Foregrounding Socio-political Dimensions of Learning Mathematics

Some Field Observations from Delhi and Bihar

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Abstract

This paper goes beyond the socio-cultural perspectives and adopts a socio-political framework for analysing mathematics learning in and out of school settings. Besides describing the 'funds of knowledge' as embedded in children's households, communities and work contexts, it also attempts to explore the interplay of power and identity with respect to mathematical practices in diverse contexts. To highlight these issues, we draw data from studies based on participation of children in everyday and work contexts in Delhi and rural Bihar. Through this paper, we attempt to foreground the notion of power while determining access to powerful ideas of mathematics as well as participation and achievement in mathematics.

Introduction

In recent years, the views related to the teaching of mathematics have undergone a "Kuhnian revolution" and challenged the allied notions associated with it such as its infallibility, in addition to acknowledging its socio-cultural character.

Redefining mathematics as a fallible social construction, continually expanding field of human creation and invention provides a rationale as well as a foundation for 'inclusive'

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approaches to mathematics; wherein "the social contexts of the uses and practices of mathematics can no longer be legitimately pushed aside" (Ernest, 1991). Mathematics needs to be "studied in living contexts, which are meaningful and relevant to its learners, including their languages, cultures and everyday lives, as well as their school-based experiences" (*ibid.*). Beginning from late 1960s and 1970s, Mathematics Education Research (MER), while drawing from sociology, anthropology, and cultural psychology, attempted to understand Mathematics as socio-cultural activity, and explored the links between culture and mathematical cognition. Some of the significant works undertaken during this phase were that of- Gay and Cole's (1965) study with Kpelle in Liberia, Zaslavsky's (1973) 'socio-mathematics of Africa' on development of numeracy and geometric knowledge in lives of people, Reed and Lave's (1979) study with tailors in West Africa. The latter half of the 1980s, as Lerman (2000) observed, witnessed a spurt in texts highlighting the social nature of mathematical thinking and reasoning. For instance, Lave (1988) in her book *Cognition in Practice* described the situation specific strategies of grocery shoppers and dieters, and in the process, challenged the power of transfer usually associated with school Mathematics learning. Carraher, et *al.* (1985, 1987) reported their work on street and school Mathematics, exploring mathematics learning in and out of school contexts, thereby challenging the assumption that school is the only site of mathematics learning. D'Ambrosio (1985) introduced 'Ethnomathematics' as a new direction in MER, which aimed at analysing mathematical practices of diverse socio-cultural groups and communities through historical and anthropological lens. Many of these studies also aimed at exploring the possibilities of integrating the 'funds of knowledge' embedded in community-based and cultural practices within the school mathematics curriculum.

This shift in focus of analysis has been documented in literature as "social turn" in MER. However, it has been argued that this social turn failed to take into account the notions of power and marginality, subordination and domination.

From Socio-cultural to Socio-political Lens of Analysis

To understand the interplay of power and identity in MER, explicit attention needs to be given to issues of caste, class and gender. A shift in the academic discourse towards addressing equity and social justice issues in mathematics Education necessitated a 'Socio-political turn' (Gutierrez, 2013) in MER. According to Gutierrez (2013), by adopting such a stance, they were not just trying to understand mathematics education, but also moving towards a transformative approach in order to make it more socially inclusive and just. Drawing on critical theory, many researchers in the last few decades have worked in the area of Critical Mathematics Education (Frankenstein and Powell, 1994; Skovsmose, 1994), and Social Justice Mathematics (Gutstein, 2006). These studies conceptualise using mathematics as an analytical tool to investigate injustices in society by enacting problem posing pedagogies.

These studies raised fundamental questions about what counts as legitimate knowledge with respect to teaching and learning of mathematics, and whose knowledge and ways of knowing come to be valued in 'academic' mathematics.

The Indian Context

As a consequence of the current reforms in mathematics education, NCF 2005 also advocates a shift from achieving 'narrow' goals to 'higher' goals of 'mathematising'; a shift in focus from mathematical content to mathematical learning environments, offering multiplicity of approaches, procedures and solutions (NCERT, 2006). The shift from the conventional noun 'mathematics' to the verb 'mathematising' poses a challenge to the conventional epistemology of mathematics. Such a shift signifies what Millroy (1992) calls a move from mathematics as an abstract "accomplished fact" to experience and process of mathematics.

Taking into cognizance the new epistemology of mathematics, NCF 2005 acknowledges the 'cultural grounding of mathematics' when it notes that 'mathematical competence is situated and shaped by the social situations and the activities in which learning occurs. Hence, school mathematics has to be in close relation to the social worlds of children, where they are engaged in mathematical activities as a part of daily life' (NCERT, 2006). Such a conception of mathematics necessitates a fundamental reconstruction of school mathematics at all levels — curricular choices, pedagogy, assessment, and teacher education. To respond to the shift envisaged and to address diverse ways of knowing, learning and communicating in and out of school contexts in India, significant efforts have been made at curricular level and designing new textbooks. Emphasising an integrated approach to learning mathematics, chapters have been developed thematically and are based on real-life authentic contexts; offering connections not just within mathematics but across subject areas.

The concern over routinised school practices, work-knowledge dichotomy, and home-school disconnect, as reiterated in the National Curricular Framework 2005, can be traced back to 1920s and 1930s when educational philosophers like Dewey and Gandhi proposed a new vision of education centered round productive work and community-based practices. Dewey (1929) noted that "the true center of correlation neither on the school subjects is not Science, nor Literature, nor History, nor Geography, but the child's own social activities". Gandhiji's proposal of *Nai Talim* was deliberated upon at the National Education Conference held at Wardha in 1937. The key feature of the proposal was to incorporate productive manual work as a pedagogic basis in school learning (NCERT, 2007), in order to break the dichotomy between world of work and that of words, and thus, providing a legitimate space to knowledge of those who have been historically marginalised. The curriculum for *Nai Talim* was designed under the chairmanship of Dr. Zakir Hussain, who explained that the objective of this innovative educational programme was not to generate artisans capable of performing a craft mechanically, but rather to utilise the resources implicit in craft work for educational purposes. "This requires that productive work not only form part of the school curriculum but should also inspire the method of teaching all other subjects." (Hindustani Talimi Sangh, 1938). Further, it emphasised that educating children through productive work is the best way to provide an all-around education since it relieves the child from the tyranny of purely academic and theoretical instruction, balances intellectual and practical elements of experience, and can educate the body and mind in coordination. It was also hoped that when children from all social backgrounds participate in some productive work, "the existing barriers of prejudice between manual and intellectual workers" will tend to break down, as "it will also cultivate in the only possible way a true sense of the dignity of labour and of human solidarity"; its educational worth was seen in the possibility that "greater concreteness and reality can be given to the knowledge acquired by children by making some significant craft the basis of education. Knowledge will thus become related to life, and its various aspects will be correlated with one another" (*ibid.*).

Children's participation in work, however, has been an issue of much debate, and needs to be understood in terms of different conceptions of childhood. For many children in rural and urban settlements, work is an integral part of their lived realities, and from their early age they are being socialised into the adult world of work. This participation in work creates many affordances for learning, which are, however, often set aside in formal learning contexts.

In Indian context, a socio-political stance in MER becomes critical to take into account multiplicity of 'isms' (sexism, casteism, capitalism, ableism, etc.) that work towards shaping the identities of most people, (Bullock, as quoted in Subramanian, 2017) and in turn, determine access to, participation and achievement in mathematics education.

Mathematics in Everyday and Work Contexts: Studies in India

Many studies have been undertaken in India uncovering and analysing the use of mathematical knowledge by people in varied work and everyday contexts. One such research was undertaken by Khan (2004) who explored the relationship between cultural contexts and mathematical practices of newspaper vendors and cigarette sellers in Delhi. Other researches include Naresh's (2012) study of Chennai bus conductors, and Sitabkhan's (2003) study of young vendors in Mumbai local trains. These studies highlighted flexible competence that is displayed by children and adults solving mathematical problems embedded in real life and work contexts, which is quite different from solving problems using school taught algorithms.

Besides arithmetic, people in their everyday lives also express an understanding of measurement and geometry concepts through estimation, spatial visualisation and optimisation. Mukhopadhyay's (2013) work with boat builders in West Bengal, and Saraswathi's (1989) work with adults (majorly, agricultural laborers) in rural Tamil Nadu focused on the embeddedness of measurement knowledge in different settings. Recently, Bose (2015) conducted an ethnographic study in a low-income settlement in Mumbai having vibrant household economies, and explored measurement knowledge in children as they engaged in diverse income-generating activities. The study also attempted at exploring possible connections between in and out of school mathematical experiences.

These studies unveil considerable mathematical competence and potential in people (with limited or no schooling) engaged in diverse out of school situations and activities. However, what needs to be systematically explored is to "turn this considerable potential for learning and understanding into conscious routes for teaching" (Nunes et al., 1993).

Funds of Knowledge Embedded in Work Contexts and Cultural Practice

The construct of "funds of knowledge" is based on the premise that children's households, neighborhoods and communities are repositories of resources that need to be strategically tapped in formal learning environments, thus refuting a deficit approach for education of marginalised sections of society. The focus of analysis within funds of knowledge perspective is "practice", that is, "what people do and what they say about what they do" (Gonzalez, 2005). The perspective also brings forth the "hybridity of cultural practices" (*ibid.*) — amalgamation of cultural and domain knowledge. This notion of hybridity seeks to blur the distinction between the domain and everyday knowledge, and has the potential to challenge the hegemonic educational spaces (Nasir, Hand and Taylor, 2008).

The section attempts at uncovering the 'funds of knowledge' in marginalised communities, and foregrounding the 'voices' of the subaltern groups in relation to their practices. It tries exploring how participation in everyday work contexts creates affordances for learning mathematics, in particular. In order to highlight these aspects, we have drawn data from two separate studies conducted by the researchers in two different settings—Delhi and Bihar.

The Settings and the Participants

The research was carried out in Jamia Nagar, located in the south-east district of Delhi. Two sites—Batla House Market and a weekly market at Abul Fazal Enclave—were chosen wherein a large number of children were engaged in a variety of street vending activities such as selling fruits and vegetables, toys, mats and items of daily use. Most of these children had migrated from U.P., Bihar and West Bengal with their families or neighbours, who usually come to cities in search of jobs. Children are usually initiated into these activities from about the age of 8 or 9 years to support their families, struggling to make ends meet. While in some cases, families cannot afford to send children to school, in others, children have been pushed out of school or dropped out due to repeated failures.

Unlike Delhi, a metropolitan city, the other setting for the study constituted three villages —Chandanpatti, Pipraulia and Barhetta—from Darbhanga district of Bihar. The area was chosen for the study keeping in view the rich cultural traditions of the state as well as the fact that majority of its people (who live in rural areas) rely on less mechanised, traditional hands-on techniques for their daily survival, requiring them to make use of mathematics in a number of ways.

All three villages have a multi-caste, multi-religious population. The participants of the study constituted of individuals (adults and children) or groups involved in different kinds of local practices such as, *Sikki Craft* (basket-making); buying and selling goods in local *haats* and shops; *sujani, kashidakari* (embroidery), and appliqué work; *Mithila*-painting; making *beedi*s, etc.

The research process was based on elements of ethnographic techniques. During the field visits, the researchers tried to understand and learn from the people (adults and children) and their practices. They engaged in employing multiple methods—observation, informal and semi-structured interviews, and focus-group discussions. The observations and conversations aimed at developing a detailed and nuanced understanding of the everyday work contexts they were engaged in. Based on the observations and conversations each day, the rhythm of the following day was planned.

Numeracy and Arithmetic Operations

Children in open markets of Delhi and rural Bihar, displayed flexibility and competence while carrying out market transactions. A wide variety of oral convenient strategies were used to solve tasks at hand. In the case of addition and subtraction, they mostly relied on decomposition, combined with counting on or counting off. Multiplication problems were handled using build-up, repeated grouping strategies. The specific chunks used to solve the problems depended on the quantities involved and their knowledge of number facts.

Situation 1
Reshma (age, 12 years) was selling peas at ₹16/kg, at a weekly market in Delhi.
Researcher: I would like to take 2 kg, how much do I need to pay?
Reshma: ₹32
(Researcher gave her a ₹100 note)
Researcher: How much will I get back?
Reshma first handed over ₹8 to the researcher and then counted using fingers: 40,….,50, 60, 70, 80, 90, 100. I'll give you 60 more.

Reshma transformed the subtraction problem 100 – 32 into a corresponding addition problemas 'how much shall I add to 32 to get 100? (i.e., 32 + ? = 100). For solving further she first added 8 to get 40 as the step made the subsequent additions at intervals of 10 easier.

Fingers or pebbles aided in keeping track of the subtotals, thus facilitating a constant monitoring by the subject of their progress towards the solution. The process has been discussed in the instance cited below.

Thus, there was a spontaneous reorganisation of problem solving strategy, depending upon the numbers involved. The problems were approached in multiple ways and there was no uniform strategy. The solution strategies reflected a good understanding of number relationships, and good estimation skills. Most of them, however, struggled with written, symbolic representations, and often got stuck with school taught algorithms.

Measurement and Fractions Knowledge

In the context of measuring practices in markets in both contexts, most children found it easier to relate to weights, like *paao/pauaa* (250 g), *aadha* (500 g), and *paunaa* (750 g). Mostly, the calculations were carried out by dividing into halves, and halving again to get quarters; and multiplying by continual doubling, as illustrated in examples below.

Situation 2
Sonu (age, 11 years) was working at a local shop in Darbhanga, and selling sugar at ₹50/kg.

Researcher: I want to buy 750g sugar, how much shall I pay?
Sonu: Half kg for 25, halving again gives 12 and 50 paise. Adding 20 and 10 gives 30, and also we have to add ₹7.50. So, you need to pay ₹38.

The final amount was calculated adding amounts for *aadha* and *paao*, and then rounded off, taking into account non-usage of 50 paise coin in commercial transactions these days.

Extensive use of binary fractions, as also noted by Bose (2017), could be observed in the use of measuring units–*aadh* (half), *paao/paua* (quarter, or one-fourth), *aadhpaua* (half-quarter, or one-eighth), *pauna* (a quarter less than one, or three-fourths, or three quarters), *dedh* (one and a half), and *arhaayi/dhaai* (two and a half). However, no reference to many of these words could be found in textbooks in order to leverage children's prior (though, partial and fragmented) knowledge of fractions embedded in their work contexts. Most of them were found to have difficulty using decimal fractions. There seemed to be a disconnect between the usage of fractions in everyday contexts and school mathematics.

Also, in the everyday contexts of measuring, estimation skills were extensively relied upon, unlike what happened in schools which tend to overemphasise precise, standardised, or scientific measurements.

Hybridised Mathematical Knowledge

In a few instances, strategies used by students to solve problems embedded in work contexts involved elements from both the practice and the school learnt algorithms. For instance, Hamid (age, 10 years) was enroled in Class IV in a low-cost private school. He also worked at a dairy in Darbhanga after school hours and during holidays. He was asked to calculate the amount required to be paid to him for a month when a litre of milk was bought every day at the rate of Rs. 35 per litre. He tried drawing from the tables learnt in schools, and the rule of adding a zero at the end when multiplying with ten. He described the strategy as "30 times 10, 300. 300, 300, 300 makes 900. 5 times 10, 50. 50, 50, 50 makes 150. So, the total becomes 1050 (*sadhe dus sau/pachaas kam egarah sau*). But if the month has 31 days, 35 more will be added." The description provided also took cognizance of the reality constraints, as in varying number of days in a month. Also, on many occasions, one could observe the use of an interesting vocabulary and terminologies, like number name for 1050 used here and binary fraction names cited above, arising from an everyday discourse, unlike formal textbook terminologies.

Fairness and Work Contexts

On many occasions, interactions were embedded in power laden relationships and evoked ideas related to justice and fairness. For instance, according to a *beedi* maker at Darbhanga, the total cost for 1000 *beedi*s is around 283 rupees. The ingredients needed for 1000 *beedi*s includes 300g beaten tobacco leaves that cost 30 rupees, 600 g *tendu* leaves that cost 48 rupees, coal and thread worth 5 rupees, and daily wage (200 rupees) of a skilled male *beedi* worker. Around 5-7 *mutthi*s are prepared in an hour, wherein the process includes filling beaten tobacco, wrapping around tendu leaf and tying with a string and excludes the prior arrangements for making *beedis* like that of cutting *tendu* leaves. In 10-12 hours, 20,000 *beedi*s are made. However, 1000 *beedi*s are sold for 170 rupees, much less than the cost price. So, instead of hiring skilled male workers, women are involved in the process and paid 30–40 rupees for making 1000 *beedi*s—around one-third to one-fourth of the wage of a male worker. According to a *beedi* worker who hires women for making *beedi*s:

> "There is no value in a woman's labour. No one is going to pay her more for it. While the cost of raw materials has shot up, the *beedi*s are still sold at the older rates. This is why we hire women for work; this helps us save some money spent on the making cost. It is because of women and children that our work is also surviving."

Many such instances were found where women and young girls were hired for *Sikki* and embroidery work, and preparing *Mithila* paintings. Though some women seemed to be dissatisfied with amounts of money they get after working for days, they rationalised this by saying:

> "We work so hard but do not get paid accordingly. The husband does not allow us to work outside, so something is better than nothing. Anyway, we do it in our free times. We get something for it. As two of my children study in private schools, I have to earn for them somehow."

However, for some young girls, the discussion on fairness of wages seemed difficult for them to grasp.

These interactions brought to fore the paradoxical relation between mathematics on one hand, and justice and fairness on the other (Bose and Kantha, 2014). While mathematics is being viewed as the discipline of power and tool for empowerment, acute disempowerment due to structural inequities prevents one from accessing or using the powerful mathematical ideas.

The next section tries to understand the continuities/ discontinuities in the mathematical experiences of two of these children in the school settings. The question that needs to be explored at this stage is—how are the boundaries between cultural and domain knowledge negotiated in the classroom contexts?

Power, Identity and Politics of Knowledge in Mathematics Classrooms

Mathematics classrooms can be conceived as sites of inclusion or exclusion, wherein one needs to look at how students in the process of learning continue to position themselves with respect to the mathematical activity, their understandings of themselves, their backgrounds and foregrounds, their peers and others around them. Drawing from the mathematical lives of two children studying in two government schools of Delhi, we attempt at foregrounding the interplay of power and identity in mathematics classrooms.

About the Participants

The participants of the study constituted of two working class Muslim boys—Shahid and Abid (pseudonyms)—aged 10 years and 12 years, respectively. Both of them worked as street vendors at open markets of Jamia Nagar, after school hours.

Shahid arrived in the city about 3 years ago from Kishanganj in Bihar. The first year of his arrival lapsed without attending any school. The following year, he went to study in a local *madarasa*, before getting enrolled in the local Municipal Corporation School in Class IV. His father worked as a factory worker, and mother sold 'used' clothes in an open market in the area. Shahid assisted his mother in the work, taking independent charge at times when she had to go for some house-related work.

Abid's family came to the city about four years ago from Bulandshahr (Uttar Pradesh). At the time of research (in 2014), he was enroled in Class V at an MCD school in Jamia Nagar. Abid assisted his father after school hours in selling fruits and vegetables in a local market, and at times helped him by independently getting vegetables from the *'mandi'* (wholesale market).

Both schools were characterised by overcrowded classrooms (45-50 students in each class), congested spaces and a lot of noise in the classrooms. Since the school was close to the marketplace, this resulted in disruption in classroom activities and interactions. Majority of the children studying in these schools were Muslims and belonged to lower middle-class homes such as the small traders and businessmen, and lower class working people who earned a living by working in factories as daily-wage laborers, rickshaw pullers, and street vendors.

The data was primarily collected through classroom observations, and informal discussions and interviews (semi-structured) with teachers and learners in order to understand the learners' transitions between the two contexts (street vending and schools), and the struggles and intricacies involved therein.

Creation of Two Parallel Worlds

In the 'routine' activities of the mathematics classrooms we observed, the teachers presented a 'new' algorithm at the beginning of a lesson, followed by some examples based on these algorithmic procedures. Students were then asked to do 'pure computational' type exercises by copying problems from the chalkboard. Looking beyond this rush, however, Shahid was found sitting silent in the second last row, struggling through the exercises. When asked why he was unable to solve similar problems in school, which he solved with ease while doing his everyday transactions in the streets, he commented:

> "In the marketplace you have to do it 'in your heads'. In school you have to do it as per the norm, same as madam makes you learn. Here, you have to do everything by writing. Madam says if you want to do it employing your ways, go and sell things in the marketplace."

According to his teacher, Shahid lacks knowledge of basic algorithms; his methods are labeled as not being the 'math way', and considered suitable to be used in streets only. Thus, school mathematics is completely divorced from the everyday contexts of children like Shahid. This in turn leads to the creation of two parallel worlds—structured differently from each other—in and out of school settings (Jorgensen, Gates and Roper, 2014).

Shahid's participation trajectory in the mathematics classroom can further be examined by looking at the valuation of different solution strategies by classroom community and how some students get affected by such positive and negative valuations.

Shahid also seems to have internalised these distorted perceptions of different systems of knowledge and his own mathematical abilities. He has come to understand two mathematics as 'different' or separate; wherein school mathematics is given higher value over 'other' kinds of mathematics, and school written procedures over every day oral ones. He has not only developed a very low self-esteem as a mathematics learner but has also started perceiving mathematical knowledge used in selling activities in streets as inferior, owing to the constant rejection of his methods by the teacher and other students. He acknowledged that the everyday transactions which he engaged in streets require solving sums, but spontaneous oral techniques used in streets have little significance in comparison to the procedures taught in school. Connecting mathematics to everyday experiences is valued negatively. The transactional-based approach followed by the children in an out of school context, when applied exactly in the formal school context is perceived as their lack of mathematical competency (Civil and Planas, 2004), and is also accorded a low status. While written school mathematics is seen to be associated with the image of a schooled person (Abreu, Bishop and Presmeg, 2002), the oral techniques are associated with the unschooled people and this everyday knowledge cannot be 'traded' for good grades and 'proper' jobs. School mathematics is, thus, seen as the only 'legitimate' form of mathematics.

Highlighting the association between mathematical practices and social identities, Abreu (2002) argues that children are quite aware of how practices in and out of school contexts are differentially valorised —competence in one providing access to power and other resulting in marginalisation (Nasir and Royston, 2013).

Atwater and Riley (1993) explains that to be successful in school mathematics, the children from historically marginalised groups need to continuously challenge the messages of inferiority transmitted to them about their abilities and their backgrounds. In Shahid's case, the active involvement in mathematical practices in one context has been replaced by passive submission in another amidst his struggles of making sense of mathematics he is learning at school resulting in a poor self-concept and low self-esteem. He gets totally confused by the school taught algorithms requiring one to "write numbers in some meaningless strange patterns" (Rampal, Ramanujam and Saraswathi, 1998). He is clearly located on the 'periphery of the classroom community' (Vithal, 2009).

Agency and Mathematics Learning

Variations were observed in the ways the students from these particular groups got access to school mathematics, their nature of participation and identification with mathematics classroom practices (Nasir and Royston, 2013). While Shahid exercised silence and withdrawal in such situations, another student was observed expressing competence in solving problems in both the settings. Talking about his mathematical experiences in streets and in schools, he said:

> "I've learnt more mathematics on my cart, than at school. In school, *masterji* makes you solve two-three problems in the whole day, while (you work) on the cart, you have one customer after another and thus get too many problems (to solve)."

For him, school does not have the monopoly over mathematics learning. He does not seem to consider his street selling activity 'mathematically inferior', rather the continuity and meaningful linkages established between every day and school mathematics helps him make sense of the decontextualised problems often posed in the classroom. As he further added:

> "For instance, if *masterji* gives the problem 200-165, I think 'in my head' that it means that a customer has bought things worth 165 from me and has given me a note of 200 rupees. Now how much change I need to tender him."

Even though opportunities to bridge in and out of school knowledge are very limited, he proudly cited his ability to bond and bridge the multiple sets of experiences and knowledge gained in and out of school settings. Thus, as Nasir and Royston (2013) note that while attending to the power dynamics, it becomes pertinent to take cognisance of the ways in which individuals use their agency to act and resist being pushed to the peripheries. He continually attempts at defying the negative image others had of him as one belonging to the working class minority community and as a street vendor.

Foregrounding the Foregrounds

Students' intention for learning and the meaning they attribute to learning experiences need to be examined not only with reference to their backgrounds (who they are), but also with their 'foregrounds' (who they can become) (Skovsmose, et al., 2008). The notion of foreground, taking into consideration one's hopes and aspirations and how one relates mathematics learning to future possibilities could be helpful in understanding one's engagement or disengagement in learning processes. Sharing his hopes for the future, Abid told us:

> "I have to take admission in a good college. I will be an Engineer. And mathematics is a must for that."

Even though he seems to believe in an instrumental relationship between learning mathematics and future opportunities, these dreams motivate him to continue to learn mathematics with much interest and involvement. On the other hand, Shahid's dreams for the future seem to be broken or shattered. He seems to have a 'ruined foreground' (Skovsmose, 2005) owing to negative interactions with peers and teachers, and being a 'low status' student in the classroom. According to Skovsmose (2005), a ruined foreground can be viewed as a learning obstacle which is likely to prevent one from putting in more effort and to find any motivation so as to engage with the proposed tasks. This could eventually turn into low achievement and confirm one's exclusion.

Teachers' Knowledge, Beliefs and Expectations

The literature based on the conceptualisation of Mathematical Knowledge in Teaching (MKT) has over the years moved beyond the content-based categories of teacher knowledge and brings to fore the contextual shaping of teacher knowledge (Rowland and Ruthven, 2011). The reconceptualisation of the construct of MKT also attempts at foregrounding the role of teachers' beliefs about nature, learning and learners of mathematics through the multiple ways in which mathematical situations are dealt in classrooms.

The section, thus, attempts at understanding teaching practice as situated in classroom settings, and in the process creating a dialogic space wherein teachers could bring forth the negotiations and decisions made and challenges faced. This has been discussed here through some specific classroom instances, conversations with teachers and through studying teacher-textbook relationships.

Four primary teachers from the Municipal Corporation schools of Delhi, wherein both Shahid and Abid were enrolled and participated in the study. All the teachers had a degree in general education and Diploma in Elementary Teacher Education. Each of them had around 5–7 years of experience of teaching primary school children. The textbooks followed in the classrooms were based on NCF 2005. The following interaction with teachers highlights what is considered as important by them in mathematics and their beliefs about learners from socially disadvantaged backgrounds.

The stereotypical views that teachers are found to hold about the students belonging to disadvantaged backgrounds often result in lowered expectations from them. These students are thus exposed to a restricted curriculum in terms of scope and pedagogy — a curriculum relatively inferior to the one made available to other less-disadvantaged ones (Zevenbergen, 2003; Jorgensen and Niesche, 2008). This was also evident in one of the teachers' comment:

> "It is enough if they (children) do some addition and subtraction well. They work very slowly. It seems that they neither listen well nor understand well. It is fine even if the others (students) do ten problems correctly and these children do four to five problems correctly. It is useless to expect more than this (from them)."

Students in these schools are largely taught through rote and skill with a major focus on few basic skills and operations (Jorgensen and Niesche, 2008). Thus, the pedagogic practices reflecting the beliefs within a deficit framework reinforce the status quo and in the process, social differences get manifested as educational differences (Zevenbergen, 2003).

Teacher — Textbook Relationship

Even though the textbooks referred to in these classrooms address multiplicity of approaches rooted in children's everyday experiences and include thematic units and chapters based on real-life authentic contexts, these changes do not necessarily translate into the pedagogy and assessment patterns. These largely remain conventional, devoid of meaning and context. As Gay (2009) puts it, "the best curricula and instructional materials are only as good as the teachers who implement them". Teachers in our schools seem to be ill-prepared for actualising the changes proposed by the National Curriculum Framework, 2005.

The problems in the classrooms were solved without taking into cognizance of the child's context. It was feared by the teachers that the students would be lost in the story situations presented in textbooks and would not focus on carrying out the procedures correctly. As one of the teachers pointed out:

> "If one keeps telling stories in maths class, where is the time for maths?"

Besides incorporating real life authentic contexts, the revised textbooks move beyond the curriculum by integrating social justice concerns in teaching-learning of mathematics. This in turn poses greater challenges for teachers. The teachers were usually found following a selective pedagogy by omitting the conflicts arising from the situations presented in textbooks. Similar observations have been reported earlier in mathematics education research in Indian classrooms. For instance, Takker (2017) based on her study at a school in Mumbai, noted that discussions on these contexts and conflicts are avoided as they are considered as irrelevant to learning mathematics, or shrugged off as out-of-school knowledge. Teachers, at times, articulated difficulties in striking a balance between social and mathematical aspects underlying some situations.

The following comment offered by a teacher illustrates the incapacity for dealing with differences students bring with them:

> "If we start learning and teaching the (diverse) ways all pupils employ in solving problems, how will the syllabus be covered? This will only make the children more confused. I don't see any problem in the methods we follow in schools to teach. We also learnt in this way only."

Differences and diversity that these students bring are seen as a 'problem' rather than as potentially important learning resources. Teachers are found to be ill-prepared to capitalise on different ways of doing mathematics, and are stuck with the notion of teaching as they were taught.

Conclusion

The disjunction between school mathematics and mathematics rooted in everyday life experiences often acts as a disadvantage for some students more than others and hinder their opportunities for learning mathematics. This necessitates a fundamental and democratic reconceptualisation of the nature of mathematics and the approaches used in the teaching-learning of the subject. The 'new' vision must seek to "connect students' experiences in the mathematics classroom to their experiences in everyday life as well as to the political and social issues relevant to their lives… This involves a complex process of validating students' current identity and sense of themselves while expanding their sense of understanding to include new kinds of social, political, and mathematical activity" (Nasir, Hand and Taylor, 2008).

The study, rooted in a socio-political framework, reveals that students' non-participation and failure in mathematics cannot be fully understood in terms of cognitive deficits alone and need to incorporate the interplay of socio-cultural contexts, economic and emotional factors. Going beyond classroom and school related factors, it is crucial to further take into account how macro-social structures influence micro-classroom contexts, practices and interactions. What comes to be valued in the classrooms need to be examined in the wider context of social inequalities.

Also, an urgent need is felt to create dialogic reflective spaces such as "justice communities" (Bullock, 2017) in order to push our agenda of addressing equity and social justice issues in mathematics education.

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