)). Credentials, like other commodities, come to be fetishized as an inherent source of value, rather than seen as a token of the underlying structure of social relations. Insofar as schooling is perceived as an essentially technical process of acquiring and certifying productive skills, rather than as a social process of selection for an already stratified social order, differences in educational attainment are seen as a reflection of individual differences in intelligence or motivation. Poverty and inequality, from this perspective, appear as the consequence of personal deficiencies in the capacity to acquire technical skills, rather than the normal outgrowth of capitalist economic institutions. This appearance lays the foundation for the meritocratic legitimation of class inequality, both at the level of popular ideology and in the more elaborate theoretical constructions of bourgeois social science (p. 17).

The actual ‘certification’ process is a mystery. It may seem that any student can pass the exams and get a certificate if they work hard enough. But this obscures the fact that certificates and exam results are by design aimed at sifting most students out of further advancement in the job market which is necessary because there are not, and cannot be enough jobs for all people. Exams create 1 or 2 toppers, and a handful of students, of predominantly certain classes, castes and abilities who actually pass the exams. A certificate also obscures the systemic nature of exclusion, and the social relations that can predict to some degree of certainty whether or not one passes the exams.

5.3.3 Obstacles as a window into contradictions

The experiences of Faiz and Binita highlighted the limits of inclusive pedagogy and raised further questions to the answer of creating an inclusive classroom as a means of dismantling ableism. They also provided a deeper insight into our experience with the textbook. While at first, the textbook appeared as an innocent teaching tool, after listening to and reflecting upon these experiences, the same textbook now served as a window into the workings of the schooling process under capitalism as a whole. The contradictions inherent to the schooling process under capitalism produces objects like mathematics textbooks that come to be fetishized as a collection of unquestionable and consumable set of ideas with the power to decide who get access to higher education and an employment. Fetishized objects mask how schools are, as Pais (2013b) emphasizes, places of economic production in which failure and exclusion is an inherent and characteristic feature. Failure rationalizes the creation of what Marx (1990) referred to as “the industrial reserve army or surplus population” (p. 786). Capitalism creates a “growing pool of redundant labour all across the globe” (Shaikh, 1990, p. 77), and the very existence of this pool of unemployed people serves to keep wages of employed labour sufficiently low, and profits increasing. Consequently, the industrial reserve army of a predominantly “ablebodied” unemployed population further justifies, from a reified standpoint, the marginalized position of disabled people.

With regard to communicating 3-d diagrams through the textbook (as I narrated in Chapter 4), actually, there are many ways of understanding dimensions, some of them even non-spatially. But taking a step back we could ask, what is the need for 3-d objects to be represented in 2-d? But with the given textbook and curriculum, under the shadow of the forthcoming examinations, this question is not asked, especially not by students. The textbook in effect functions to define the curriculum, the pedagogy, and mathematics as well. It therefore contributes to inhibiting students’ creative attempts at “authentic mathematization.” This hindering of authentic mathematization disables all students from engaging meaningfully, authentically and socially, with mathematical ideas. And the disablement only became apparent through the lens of the disablement of excluded groups of students, in this case, blind students. Students are expected to use diagrams and follow prescribed instructions and methods, without questioning their use value. The textbook and the diagrams appear to be just an illustrated book, a tool that is useful for learning/teaching mathematics. But behind this fetishized form, the reified body of

knowledge have a hidden function of sifting and excluding students. Reification obscures this function and the social relations that give rise to the need to sift and disable.

The problem with the textbook was not simply that it was inaccessible to blind students. The transaction of textbook knowledge, in its current form reflects a larger political economic ideology that reduce teachers to “bureaucratic agents who labour to implement a prescribed curriculum and reduces the students to passive learners” (Radford, 2016, p. 261). Textbooks are designed to feed a certain amount of stipulated mathematical content to a maximum number of students (which is arguably desirable). However, even though textbooks are supposed to be learning aids for students, students find themselves subordinated to the textbook. But, even if students do end up having consumed a sizable portion of mathematical content (whether through a constructivist route or otherwise), it is unlikely that will find opportunities for realizing their mathematical potential, beyond the walls of their classroom.

By taking the form of a collection of consumable content, textbooks end up contributing to exclusion and disablement. In their present form, textbooks, examinations, certification, etc. enable surplus generation by helping the market capitalize on *human need* (for a meaningful education for their children) that can easily be turned into a *market demand* (by a subset of those people, who have purchasing power). The contradiction between *human need* and *market demand* is also obscured by these reified objects. Even if textbook writers are not profit minded, they are compelled to produce textbooks that end up defining knowledge as a consumable thing with a magical quality of providing a rational justification for a student’s success or failure. The ableist assumptions underpinning the textbook are therefore not merely a matter of discrimination based on ignorance or insensitivity but an outcome of a complex of social and economic relations. There are material economic interests involved in preserving what turns out to be an ableist schooling system. Saying this is not to deny the emancipatory potential of education and its role in escaping systems of oppression but to highlight the limits of our efforts to mitigate exclusion by merely making school classrooms more inclusive and mathematical knowledge more accessible.

5.4 Concluding Analysis: On Contradictions

The previous chapter suggested ways of creating an inclusive learning environment by focusing on facilitating collective solidarity and mathematization. By identifying individualism as a cause of disablement, it was inferred that an environment that facilitates collective and social learning could help dismantle ableism, and contribute to a more authentic and meaningful mathematics learning. However, on turning our gaze outside the classroom where we ran into a different set of contradictions we realized that the story is more complicated than that.

Chapter 4 highlighted certain events related to my students' mathematics learning, that involved encountering obstacles or "limits." Many of such obstacles were overcome by our collective efforts such as modifying my teaching method or using teaching aids (like the abacus, *Wikkistix*, etc), or through discussions and even questioning the body of curricular mathematics knowledge (for example, by redefining mathematical concepts like "even numbers" as defined in the textbook). A salient feature of the limits we faced was that they revealed "contradictions." In his essay titled *Theories of surplus value*, Marx (1863) proclaimed that, "In the crises of the world market, the contradictions and antagonisms of bourgeois production are strikingly revealed." While Marx spoke of a specific kind of problem - crises of the world market, his perspective through which he shared his observation, proved useful for analysing and presenting my field observations. For example, while teaching geometry to Faiz, the task of communicating the image of parallel lines to him led to a hiccup, which revealed a contradiction - The mathematics textbook is a teaching aid that is supposed to empower students by making mathematics accessible to all. But the same textbook confronts students as an alien physical entity which, owing to its visual nature, served to construct blind students as incapable of learning mathematics. However, this particular difficulty did not turn into a crisis situation since we had *Wikkistix* by which diagrams could be made tactile. But soon enough, we needed to discuss parallel planes that were represented in the textbook as a 2D image. A deeper contradiction was now revealed which concerned the nature of curricular mathematics education. On the one hand, mathematical objects are considered abstract and not contingent upon material objects (even if the concepts are themselves abstracted from material reality). But the textbook now demanded sight for answering questions of mathematics even at an epistemological level. The problem of the diagram was not limited

to visual representation that might be partially overcome through, say, developing a tactile textbook (to say nothing of the challenge of *constructing* geometrical objects!). The textbook's representation of the figure of the parallel planes was based on the assumption that a student who "looks" at what appears to be two identical parallelograms with corresponding vertices connected, sees a cube. However, owing to our competence in mathematics, we could resolve this particular contradiction by reconceptualizing the idea of a cube.

Fast forwarding 5 years later, Faiz successfully completed his schooling and college having overcome many obstacles through resolving contradictions. However, as I described in this chapter, the contradictions that were revealed when Faiz (or Sunny or Binita) entered the competitive labour market could not be overcome individually. This contradiction involved "producing a mathematically competent workforce and realizing that competence albeit in an economy that does not offer adequate employment opportunities to facilitate such realisation" (D'Souza, 2018, p. 560). And this contradiction was economic in character. And more importantly, the economic contradiction of what can only be characterized as ableism in the labour market, which made apparent the economic dimension of assessable mathematics, also contributed to shaping the nature of mathematics education within the classroom in terms of giving rise to the various aforementioned contradictions.

Indian educationists have also pointed out a similar problem. For example, Ramanujam (2012), Shirali and Ghosh (2012) express how the shadow cast by high stake exams like the 10th and 12th standard board exams influence how students will be assessed in the classrooms. As opposed to the mathematics content which is currently used for assessment owing to the shadow of high stake examinations, Ramanujam, et al. imply that while (the learning process of) children must indeed be assessed, it should be along different parameters. Shirali and Ghosh take for granted the use value of school and college mathematics and the availability of meaningful jobs, by stating that "Clearly mathematics has an important role to play here in developing [a student's] skills so that she may pursue her chosen course" (p. 107). And from this premise they lament that certain topics "that are rich in mathematical content" are neglected during assessment. Shirali, et al. thus tend to justify the larger structure of the schooling system and overlook the political economy of examinations, while locating the imperfection in certain localized technical details involving the topics that should ideally be used to assess students. The political

economy of examinations has created a misconception of mathematics education as a whole, not merely the assessment aspect of it. Under our current sociopolitical economic order, the primary purpose of examinations, in which mathematics occupies a key role, is to regulate access and exclusion, and institutionalize inequity. Even if topics that are “rich in mathematical content” are used to assess students, the economics of examinations makes assessment incompatible with student creativity, and forecloses possibilities for students to bring their mathematization to the learning environment. Assessment, which by its very nature engenders failure, will therefore continue to exclude and disable students irrespective of the specific parameters used to measure and grade their learning. In India, there are big businesses that are invested either directly or indirectly in preparing Indian (among other) students to crack examinations either through private tuition or through proprietary software, etc. These industries thrive on the fears generated precisely by the exclusionary and disabling aspect of assessments. Therefore, to address the problem of exclusion and disablement, we need to look at assessment in its totality, in view of how examinations, failure, exclusion, disablement, unemployment, etc. are interdependent and intrinsic to the economics of how schooling works in a global capitalist social order.

To summarize the central argument of this chapter, the political and economic dimension of exclusion which became apparent outside the classroom revealed the contradiction that, while inclusive learning is indeed achievable, a pedagogy of *inclusion* in itself does not serve to disrupt or transform the material economic conditions that beget *exclusion*, disablement and ableism.

Chapter 6

Concluding Remarks

... democracy is incongruous with modern-day capitalism and is consistently violated by a capitalist social order, and yet ... popular forces continue to fight back and sometimes even make gains.

- Michael Parenti, *Democracy for the Few*

The research study seen through the lens of social model of disability illuminated the structural nature of the disablement of blind students. As a philosophical framework, the social model of disability offered a worldview which highlighted the dynamic nature of human society as a whole, by locating the present as a part of history, and shed light upon the interconnections between various aspects of society including the interconnections between mathematics education, exclusion, disablement and the political economy.

Analysing my field observations using the social model of disability, led to the conclusion that *while inclusive learning is achievable, an inclusive pedagogy in itself does not serve to disrupt or transform structural material economic conditions that beget exclusion, disablement and ableism.*

The field study began with the recognition that disablement is socially produced, and it sought to explore what such a perspective could mean for mathematics education. My research drew from, and lent support to the works of disability studies scholars like Michael Oliver, Roddy Slorach, et al., and Critical Mathematics Education (CME) scholars like Ole Skovsmose, Alexandre Pais, et al. whose writings highlighted ways in which

disablement and mathematics education are embedded in a social structure. Gutstein, et al. described CME as involving critically reading the world and politically engaging with it. But Skovsmose pointed out that this may be a challenge for blind students owing to, among other reasons, “the relationship between Braille and mathematical symbols.”

However, through the use of a Case Study research methodology in a study centre for blind children in Mumbai, the field observations indicated that, at least within school mathematics, limiting my work to addressing visual hegemony through materialization strategies was not sufficient. And the research study needed to acknowledge and act against social conditions within which students are embedded that *disable* them from learning mathematics in meaningful and empowering ways. However, consistent with Giroux’s observation of the dialectical relationship between power, ideology and resistance, the students also exercised resistance against disabling ideologies like competition, through ensuring inclusion of their peers and challenging mathematical statements that I initially assumed to be unquestionable.

Skovsmose and Borba (2004) had argued that for mathematics to work in the interest of democracy, a mathematics classroom must also show aspects of democracy. To realize the concerns underlying their argument appeared to be an open challenge which was to a large extent addressed by the research study. As I described in chapter 4, there were democratic practices in our classroom setting, albeit not because of my individual effort but because of the collective solidarity exercised by the students. However while democratic practices within the micro-society of a classroom was achievable, the question of whether such a classroom could be characterized as contributing towards a larger struggle for an equitable society was brought to the fore when the political economic dimension of exclusion was made apparent while following up with the students after they finished schooling and sought higher learning and jobs. The field observation beyond the classroom seemed consistent with the argument of Pais who rejected the use of mathematical thinking as a means of achieving “high ideals of peace, democracy, social justice and equality”. However, my study showcased a different relationship between mathematical thinking and ideals of equity. It was the equitable character of the learning within the classroom that facilitated genuine mathematical thinking, if not the other way around. Considering the structural nature of exclusion and disablement, developing an equitable classroom can hardly be considered as moving towards structural change, but it is nonetheless, necessary. Perhaps, it is only by engaging with excluded students can we understand the

limits of apolitical individual actions in addressing problems related to exclusion, that are by nature economic, political and structural.

My research study seen through the lens of the social model highlighted that firstly, disablement of blind students is an outcome rather than the cause of their exclusion from full participation in society. My field observations thus reaffirmed the declaration of the UPIAS that “Disability is something imposed on top of [people’s] impairments, by the way [they] are unnecessarily isolated and excluded from full participation in society.” For instance, Rina’s contrasting experiences in two different schools demonstrated that her disablement from learning was an outcome of discriminatory treatment that was “imposed on top of” her “impairments, by the way she was unnecessarily isolated and excluded from full participation” in her social environment.

Secondly, exclusion and disablement are interconnected with various other, especially the political and economic, aspects of society. The experience with Sunny at his entrance exam made it evident that the only reason difficult and irrelevant questions featured in a test where no one cared if candidates cheated or not, was so that most students could be sifted out, since there were so few jobs available, less so for people with disabilities. In this manner, examinations rationalize unemployment and individualize the cause of joblessness as a personal deficiency or failure to have worked hard enough, or be smart enough. The market creates a reserve army of unemployed labour to depress wages and keep profits rising, and an additional pool of lesser demanding labour comprising of oppressed minorities (for example, displaced immigrant women and people with disabilities) who compete to work for even less than subsistence wages. The existence of a market for scribes with an expertise in cheating is also very much a part of the political economy of exams. The pathetic condition of job opportunities for people with disabilities also evinced the politics of *Divyangization* - a politically convenient alternative to spending towards creating more employment opportunities for people with disabilities.

6.1 Disablement under Neoliberalism

In her book, *India Goes to School*, Shivali [Tukdeo \(2019\)](#) addressed the various ways in which global economic forces including NGOs, the IMF, the World Bank, etc., impinge on the structure of public schooling. She opened a chapter citing a “casual banter” made

by a school teacher: “We are not sure if we will have enough supply of chalk for next week, but there will always be an organization visiting us, teaching us how to manage our classrooms, how to improve, develop leadership skills. . .” (p. 57). The powerfully striking feature of this remark was that it reminded me of the various times my women colleagues made similar remarks on their return from different parts of rural India where they were sent by their bosses to supply educational technologies and training to the children with the aim of improving their mathematics learning outcomes. The objections raised by my women colleagues were not about the lack of chalks but rather the lack of toilets in schools where 50% of students were adolescent girls. Their outrage was effectively on the lines that, “We do not know how the adolescent girls manage without toilets, but there will always be an organization sending mathematics education researchers to visit them, teaching them how to use ICTs and educational software that will improve their understanding of elementary and middle school mathematics concepts. . .”.

It is an inherent contradiction of neoliberal capitalism, that the very funds which are invested into improving learning outcomes of students (in view of fulfilling the Millennium Development Goals as set forth by the United Nations and the World Bank) lead to increased exclusion. The underfunding of public schooling under neoliberalism has compromised on the educational needs of students with disabilities. While one might argue that budget allocation towards education in capitalist countries like US and India has somewhat increased over the years, it has not been at par with, as [Macewan \(2020\)](#) puts it, “the need for money [that] has also gone up as the schools have made improvements to educational programming and are also told to perform additional functions. [And] existing data and information from people who work in the field of special needs indicate that the cost per child is on average at least twice as high as the cost per child for students who are not classified as having a disability.” Moreover, “schools have to provide their classrooms, and sometimes each kid, with a computer or tablet. Although the cost of these kinds of equipment has dropped dramatically in recent years, they are still much more expensive than the pencils and pens of the 1980s and 1990s.” Macewan clarifies that “program improvements and their expansion add to the costs, but we think that these are things that society should pay for, and they should not come at the expense of teachers’ salaries or other resources for students.” However, in 2021, India’s finance ministry reduced their budgetary allocation for education by Rs 6,088 crore while opening more routes to privatise school education ([TheWire, 2021](#)).

Political economic forces impact education not only at the level of school admission, employment opportunities, etc., but also at the level of the curriculum and pedagogy. It has almost become a cliché to say that teachers follow a traditional rote learning approach and focus on completing the syllabus by transacting a body of knowledge thereby making learning boring, etc. I add to this clichéd statement by claiming that this form of teaching (that inhibits authentic mathematization and collective learning) is disabling as well. However, the reason behind the prevalence of such a teaching model is not simply that teachers are ignorant. There are economic reasons why the traditional rote learning, and syllabus completing model, retains a hold on teachers with decades of experience and exposure in the field of education. The structure of the examination system “thingifies” the process of learning into a set of learned facts on the basis of which students can be assessed, failed and denied access to jobs or higher education. The examination system which serves as a gateway, for children of working class parents, to fit into the economic system has created an omnipresent fear of failure and underemployment which teachers can hardly ignore. The choice of a teaching approach which is often a response to conditions imposed by global economic forces must not be seen in isolation from the economic structure in which teachers are embedded.

The fear of failure has created a market demand for the multi-billion dollar Indian coaching class industry which adds to India’s Gross Domestic Product (GDP)! As school mathematics is inextricably linked with the market that imposes a shortage of jobs, a scarcity of opportunities for higher education, etc., and hails competition among workers as “ambition,” a disabling culture of competition dominates mathematics classrooms as well. Therefore, even if teachers wish to carry out more meaningful and inclusive teaching methods, their intentions are prevented from materializing as they find themselves pressed to transact the kind of teaching demanded by the examinations system which serves as a means of helping students fit into the economic system. Teachers do not have the privilege to ignore the economic structure within which they, their students and the market are embedded in, and carry out alternate ways of teaching mathematics.

Exclusion and disablement therefore cannot be understood in isolation from the interconnections between competition, examinations, failure, exclusion, un/employment, school fees, underfunding public education, deteriorating conditions of public schools and quality of education, shortage of school teachers, overcrowded classrooms, increased privatization of schools and internationalization of profits, etc. that characterize neoliberal capitalism.

A central feature of the hegemonic ideology of neoliberalism is the prevailing belief that “everything works better in the hands of the private sector, and government should be run more like a business” even though private companies are answerable not to the public but to “few banks and big investors” (Parenti, 2002, p. 263). Foreseeing the neoliberal assault on public schooling, Parenti (2002) warned about the malicious intents behind the creation of the GATT and the WTO that served to bulldoze all barriers to what is referred to as “free trade” (or what Parenti prefers to refer to as “monopoly corporate control” (p. 174)). Parenti aired his fears, in 2002, that

Education is a trillion-dollar industry, and private corporations want a big piece of it. If the issue is ever brought before the WTO or whatever trade council, public education and protests against corporate-run schools could be seen as a barrier to free-market investments and lost market earnings for corporations involved in privatizing schools. It is probably only the fear of a heated public outcry that keeps privatization from moving more precipitously into the “education market.”

Parenti’s worries came true in India with education being turned into a tradable commodity under General Agreements on Trade in Services (GATS), a multilateral trade agreement under the World Trade Organization (WTO).

Under neoliberalism, we witness increased efforts by private players to preserve the capitalist economic system and ensure continued accumulation of wealth by turning public amenities into profitable investment opportunities, and commoditizing education. Under such conditions we can only expect increased exclusion and disablement and, consequently, greater challenges in creating the kinds of classrooms we envision, that facilitate meaningful learning of mathematics. And this highlights the need for collective efforts against such neoliberal economic forces.

6.2 Implications of the study

To call attention to limits of pedagogical and curricular reform is not to relegate pedagogy to a secondary position in view of larger collective political struggles. The question of

making classrooms more inclusive to all students is not a deviation from the question of creating a more egalitarian society. Consciously promoting a culture of empathy and cooperation, as suggested by the study, may certainly not serve to dismantle capitalism. However, not being conscious of our ideology certainly serves the interests of capitalism in terms of reproducing an atomized and competitive work force. In this regard, I agree with [Bowles and Gintis \(1976\)](#) who I quote at length.

We must press for an educational environment in which youth can develop the capacity and commitment collectively to control their lives and regulate their social interactions with a sense of equality, reciprocity, and communality. Not that such an environment will of itself alter the quality of social life. Rather, that it will nurture a new generation of workers - white and blue collar, male and female, black, white, brown, and red - unwilling to submit to the fragmented relationships of dominance and subordinacy prevailing in economic life (p. 14).

Exploring the question of what the social model of disability can mean for mathematics education highlighted various complexities related to the social and political economic aspects of education. However, it also offered some practical suggestions. I categorize the implications of my study into five sections. The first concerns theoretical aspects of the social model of disability. The second, third and fourth focus on pedagogical aspects of the teaching sessions that served to facilitate inclusive learning. The fifth implications addresses the limits of pedagogical implications and the need for collective action.

6.2.1 Reclaim the Marxist Social Model of Disability

The social model of disability is not simply a recognition that disability has a social dimension. The social model also provides a lens through which we see society in its totality, and the internal contradictions that drive its development, and produce social phenomena like the exclusion and disablement of blind students. By helping reveal contradictions, the social model also helps indicate methods to resolve these contradictions. The underlying goal of the social model can therefore be seen as creating a society that has resolved these contradictions. In the context of mathematics education, this means

that the social model sees the aim of education, among other things, as a means towards creating a new kind of *society* rather than producing well adapted and mathematically capable *individuals* within a given social order.

By providing a structural analysis of disablement, the social model helps in understanding how various social phenomena (for example, underfunding and privatization of public education, discriminatory treatment against blind students in schools with overcrowded classrooms) are interconnected. And moreover, such social phenomena are interconnected with social factors such as caste, race, gender, etc. In this regard researchers in disability studies in mathematics education need to take into account insights from, and extend solidarity with, those who critically engage with mathematics education from other margins such as race, caste, gender, etc.

We need to rethink what we mean by “the social model of disability” more so in the context of academia which often speaks of the social model from postmodernist standpoints and present mostly culturalistic explanations for problems associated with disablement and claims to move beyond the “orthodox” social model. Culturalistic explanations for disability focus on beliefs about dis/ability without engaging adequately into the material (including economic) conditions that produce disablement along with ideological justifications for ableist discrimination. A disablist culture (or a culture of ableism) is a symptom, an ideological reflection, of sociopolitical economic conditions. Therefore, as Parenti (2006) put it, “one cannot talk intelligently about culture if one does not at some point also introduce the dynamics of political economy and social power” (p. 17). For example, the culture of competition and following a “traditional rote learning” approach to teaching mathematics, cannot be seen in isolation from the political economic milieu within which students and teachers find themselves embedded. In India we have on the one hand, a scarcity of jobs for qualified teachers, and on the other hand, a scarcity of qualified teachers for schools. As argued by the research study, as mathematics education is inextricably linked with a market system that imposes scarcity, a culture of competition dominates mathematics classrooms as well. It is these material conditions that induce certain kinds of teaching learning practices like rote learning, etc., that are far from ideal.

Theoretical frameworks based on postmodernist perspectives on ableism do not make room for the political economic aspects of exclusion such as entrance exams, the market, structural adjustment loans imposed by the IMF, etc., and the interconnections between

each other and disablement. They also do not consider the historical significance of collective political struggle in shaping the dynamics of social phenomena and bringing about democratic change in society.

6.2.2 Facilitate Solidarity and Social Learning

A notable conclusion of my study which was based on my interactions with students at an individual and group level (as described in chapter 4) was that students do not naturally behave in a competitive fashion. In fact, at times I found that it was I who was imposing an environment that could have led to a competitive behaviour among the students. Competitive and individualizing ideologies insinuate into classrooms given the larger sociopolitical environment in which schools are embedded. And therefore, as educators, we must consciously strive to create conditions for collective solidarity and social learning in our classrooms.

As the data from chapter 4 suggested, despite having students with various diagnosis of disabilities in the classroom, there was a fair amount of inclusion and democracy in our sessions. This had less to do with either my intervention or even with the available assistive tools, and more to do with a culture of empathy and cooperation developed among the students. The older pupils ensured that every student was taken along as the discussions proceeded. Perhaps they did this because they realized that some of the other students were not understanding, that my teaching was not very effective, and that they could better understand the problems the other students were having and how to help them overcome these problems. Whatever might have been the reasons, collective solidarity among students facilitated inclusive learning. The contributions of the teachers involved in creating such an atmosphere cannot be overlooked. Although when students leave the confines of the classroom and enter the labour market they will be made to compete, we need to have faith in the agency of the children we educate, and their potential to transform the world into a more humane and enabling social environment.

6.2.3 Facilitate Mathematization

Faiz's materialist approach to mathematics was a salient factor behind the democratic nature of the teaching sessions. Faiz facilitated authentic mathematization in the classroom due to which the nature of the mathematics learning was connected to practices of materiality, not dependent on visualization, and thus, incompatible with assessment and grading, thereby contributing to democratizing mathematics learning. A similar idea is held by many educators even if they do not share my perspective on equity issues in mathematics education. For example, [Civil et al. \(2017\)](#) draws from [Louie \(2017\)](#) who contrasts "exclusionary and inclusionary teaching practices" in which inclusive teaching is characterized by the understanding that "Mathematics is about making sense of ideas and understanding connections" as opposed to the "exclusionary" practice in which Mathematics is seen as "a fixed body of knowledge to be absorbed and practiced" and which considers "correctness" as "paramount." Civil also showed how Louie's "sense-making frame" served to develop "students' self-confidence and ownership of their mathematical ideas" and shift "the authority from the teacher to the student," and that inclusive mathematics teaching practices "communicate to students that their peers are a valuable resource for learning mathematics" (p. 248).

My stance on "authentic mathematization" differs from what Civil, et al. described through the notion of meaning making. Civil et al. argue against the traditional rote learning approach but their proposed alternate still involves what [Roth and Mukhopadhyay \(2012\)](#) refer to as "canonical practices of mathematics" that involves constructing knowledge but not to the extent that the answer students arrive at, or ideas they develop, deviated from the "correct" or canonical body of mathematical knowledge. In contrast, in our teaching sessions, the students began their investigation into mathematical ideas based on their observations of the real world as well as their observations of properties of numbers. They did not try to fit their observations into some pre-existing mathematical concepts given in the book, and in fact, at times, their ideas challenged the "canon" as presented in the book. The students' expressions of different mathematical ideas served to resist power that was exerted through mathematics teaching. Faiz explicitly argued that mathematical concepts are not to be taken as the starting point of a mathematics discussion or as though existing *a priori* and to be fitted into an example, but are developed by people for a reason. And this authentic mathematization was a byproduct of collective solidarity exercised by the students. Therefore, as mathematics teachers, we

must recognize, as Faiz demonstrated, that mathematics is a social process rather than a given thing. By taking into account that mathematical ideas have human histories, the students posed a significant challenge to the authority of the teacher whose uncritical views on mathematics implied that some students being left behind is a natural outcome of any diverse learning environment.

If we wish that children use mathematics meaningfully to critically interpret and politically engage with the world, it is equally important to create conditions wherein children build a sense of ownership of mathematics. Presenting mathematics as some alien and assessable thing whether to be consumed in a top-down manner or even constructed, could be alienating. We therefore need to rethink how we conceptualize mathematics.

6.2.4 Universalize Braille and Tactile Teaching Aids

My field experiences uncovered various affordances offered by tactile teaching aids (for example, using abacus to discuss the divisibility rules for 9), which have hitherto been considered unnecessary to students in regular classrooms. Tactile modes of communication like Braille offered affordances in terms of learning as well as argumentation. Unfortunately such teaching aids are considered the language of the blind. It is not only contradictory to speak of an inclusive classroom when one group of students are taught to read only print while another are trained in Braille, but also detrimental to children's learning in terms of helping them exploit the various affordances offered by these devices. The challenges highlighted by [Skovsmose \(2016\)](#) in realizing CME in the context of blind mathematics learners (see Section 1.2), is partly due to the norm of restricting Braille to blind students rather than universalizing it as a mode of communication that could benefit society as a whole. We must insist that Braille and sign language as a form of communication be taught to all children, especially to break the barrier between the sighted and the blind, between the deaf and the non-deaf, etc.

6.2.5 Confront the Political Economic Dimension of Exclusion

Another limitation of the research work of Louie, Civil, et al. is that while they reject the rote learning paradigm they don't explain why that paradigm still continues to dominate

mathematics education. Civil, et al. do not explain the material roots of the traditional rote learning pedagogy that retains a hold on teachers. Merely presenting a different teaching approach tends to indicate that teachers are unaware of alternate ways of helping children learn. Also, while talking of inclusion, they don't take into account the political economic dimension of exclusion and disablement, and the limits of inclusive learning in the struggle for equity. By providing a dialectical perspective on disablement, the social model does not limit its analysis on disablement within the classroom but looks at society in its entirety and makes room for understanding and concretely addressing the limits of a "sense-making frame" in terms of addressing equity concerns.

The experience of accompanying Sunny to his entrance exams, and the dilemmas that I was compelled to confront, highlighted the interconnections between mathematics education, unemployment and disablement. The experience, as described in chapter 5, highlighted the structural nature of exclusion that renders it unamenable to mitigation by individualist approaches like adopting an inclusive pedagogy.

Contradictions such as rising poverty and unemployment amidst a rising GDP is inherent to the political economy of capitalism, and is inextricably linked with the increased commoditization of education that has systematically disempowered children from exercising their fundamental right to a decent education.

The very concept of "inclusion" is premised on an individualist understanding of society that takes mass exclusion for granted. Neither the Indian Constitution nor the [Kothari Commission Report \(1966\)](#) nor the PWD Act speak about inclusion. They all demand free education to children with disabilities.

The exclusionary and disabling aspect of schooling, under capitalism, is structural, and not contingent upon the disabilities of individual students. Helen Keller (1920a) stated that, "We have been accustomed to regard the unemployed deaf and blind as victims of their infirmities. That is to say, we have supposed that if their sight and hearing were miraculously restored, they would find work" (p. 242). By modifying the quote of Helen Keller and replacing terms associated with employment with those related to learning, it would be equally true to say that "we have supposed that if the sight and hearing of all deaf and blind children of school going age were miraculously restored, none would be excluded from school, and all would receive a meaningful and useful mathematics education, and the exams they face would be equitable."

The exclusion of students with disabilities reveals in a stark way, the inherent exclusionary character of schooling under capitalism. Therefore, any genuine attempt at addressing exclusion has to confront the political and material economic structure of society with the aim of reorganizing society along entirely different lines. And this requires widespread collective mobilization. Considering how the public's money and resources often get diverted to subsidize and support giant transnational corporations and waive off their faulty loans, it becomes evident that the government lacks not funds but the political will to build more public schools and make quality education free and accessible to all children irrespective of their learning needs.

As propounded by the social model, if we take into account the political economy of capitalism and investigate the internal contradictions of capitalism as a whole, we see that authentic inclusion is incongruous with capitalism, and the solution to the problem of exclusion cannot be found from within a neoliberal economy. Although we may find it discouraging to realize that there are limits to creating inclusive pedagogies, and that neoliberalism is impossible to challenge at an individual level, we also see firstly, that there is a commonality among the various inclusive education related problems, each of which we would otherwise consider in isolation. For example, problems related to pedagogy, examinations, competitions, job opportunities for our students, etc. And secondly, we also see a commonality among the cause of struggles waged by various groups of working class people including teachers, special educators, students, as well as industrial workers and farmers, who resist neoliberal reforms in their sphere of activity and in solidarity with others. We therefore see that students who resist privatization of education, or workers who resist dilution of labour laws, or farmers who oppose neoliberal reforms in the agricultural sector, or tribal communities who resist corporate grabbing of their land and natural resources, are all engaged in a struggle against the very same political economic forces whose ruthless drive for private profit create disabling conditions in schools for our students. And this makes us hopeful. In this regard, along with developing inclusive learning environments, we also extend our solidarity with working people who are engaged in an organized political struggle against neoliberal capitalist forces.

Although on the one hand we see powerful imperialist financial institutions and their political allies in parliament paving the way for a corporate takeover of public education, we also see, on the other hand, massive demonstrations and even democratic victories by activist and student groups who have rallied against such vested interests. [Henry \(2018\)](#)

shares detailed accounts of various student movements in the recent past, that have rallied against WTO, GATS and the Brahminical fascist regime which has constantly been striving to convert education into a commodity to be accessed only by children of upper caste parents. As crisis situations reveal the ongoing class struggle between, on the one hand, financial institutions and super-rich private players who strive to have public schools sold to the highest bidder, and on the other hand, the majority of labouring people who strive to provide quality and accessible education for our children, we find opportunities for meaningfully addressing the real underlying causes of students' exclusion and disablement. But taking up these opportunities sometimes entail leaving the confines of our classrooms.

6.3 Further Questions

Through the lens offered by the social model, the exclusion of blind children highlighted the exclusionary nature of schooling as a whole. However, my conclusions were developed based on a study that was specific to a group of blind students in an informal learning environment. While I did draw insights from my experience in teaching regular classrooms as well as with non-disabled school students who visited HBCSE for camps, I did not explore deeply enough how the dialectical relationship between power, disablement and resistance operate in regular classrooms among non-disabled students. And this question is worth exploring further if we wish to develop a more dialectical conception of education, schooling and exclusion.

Also, my work did not adequately get blind students to do what Critical Mathematics Educators like Gutstein and Skovsmose have argued for, namely, to critically read and politically engage with the world using mathematics. The study recognized that mathematics education itself was complicit in disempowering blind students, and thus regarded addressing, or critically engaging with, dominant and oppressive ideologies within mathematics education as a prerequisite to get students to engage politically with mathematics and society. While I believe that the study did add an important insight to the question of how mathematics education can be used in our struggle for social justice, the question of how to meaningfully include blind mathematics learners in this larger political battle remains in need of further exploration.

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