Title of the paper: Textures of transaction: Exploring the heterogeneity in primary teachers' engagements with mathematics textbooks in Delhi

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Abstract

For more than a decade, government primary school teachers in many parts of India have been using mathematics textbooks based on National Curriculum Framework-2005. While curriculum and textbook development is often debated, teachers' use of textbooks does not receive enough attention in policy and research. This paper, drawing from a multiple-case study of ten teachers, using classroom observations and teacher interviews, explores different ways in which teachers use the Math-Magic mathematics textbook in Delhi's government primary schools. The findings demonstrate heterogeneity in the ways in which teachers use textbooks which are the dominant teaching resource in these schools. Teachers use different degrees of agency in textbook use: from avoiding the textbooks to designing their lessons. These are influenced by teachers' views about the textbooks as well as their institutional realities. Finally, this heterogeneity offers a useful approach to understanding textbooks, and its relevance to teaching, beyond being viewed as teaching scripts.

Key words: Textbook use, textbook enactment, teacher-textbook relationship, primary mathematics teachers, Indian primary teachers

Introduction

In Indian scholarship, there has been a long-standing criticism of overreliance on textbooks in defining classroom activity (GOI, 1993). Kumar (1988) described this overreliance as the 'textbook culture', which refers to the culture of all pedagogical activities being restricted to the prescribed state-produced textbooks. Subsequently, studies in the past two decades have corroborated the prevalence of textbooks in the Indian educational system (Clarke, 2001; Sarangapani, 2003; Vijaysimha, 2013). For mathematics teaching, textbook culture is often argued to restrict the mathematical activity to 'one correct version'; without accommodating students own lives, or showcasing the flexibility of diverse mathematical processes (Maithreyi, 2012). The National Curriculum Framework-2005 (NCF-2005) was introduced to challenge this predominance of prescriptive textbooks and to reform mathematics teaching and learning. It was in this context that a series of primary school mathematics textbooks, named *Math-Magic* (NCERT, 2006a, 2006b, 2007a, 2007b, 2008), were developed. These textbooks were commended for attempting a unique approach by several reviewers (see Mukherji & Mukul, 2009; Sengupta, 2007; Subrahmaniam, 2005; Tripathi, 2006). The textbook authors themselves describe the different ways in which reform ideas were embedded in the textbooks (Rampal, 2015; Rampal & Makar, 2012; Rampal & Subramanian, 2012). In Rampal and Makar (2012), the authors describe how culturally relevant themes were included in the texts to provide an authentic representation of the people's lives. Similarly, in Rampal (2015) and Rampal and Subramaniam (2012), the authors further highlighted the critical socio-political aspect of the books. Overall, the *Math-Magic* textbooks were developed as a 'thinking device' (material as a means of multiple meaning making, with the text itself being heterogeneous) rather than a 'delievery mechanism' (curricular materials primarily as information that can be encoded by the teachers and delivered to the student) (Choppin, Davis, McDuffie, and Drake, 2015).

In such a context, it becomes imperative to understand how these textbooks (created to challenge textbook overreliance) are used by teachers. While textbooks have been an important field of study in India, there is a lack of focus on textbook use (across subjects). Since the introduction of NCF-2005, there is a continued focus on textbook analysis (Gandhi, 2015; Gandhi et al., 2018; Jayathirtha, 2018) but a neglect of empirical studies on teachers' use of such textbook (Nawani, 2010). One recent exception is the work of Mili and Winch (2019) which explores geography teaching in India. Their analysis is focused on the ways in which knowledge, pedagogy and textbook intersect. Another study looking at mathematics textbook use, in the context of NCF-

2005, was conducted by Banerjee (2015). Her study, based in English medium government run upper primary schools, explored how the topic of Algebra is dealt within the *Math-Magic* textbooks and then taught in the lessons. She found that while the textbooks had attempted a different treatment of Algebra, they did not simply translate into reformed classroom teaching. Overall, as Nawani (2010) has commented, there is a lack of *textbook use research* in the Indian context, and especially studies focusing on mathematics textbooks. This paper fills this gap by focusing on teachers' use of mathematics textbooks. In the next sections, using concepts from the field of International Mathematics Education, I will first conceptualise the teacher-textbook relationship, and then focus on the teacher related characteristics that influence this relationship.

Conceptualising Teachers' Use of Textbooks

Research on mathematics textbooks is a growing field in the International Mathematics Education (Fan, Zhu, & Miao, 2013; Schubring & Fan, 2018). Studies either focus on the intended curriculum (textbook and curricular materials) or the enacted curriculum (use of these materials) (See Schmidt, 1996; Thompson & Usiskin, 2014; Valverde, Bianchi, Wolfe, Schmidt, & Houang, 2002). Many of the enactment studies have focused on the relationship between the textbook and the teacher who mediates the text in the classroom (Ball & Cohen, 1996; Brown, 2009; Remillard, 2011; Sherin & Drake, 2009). Remillard's (2005) meta-analysis of the conceptualisations of curriculum enactment sheds light on the different ways in which teachers interact with textbooks during its enactment. She broadly discusses four conceptualisations of the relationship: following or subverting; drawing on; interpreting; and participating with. This provides a spectrum of use where on the one side teachers are conceptualised as the implementers of the textbook, with the objective of achieving fidelity in use (following), whilst on the other, they are viewed as active collaborators with the textbook, both using and designing their own curriculum (participating with). The dominant perspective consequently taken up in research studies uses this fourth conceptualisation, where teachers enact the curriculum by participating with the textbooks. This approach (also taken in this study), views the teacher as the 'collaborator with the curriculum material to design enacted curriculum' (Remillard, 2005: 217). To operationalise a participatory conceptualisation of textbook enactment, Brown (2002, 2009) introduced the 'design capacity for enactment'. Assuming that teaching itself is designing, the enactment framework places agency both on the textbooks' affordances and teachers' characteristics. While recent studies attempt to refine notion of teacher's work as 'designers' of curriculum (Pepin et al., 2017), this remains a useful framework to explore textbook enactment.

This paper uses Remillard's (2005) notion of participatory relationship and Brown's (2009) notion of 'capacity for enactment' to interrogate how teachers enact mathematics textbooks in the Indian context. This paper draws from a larger doctoral study which examines the interaction between particular mathematical ideas within the textbook viewed as affordances (nature of textbook voice, context, and structure) as well as teachers' characteristics that lead to unique 'textbook enactments' (Nag Chowdhuri, 2019). However, this paper focuses only on one aspect of this two-way participatory relationship, i.e., teachers' characteristics that influence this enactment.

Teacher Views and Institutional Realities Influencing Textbook Use

Brown's (2009) enactment framework focuses on three teacher related characteristics which influence the ways in which they use and interpret the curriculum materials: 'teacher beliefs', 'teacher subject knowledge' and 'teacher pedagogical content knowledge'. Studies in India have also suggested an influence of beliefs and knowledge in classroom practice (Kumar & Subramaniam, 2015, 2013; Takker & Subramaniam, 2018). However, belief studies have been critiqued for overemphasising teachers' individual psychological characteristics (Skott, 2015). Moreover, within enactment studies, they run the risk of portraying teachers as 'inconsistent beings' when their 'professed' beliefs are not aligned with 'enacted' beliefs (Leatham, 2009, p. 91). Further, Indian primary teachers often do not get adequate 'subject matter knowledge' training during their teacher education programmes (Kingdon & Banerji, 2010; Kumar et al., 2012). We already have a lack of teacher 'voice' in curriculum development (Batra, 2005), and thus there is a critical need to listen to the teacher. In such a context, I use a broader notion of teacher 'views' which influence their textbook enactment, instead of distinguishing their voice in terms of 'beliefs' or 'knowledge'.

Another important teacher-related aspect is their 'institutional reality' (McClain, Zhao, Visnovska, & Bowen, 2009). McClain et al. (2009: 61) argued that 'institutional realities' capture teachers' 'perceived institutional demands, constraints, and affordances'. For example, Herbel-Eisenmann, Lubienski, Id-Deen (2006) found that the same teacher used two very different approaches to the same curriculum in two different school settings. Additionally, institutional contexts also include the extent to which teachers are able to work as a 'community of practice' (Gueudet, Pepin, & Trouche, 2013; Wenger, 1998). Overall, this paper focuses on teacher 'views' about the textbook, its use, as well as their institutional realities to understand their textbook enactment.

Research Design

Context of the schools and teachers

In Delhi, different management bodies run different types of government schools: the central-government (Kendriya Vidyalaya, KV), the state-government (Directorate of Education, DOE) and the municipality (Municipality of Delhi, MCD). For this study, four MCD schools (which has the largest number of primary schools under its purview) were chosen as the site for the study. These schools are mandated to use the *Math-Magic* mathematics textbooks. The MCD schools also are heavily under-resourced when compared to schools managed by the central government or the DOE (Chopra, 2016). In particular in the recent years, the MCD has struggled with funds which has caused several issues including non-payment of teacher salaries (See Anwar, 2016). While the DOE has increased its education budget considerably, this hasn't impacted MCD schools. On the other hand, MCD schools are often attended by the most marginalised group of children (Ramachandran, 2006; Subramanian, 2019).

The Municipal Corporation in Delhi is divided into three zones – East Delhi Municipal Corporation (EDMC), South Delhi Municipal Corporation (SDMC) and North Delhi Municipal Corporation (NDMC). I got permission to study two schools in EDMC, and one school each in SDMC and NDMC. The location of the schools (across and within zones) is critical, as school catchment depends on availability of private schools in the neighbourhood, level of prosperity, as well as the socio-economic composition. Across the zones there are varied demographics that impact the composition of students attending these schools. Delhi has historically had (and continues to have) segregated urbanisation based on socio-economic characteristics (See Ahmad et al., 2013). East Delhi, specifically, has a very high urban deprivation, yet as Dupont (2004) points, it has pockets of ghettoisation (both privileged and underprivileged). This is reflected in my sample too. For instance, despite being in the same zone, the two schools in EDMC were very different. School 2 was located in a more prosperous locality, whereas School 3 in a more deprived neighbourhood. School 3 had a high proportion of children from the Scheduled and other backward castes background, while School 2 had no children from such a background (See Subramanian, 2017 for analysis on caste and mathematics education in India). On the other hand, School 2 had a high proportion of Muslim children. The other two schools, School 1 and School 4, were all-girls school located on the city's fringes (another high deprivation urban area) in the South and North zones with growing enrolment rates. These schools had overcrowded classrooms (45-55 children per class), as opposed to School 2 and School 3 where the class sizes were much smaller[1] (15-20 children per class). Overall, despite choosing MCD schools, the characteristics of

the four schools were diverse.

Government primary teachers (who are not subject specialists) are responsible for the holistic development of the child for five years of primary schooling, including curricular and co-curricular growth in mathematics, environmental studies (EVS), Hindi, English, arts (drawing, music) and physical activity. The same group of children typically spend all their years of primary schooling (Class 1 to 5) with the same teacher. This study focused on the last two years of primary schooling – Class 4 and Class 5. Studying these grades meant that the teachers were already familiar with the students in their class, and in turn their pedagogical needs. As the textbooks were central to the study, it was important that the teachers had been using them since their introduction in 2010. Thus, all the sample teachers had minimum of seven years of teaching experience. Six teachers had 7-8 years of experience (early career), two had 11-14 years (mid-career) and two had 20-30 years of experience. There were two male teachers in my sample and eight women teachers. This is representative of the primary teachers' community in Delhi, where only about 27% of the teachers are male (DISE 2015-2016). Seven out of the ten teachers had the Elementary Teacher Training Diploma (ETE). Of the remaining three, one had obtained her qualification from the Bachelors in Elementary Education (BElEd) course, which is significantly different from the other courses and consistent with the NCF-2005 ideals (Batra, 2009). Work for a government teacher also includes several administrative tasks. These include government census work, election duties and other kinds of endeavour outside of the schools. As Ramachandran et al. (2005: 2142) comment, these 'non-teaching tasks' often cause teacher demotivation as their job becomes more burdensome. Along with these tasks, teachers are expected to implement different types of directives that come to schools from the administrative bodies at short notice (Gupta & Ahmad, 2016). Teachers' role is further complicated by the growing contractualisation of the profession (Beteille & Ramachandran, 2016). One of the ten sample teachers, was hired on a contract-basis, which meant that his appointment was subject to renewal every year.

Due to his tenuous contract position, he had already taught in three schools in three years, unlike the permanent teachers, who had been teaching in the same school for majority of their teaching years. None of the teachers in my sample had received any training specific to the *Math-Magic* textbooks. Rakhi and Afreen, stood out in that they had recently been awarded a teacher award by an NGO in partnership with the MCD. The reward included a cash award, a teaching and learning materials package and a residential workshop. The teaching and learning package and the workshop included mathematics specific resources (offered by another NGO). In schools 2 and 3, there was some NGO presence (a library project and remedial classes), but none of the sample

teachers directly engaged with them.

Table I: Characteristics of the ten case study teachers

Teacher	Class	School	Years of Experience	Teacher status	Qualification
Payal	5	S1	8	Permanent	2-year diploma (ETE, DIET Delhi)
Afreen	4	S1	8	Permanent	2-year diploma (ETE, DIET Delhi); MA Political Science
Rakhi	4	S1	8	Permanent	2-year diploma (ETE, DIET Delhi)
Jyoti	4	S2	14	Permanent	2-year diploma (ETE, DIET Delhi); BEd
Aanchal	5	S2	11	Permanent	2-year diploma (ETE, DIET Delhi)
Dolly	4	S3	20	Permanent	3-year degree (BEd, DU Delhi); MA Political Science, BCom
Vijay	5	S3	7	Contract	2-year diploma (ETE, DIET Maharashtra)
Neelam	5	S3	30	Permanent	3-year diploma (JBT, DIET Delhi)
Prateek	4	S4	8	Permanent	2-year diploma (ETE, DIET Haryana)
Padma	4	S4	8	Permanent	4-year degree (BElEd, DU, Delhi)

Research methods

This paper draws from mathematics lesson observations and semi-structured interviews with the ten teachers included in the sample. To collect classroom data, I audio-recorded 3-5 mathematics lessons of each of the teachers. I supplemented the audio recording with observation notes on student responses, use of gestures, teacher's blackboard work, and small-group interactions. Although students' voice (interview and observations) can give an important perspective on textbook use (Rezat, 2013), due to the limited scope of the study I focused on the teacher and did not collect any student specific data. To fully capture the institutional context within which the teachers worked, I further took in-depth field-notes during my school visits (Delamont, 2016). To analyse the classroom observations, the 37 lessons were categorised into 148 episodes identified as 'periods of time during which the class is engaged in one relatively coherent type of classroom activity' (Schoenfeld, 2013: 612). To analyse teachers' selection choices, these episodes were then coded as 'direct textbook use', 'adapted textbook use' and 'insertion outside textbook' (Table II).

Table II: Codes used to categorise episodes within each lesson observation

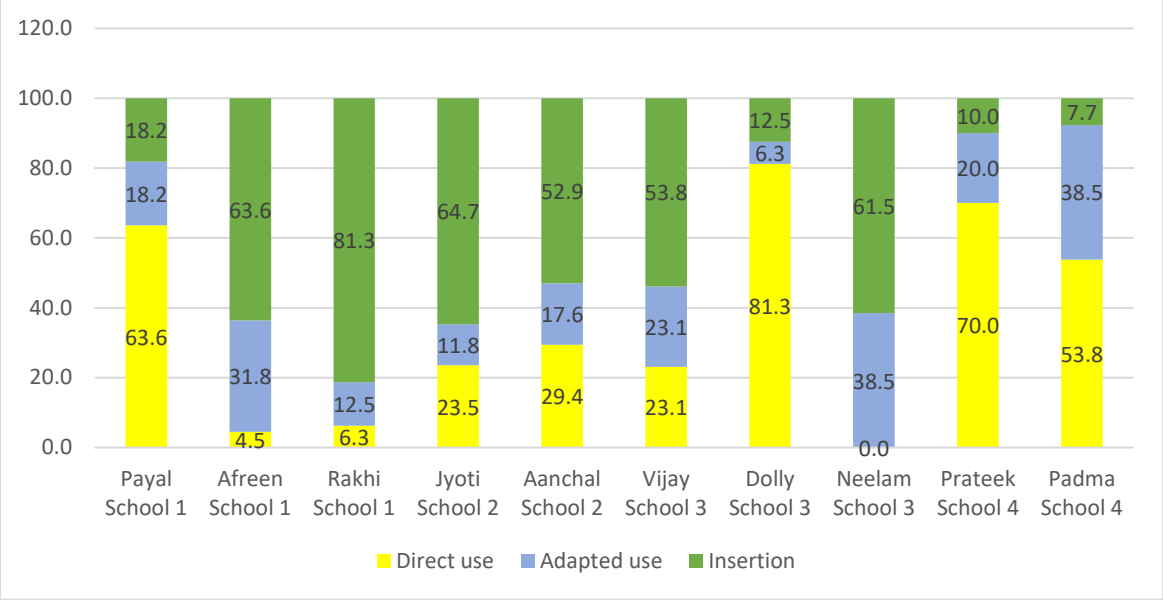
Direct Textbook Use (DTU)	Episodes in which teachers attempted directly to use a textbook task or at least some of its sub-tasks.
Adapted Textbook Use (ATU)	Episodes that are explicitly modified from the tasks in the textbooks.
Insertion outside textbook (INS)	Episodes that bear no resemblance to any textbook task (eliciting sub tasks, non-eliciting components or context).

I conducted two semi-structured interviews with each teacher – one before starting the lesson observations, and the second at the end of my nine-month fieldwork. Each interview duration was about one hour. The aim was to understand teachers' views on the textbook features (first interview) and their views on the use of the textbooks including institutional constraints and support (second interview). I analysed the interview data, using a hybrid inductive-deductive analysis method (Fereday & Muir-Cochrane, 2006). The first interview was analysed using the textbook analysis themes, focusing on teachers' views on specific textbook features. For the second interview, a more inductive approach was taken, and open-coding was conducted to identify themes on teachers' decisions around textbook usage.

Primary Teachers' Enactments of Mathematics Textbooks

Across the observed lessons, 46 per cent of the episodes were coded as insertions, which did not have any resemblance with the tasks in the textbook. The other 54 per cent were either direct textbook use (32 percent) or adapted use (22 percent). This indicates that half of the episodes across the lessons of the ten teachers as a whole were taught through the textbook tasks (direct or adapted), whereas the other half had teachers using alternative ones. This signifies that while the textbook is an important resource, teachers may just as much use other resources.

Figure I: Percentage of observed episodes categorised as direct, adapted or inserted textbook use



Moreover, selection choices among the ten teachers differed. Figure 1 shows details of the textbook use of each of the ten teachers. This indicates that four teachers used textbook tasks (direct or adapted) for more than 80 per cent of their lesson episodes (Payal, Dolly, Prateek, and Padma). On the other hand, one teacher (Rakhi) used inserted tasks for more than 80 per cent of the episodes, whilst the remaining five teachers (Afreen, Jyoti, Vijay, Aanchal, Vijay and Neelam) did so between 50-65 percent. Instead of labelling these teachers as 'acceptors' or 'rejecters' of the textbook, it is important to explore the textbook task selection along with teachers' own views about their practice to understand their enactments. Table III details the four types of enactments – follow, customise, design, and avoid. In line with my conceptual framework, I will now discuss how teachers' views and institutional realities influence these textbook enactments.

Table III: Types of textbook enactment by primary teachers

Textbook enactment	*Characteristics of use*	*Teachers*
Following	Using the textbook as a script to define the classroom activity and mathematics teaching and learning	Dolly, Prateek, Padma
Customising	Modifying the textbook use to accommodate own ideas about mathematics teaching and learning	Payal, Rakhi, Jyoti
Designing	Intentional integration of ideas from the textbook and own ideas to design mathematics teaching and learning	Afreen

Avoiding	Neither engaging with the textbook nor exerting own agency to customise or design mathematics teaching and learning	Vijay, Neelam, Aanchal

Following: using the textbook as a script

Three teachers (Dolly, Prateek, Padma) were observed to *follow* the textbook, viewing it as a script. They included insertions and adapted textbook tasks only to supplement the textbook. From one point of view, these teachers can be viewed as 'adhering' (Nicol & Crespo, 2006) or 'offloading' (Brown, 2002) the textbook. As Nicol and Crespo (2006) held, adherence to curricular material involves treating the textbook as an authority and the primary resource in the classroom, which was seen in the lessons of all these three teachers. However, this adherence does not mean that these teachers necessarily always agreed with the textbook and its features. In fact, two of the teachers, Dolly and Padma, were particularly vocal in pointing out what they considered to be several shortcomings of the textbook. For instance, Dolly felt dissatisfied with the textbooks and pointed that the authors had put too much emphasis on activities and ignored practice-based questions.

> Sometimes, these details are not important. You have explained, given them examples, then [children should] do the examples on their own. For that the teacher has to prepare 10 questions, which increases the work of teachers. So, I think that the work of the teacher should be reduced. [Dolly]

However, when it came to her lessons, she was observed focusing on the textbook tasks, attempting all the different types of questions and only rarely supplementing them with insertions. One explanation for such a mismatch between the teacher's views on the textbooks and her teaching could be the 'official' status of the textbook itself. Her adherence to the textbook task could be explained by the fact that she viewed her role as that of a teacher/employee in the government school who *had* to follow and comply with this 'official' curriculum. When asked why she used the textbook, she replied '*syllabus to karna hi karna hai*' (We have to do the syllabus). As Kumar (2005) remarked, within a larger 'textbook culture', any kind of textbook would always be viewed as a source of authority, irrespective of its nature. The pervasiveness of the textbook culture also indicates that the teacher herself did not conceptualise her teaching as being shaped by her own views, as she has offloaded the agency onto the textbook. Thus, both Padma and Dolly, despite disagreeing with several aspects of the textbook, appeared to consider it had to be used as a primary source of material in their classrooms.

Another important aspect to consider in understanding this 'mismatch' is the institutional setting within which the teachers are working. Dolly (senior teacher), especially, was often called out to

do several administrative duties during the course of my field work, as she took on many of the responsibilities of a head teacher (who was yet to be appointed) in her school. She repeatedly pointed out how this took up a lot of her time, leaving very little time for teaching. Other teachers also reported how disruptions in their schedules caused them to give insufficient attention to their teaching. Stoffels (2005) in his research on South African teachers' implementation of curricular reform, brought to the fore the notion of the intensification of teachers' work. This refers to the move towards teachers' work becoming more clerical and administrative, accompanied with a lack of emphasis on craft of teaching (deskilling) (see Gitlin, 2001). Stoffels (2005: 531) went on to argue that the mismatch between teachers' personal views, and their practice, has to do with the 'threat of intensification'. Similar arguments have been proposed in India by Ramachandran et al. (2008) who chronicle the impact of the burden of administrative tasks on teaching and learning. Since teachers have so many other administrative duties, they fall back on their 'default' teaching (curriculum as delivery mechanism), rather than attempting to bring their own views into their practice. In this context too, teachers have to juggle between their multiple roles of 'politicians, civil servants and professionals' (Majumdar, 2011: 33). Thus, the institutional context of textbook culture and work intensification could explain why teachers, such as Dolly and Padma, are unable to use their views to change their task selection choices.

The third teacher, Prateek, on the other hand, seemed to have a much closer alignment between his views and textbook use. He was the only teacher who did not explicitly disagree with the textbook's approach.

> The benefit [of this textbook] is that you get content and a content pattern that you go along with. So, we don't have to make the pattern. Also, I feel that, for example *Bhopal ki sair* (Trip to Bhopal), is practically related to addition and subtraction. Then if we want we can make our own exercises. [Prateek]

It seems that Prateek's choice of 'following' the textbook was not only influenced by the cultural dominance of the 'textbook culture', but also his 'curricular trust' (Drake & Sherin, 2009). He appeared to trust the decisions made by the textbook authors in creating a series of tasks that provide a coherent framework for mathematics learning. When reporting the influences on his teaching, Prateek credited both the textbook itself, which he believed had instructed him ways of teaching that he might not have attempted on his own. Prateek also expressed the help he got from a senior teacher in their school.

> For the usage of the textbooks, if there are any such difficulties then I ask Adeel Sir or the other teachers for help. Mostly, I ask Adeel Sir. His class is in front, and he's there to help. [Prateek]

While the teacher placement structure does not have any sort of formal mentorship programme, this revelation shows that informal collaborations can be important. Having strong affiliations with

the academics who formulated NCF-2005, this particular senior teacher was very familiar with the ideologies and politics behind the textbooks. Prateek echoed the views of the senior teacher (who was also interviewed), when it came to critiquing the influence of NGOs and their intervention in government school systems. Their school had taken a firm decision against an NGO intervention in the recent past. Prateek consciously did not use any other 'NGO educational resources' and favoured the state produced texts (unlike other teachers discussed later). The scepticism of NGOs and their influence needs to be contextualised within the growing marketisation discourse of education in India (Kumar, 2008; Subramanian, 2019). As Kumar (2008) argues, increasingly NGOs are offering 'solutions' as an alternative to 'failing' state schooling, which several teachers and educators are opposed to. Overall, Prateek's 'curricular trust' of the state-produced textbooks, seemed to be influenced by both, because of his understanding of the underlying pedagogical ideas and its larger policy context.

It is interesting to note the difference between Prateek and Padma: both following the textbook script, from the same school, with similar years of experience and teaching the same grade in adjacent classrooms. Yet, their thinking about the textbook was dissimilar. It is striking that while Padma was a graduate of the four-year BElEd programme in Delhi (where the pedagogies that have influenced these textbooks are explicitly taught), Prateek had undertaken a DIET programme. Batra (2009), in her paper on teacher education and its role in progressive pedagogies, particularly discussed the potential of this University of Delhi's BElEd programme. Yet, in this case, this does not seem to have influenced the teacher. In fact, while talking about her training, Padma mentioned its rigour, but did not articulate any connection between the pedagogies of the textbooks and those she was taught.

Customising: using own resources to enact the textbook

Three other teachers (Payal, Rakhi, Jyoti), appeared to have been 'pushed' into taking on a more active role and customise the textbooks to align them more with their own views regarding mathematics teaching and learning. They were observed structuring their lessons around insertions, with some adaptations and direct textbook use episodes supplementing them. These teachers still attempted to 'cover' the chapters within them, but were not scripting their lessons based solely on textbook tasks. These teachers used their own aims for mathematics teaching to justify and guide this 'customisation'.

> Yes, I did these questions in the chapter *Trip to Bhopal*, but before doing this, they had to learn division. That is why I stopped that in between, and first taught them division and counting. [Rakhi]

A similar technique of interrupting the use of the textbook was seen in Jyoti and Payal's lessons, where information, procedural information, and repeated tasks were interspersed between and around direct textbook use. These teachers also dedicated entire lessons where they only attempted some inserted topic, which they saw as being important within the wider aims of mathematical learning. For instance, Payal, in her first lesson, taught place value and numbers in words, which are not included in any of the chapters in the textbooks. In her view, these insertions were necessary.

> I always teach them the basics on my own, for example, write in numbers, write in words, profit and loss, addition, subtraction, multiplication. [Payal]

So, they made adaptations and insertions that they believed aligned more with their own vision of the chapter as well as other mathematical needs of the children. This notion of 'customising' is similar to the 'elaboration' of that Nicol and Crespo (2006), who also talked about teachers viewing the textbook as a guide instead of an authority.

To understand the reasons behind this type of textbook enactment, teachers' views about mathematics learning needs to be considered. All these three teachers expressed ideas of mathematics teaching and learning that contradicted the open-ended and socio-constructivist approach of the mathematics textbooks. They preferred a textbook with a fixed mathematical progression for each topic sequenced as introduction, activities, solved examples and practice questions.

> If there was some demarcation given, like we are doing 'time' first, and after that we are doing 'distance' and then integrating it with this, then children would have understood it clearly. [Rakhi]

Teachers' views on these textbook's (perceived) missing elements further indicates their lack of 'curricular trust' (Drake & Sherin, 2009). That is, these three teachers seemed to not trust the textbook and thus, used their autonomy to customise their lessons. Customisation became a means of traversing the 'gap' (what is missing) between their aims and what they saw in the textbooks, borne out of a perceived deficit and mistrust of the textbook.

Apart from their own resources (making their own tasks as they moved along), the teachers relied on 'other' resources to help with the customisation, which included: (a) *Medhavi* question bank books (b) privately published student textbooks and (c) NGO and other resources. Medhavi scholarship examinations are state-wide competitive merit scholarship exams held by the MCD, in which high achieving students of Class 4 and 5 are eligible. For these teachers, these standardised examinations were crucial and needed special attention and preparation, for which teachers sought

out different pedagogical methods and resources. For instance, Payal used a privately published book with sample Medhavi questions within her mathematics teaching.

> Medhavi exams happens in December, so we complete the syllabus in October and then from November to December, for a stretch of one to one and half months, we make the children to practice these [Medhavi book] sums. [Payal]

Here again, Kumar's (1988) notion of textbook culture is being reflected. Despite the new reforms aimed at moving away from the syllabus-textbook-examination pipeline, the state apparatus continues to reproduce these in some forms: the Medhavi exams in this case. It is further crucial to note that these textbooks were being sold by private publishers directly to the schools. Thus, the demand for resources within these schools was being fulfilled by small-scale publishers, who had no incentives for creating materials in line with the NCF or the NCERT (National Council of Educational Research and Training) pedagogical epistemologies (see Ramachandran et al., 2004).

The second kind of resource coming into these lessons was the privately published textbooks used by private schools. Neelam, Jyoti and Aanchal, in particular, discussed the ways in which they brought them into their teaching. Unlike Prateek, who reposed his trust in 'state-produced' textbooks; we saw an opposite trend here. These teachers felt that the privately published textbooks were 'better'. All these three teachers had access to these private textbooks via their own children, who attended private schools. As Ramachandran (2006) has argued, in government school contexts, the social distance between the teacher and the student is often wide and most of the teachers do not send their own children to government schools. As became clear from their expressed views, they also saw the textbooks in the private schools (for *their* children) as being superior to the government resources (for *other* children). They also particularly felt that this made the government school children lag behind private school children.

> All the books should be same, both for the private schools and for ours. Then, they should talk about who is better. If you are making good books for them, and for us you are giving [books] like these, we also need those kinds [privately published] of books. [Aanchal]

It is important to contextualise these views within the wider public discourse around marketization of schools. There is a strong discourse that views government schools as inferior, with poor teachers and whose students are constantly compared with private schools (Vellanki, 2015). It is worth noting that some of the teachers expressed how they felt 'wronged' by having been given these books, while private school teachers used better, privately published textbooks. This idea that, if they were also given 'those' books, the students would do better is an important observation that requires further elaboration through in-depth research. It brings to the fore important

questions of equality in education. The designers developed these textbooks as a means of making mathematics more accessible to children from disadvantaged socio-cultural backgrounds. Yet, the same textbooks are being perceived as sites of 'creating' inequality (See Sethi & Alavi, 2017). In such a segregated school context, it becomes crucial to invest in constructive teacher professional development interventions that get primary school teachers to understand and engage with these textbooks and use them in ways in which they were truly envisioned to be used in the classroom.

Finally, Rakhi and Afreen included resources produced by NGOs which had entered the school 'formally' (and legally) through sanctioned Public-Private Partnerships (PPP) with the MCD. These included the teaching materials that they both received along with a teacher award via an NGO. Furthermore, Rakhi had also accessed resources during her work with the SCERT (State Council of Educational Research and Training) curriculum development. Rakhi seemed to be aware of different types of materials being developed at the SCERT, including question banks, additional workbook (more in line with her idea of mathematics teaching) and expressed disappointment that these never reached MCD schools.

> I had told you that administrative schools [Delhi state schools, unlike MCD schools] have worksheets available for practising which are prepared by the SCERT. I saw the worksheets there and I asked the madam to give me one sample of each, but I haven't got any yet. [Rakhi]

This further emphasises the disparities within the state schooling system. Since the MCD schools (part of my study) are run by the municipality, the facilities are very different from other state schools run by the Delhi. This difference became even more pronounced in the schooling system since the Delhi state in the last few years has increased their education budget by twofold and have made a concerted effort towards reforming their schools (Khanna, 2015). The benefits of these reforms or funding had not reached the MCD schools. Thus, resource-based differences are not just created between the private and government schools; but also within government schools of different governing bodies (both across and within). This has implications in the kinds of resources teachers have access to for 'customising' their textbook enactment. Overall, teachers express being 'pushed' into customising their textbook use and in turn challenging its place 'in' authority, due to the intrinsic incompatibility of the textbook with their notions of mathematics teaching and the influence of marketisation discourses.

Designing: using textbook and own resources to create lessons

I consider here a special case, that of Afreen, who did not articulate her mode of using the textbook as arising from her perceived deficiency of the textbook. Instead, she seemed to have internalised an agential role of the teacher, who is *supposed* to be using the textbook as a 'thinking device', instead of the expectation that it would be ready-made for use. Afreen was one of the teachers who did not have any explicit disagreement with either the pedagogical approach or the structure of the textbook. She even expressed an ease and confidence in terms of her ability to navigate it.

> The book is giving so much. These activities are fantastic, and we are unable to even do all of these. We can always take out practice questions from these. It's not like they should provide everything in writing [in the book], it depends on us. If it is all readymade, then what did you [as a teacher] do with the children on your own? [Afreen]

Yet, when we compare this to her use, we rarely find her 'directly' using the textbook tasks, but rather adapting them (32 percent) or inserting her own tasks (64 percent). This gives an opportunity to discuss Afreen's own unique *design* (Pepin, Gueudet, & Trouche, 2017). Pepin et al. (2017: 801) describe 'teachers' design' as a 'deliberate/conscious act' of 'creating something new', thus bringing dimensions of intentionality and genesis to the fore. I argue that Afreen's views and use of the textbook could be conceptualised through such a lens of teachers' design.

First, unlike teachers who customise their textbook use, Afreen did not conceptualise the 'adaptations' or even the 'insertions' as something that had to be done when you interrupt textbook use, but rather, this was to be considered as being a part of its 'use'. For instance, when asked to explain her insertions she stated 'yes, this is related to the book' (Lesson 3, post-lesson interview), thus indicating that she did not view them as being very distinct from the textbook. Moreover, unlike the teachers who customised the textbook yet covered each chapter (one after the other), Afreen viewed the textbook differently. She was the only teacher who explicitly expressed modifying her teaching design based on student understanding (rather than her own presumptions about mathematical learning).

> I won't call it a chapter; this is an entire unit. One unit in maths can take up to 2 to 3 weeks, if you want that child to understand it properly. If the child is not able to understand with one method, we will make her understand by the second method. And if she is not able to understand with that also, then we will apply the third method. When children have not understood, some of my units have taken up to one month. [Afreen]

Her approach to mathematics 'units' seems to involve an in-depth longer engagement with the topic, rather than covering a chapter page-by-page, as presented in the textbook. Afreen, with this approach to 'units', seemed comfortable 'combining' chapters. In the following excerpt, we can see her talk about how she combined the chapters 'The Way the World Looks' (concepts of different views of 3D objects) and 'Fields and Fences' (area and perimeter). While these two topics

are traditionally seen as separate, she felt that space and measurement could be interlinked and discussed together.

> Yes, this one, *Khet aur Bhaad* (Fields and Fences) and *Duniya kuch aisi dikhti hai* (The Way the World Looks), I am going to teach these chapters together. Because in this there are a few hypothetical things, I mean, a child cannot understand the things that are there in this [The way the world looks]. I am finding this lesson a little theoretical. So, it can be related to this chapter [Fields and Fences]. They can be related together. [Afreen]

Thus, based on how she viewed the tasks being 'related' to the textbook and her perception of units/topics rather than focus on chapters, she integrated adaptations and insertions within her textbook use. This indicates an intentional act of creating (and combining and prolonging) her own curriculum, thereby demonstrating that active designing was involved.

It also becomes important to discuss why Afreen is such a unique case, especially in a system that does not necessarily encourage teachers to develop their design capacities. Afreen, despite getting admission and wanting to study at a prestigious university-based teacher training institute, got her teacher training diploma from a private DIET for personal reasons. To an extent, her motivation for professional development seemed personal, as she regretted not getting trained at a better institution. She was motivated as a teacher and was actively seeking opportunities for professional development. There were two ways in which this was made evident: (a) teacher award scheme and other opportunities outside the school; (b) and support from her fellow teachers within school. Afreen was clearly encouraged by the teacher award that she received, which helped motivate her as well as (re)source other materials through this exposure. The other important dimension in Afreen's teaching was the 'community of practice'. As Pepin et al. (2013; 2017) discuss in their work, the collective dimension of the resource system is very important in defining how teachers use curricular materials. Afreen's school stands out as an exception compared to all the other three schools, in terms of teachers sharing pedagogical ideas as a collective, as mentioned by all the three teachers - Afreen, Rakhi, and Payal.

> Wherever you have a problem, you should talk to colleagues. I always discuss with my colleagues. Rakhi is my best friend. So, those who have similar thinking (like-minded), we interact with them. Like there is teacher Vanita, who I go to. There are some teachers in our school who think that they know everything. So, they stay 'reserved'. We will also discuss things during lunch. So, this I think it is very useful. So, in our 'group' we discuss. If there are children who have some emotional or other kind home related problems, then we discuss that as well. [Afreen]

In a context where teachers often work in 'intellectual isolation' (Batra, 2005: 4352), this 'community of practice' provides a platform for Afreen to engage with different pedagogical ideas. Afreen's designing of her own lessons facilitated through support and engagements with other teachers, shows a unique form of resource and textbook use.

Avoiding: neglecting the mathematics textbook and teaching

Among the ten teachers, there were three who neither attempted to use the textbook as a 'designer' nor 'customised' it nor 'followed' it. These teachers seemed to be 'avoiding' or 'neglecting' the textbook (in turn mathematics teaching) altogether. Three teachers, namely Neelam, Vijay and Aanchal, appeared to be doing this in different ways. All three of them reported their inability to understand what is required with these textbooks.

> I don't understand what is happening [in these textbooks]. Things are all mixed up. [Neelam]

> They have not clearly mentioned here, that what needs to be done. The concept is not very clear. If they had given good questions, then it would have been better. Yes, actually it is not very clear. There is nothing worth doing in that (*karwane layak*). [Aanchal]

This lack of clarity of purpose of the textbooks has also been revealed in the South African reform context (Bantwini, 2010), where the author reported how there was often a lack of understanding as well as any point of reference on how and why the reform was introduced. Here, Prateek's case can be contrasted. He was the only teacher who could explicitly point to the NCF-2005 document to explain the rationale for the textbooks. On the other hand, in case of these three teachers, they seemed to be speculating on the purpose and their implications. Aanchal and Neelam were unable even to articulate their discomfort with the textbook and were completely dismissive about them. Vijay, while being more articulate in terms of expressing his concerns, especially the futility of using context in mathematics lessons, expressed the view that the textbook was not 'worthy' enough to be taught from. This dismissal of the textbook, and inability to comprehend it was leading to neglect of not just the textbook, but also, of the subject itself. All three of them, for instance, had very short lessons (only about 20 minutes) and attempted only a few of the chapters in the textbooks, paying less attention to the subject compared to the other teachers (who included mathematics almost every day in their teaching). Since they did not seem to follow the textbook either as a script or to structure their lessons, Aanchal and Neelam often asked me what I wanted them to teach as I observed their lessons.

This kind of avoidance of the textbook and neglect of the subject, can be attributed to various reasons. Firstly, primary school teachers are responsible for teaching all subjects – mathematics being only one of them. They are 'free' to use the time during the day and organise it however they want for their teaching. Thus, the importance given to mathematics teaching within the day/week/year varied among the teachers. Not all had a similar commitment towards mathematics as a subject. For instance, Vijay attempted to finish multiple chapters of a single subject in one week. He explained how he had 'covered' most of the mathematics syllabus even though only a few of the textbook chapters were attempted. Neelam too, hardly seemed to pay attention to

mathematics, and did not spend time on the subject (she attempted only two chapters). This characteristic of 'avoidance' is very different from the teachers who 'customise' and 'design' their practices of mathematics teaching that I have explained above, who all prioritised mathematics. Secondly, this non-seriousness around the teaching of mathematics by these teachers (Neelam, Vijay and Aanchal) is related to the lack of academic emphasis in these particular schools. This is corroborated by studies which describe how the nature of the teaching profession in government schools seem to privilege administrative tasks over pedagogical tasks (Ramachandran et al., 2008; Vasavi, 2015). Thus, some teachers start focusing on administrative tasks as a means to climb up the 'administrative ladder of career success' (Vasavi, 2015: 42). Vijay (who was also the only contract teacher) is a good example of using this strategy. He spent a large amount of time in the head teacher's room, and also would bring his personal laptop to complete some of the administrative work. In addition, he was the only male teacher in his school and felt responsible for taking up administrative tasks which required teachers to go outside of the school. It is interesting to keep in mind that men are often over-represented in school leadership positions despite being smaller in number in the teaching profession at the primary level (Mythili, 2019).

Finally, it is important to examine Aanchal's neglect of the subject, which seems to be strongly influenced by her own anxiety towards mathematics. Unlike other teachers, she was the only teacher who expressed being intimidated and nervous about teaching through these textbooks.

> Not all the teachers are experts, who can churn out examples and explain to the students, can they? [Aanchal]

In this 'avoidance', maths anxiety and confidence in 'customising' or 'designing' their own lessons are important issues to be considered, especially among primary teachers who are themselves not required to have studied mathematics beyond Grade 12 (Rajput & Walia, 2001). A textbook that presents itself in a complex way, demanding careful and intense reading, as with the prescribed one, can lead to further anxiety (Bapat & Takker, 2016). In this 'avoidance', Aanchal's views bring out the importance of understanding and engaging with more complex intersections of pedagogical content knowledge of mathematics as well as teachers' professional identities.

Conclusion

In this paper, I have explored the heterogeneous ways in which primary school teachers use *Math-Magic* mathematics textbooks. In a context, where there is a prevalence of the 'textbook culture' (Kumar, 1988), this study deepens our understanding of the diverse ways in which teachers use and engage with textbooks. The study finds that teachers use their agency to modify and select texts in unique ways, influenced both by their views and the institutional realities. For example, teachers such as Dolly who do not fully support the textbooks seem to end up following the

textbooks due to the institutional and time constraints. Another emerging notion that seems to influence diversity in textbook use is the notion of 'curricular trust'. Only one 'follower' (Prateek) and 'designer' (Afreen) seemed to actively trust the textbook and its pedagogy. Despite the textbook's official status and overarching 'textbook culture', it does not translate to 'curricular trust'. As several other studies show, traditional ideas of mathematics teaching are stickier than they seem (Cohen, 1990). Here, we see teachers 'customising' textbook use to accommodate their own views on mathematics teaching that are in turn linked to certain modes of state-based standardised assessments. 'Curricular trust' among teachers is an important aspect that curriculum developers need to build through engaging with 'communities of practice'. Examples of this can be seen in Prateek's case, where trust was built by the informal mentorship through the senior teacher; and we see a strong impact of colleagues' support in Afreen's case as well.

Insights from this study can become integral to both teacher education and textbook development. Recognising that teachers' engagement with textbooks is not homogenous calls for the developing of adequate teacher education support to develop teachers' design capacities (both during initial teacher education and in-service professional development) (Brown, 2009). Scholars such as Mili and Winch (2019: 181) have argued that textbooks can become 'powerful pedagogical tools' within the Indian contexts rather than purely being teaching scripts. Looking forward, with the introduction of new National Education Policy (NEP-2020) there are likely to be several curricular reforms with possible introduction of new textbooks. It will be crucial to develop educative teaching materials (Davis et al., 2014), keeping in view these different enactment types. For textbooks to become powerful tools for teaching, the teacher-textbook interaction needs to be carefully considered.

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Notes

[1] In the book by Jain, Mehendale, Mukhopadhyay, Sarangapani, and Winch (2018); Jain (2018) and Gurney (2018) describe in detail the different types of school provisions in Delhi. They particularly highlight the influx of unrecognised private schools along with the neglect of government schools which has led to low enrolments in several inner-city MCD schools. Both the schools in my sample in East Delhi had this issue of low enrolments. In School 1, several sections had been combined together; and School 2 was a 'merged-school' where two separate schools (boys and girls) were running in the same shift within the same building. On the other hand, the other two schools which were located at the city's peripheries were overcrowded. As Jain (2018) highlights, this overcrowding and 'slumming' of schools is linked with the city's political economy which either forces the inner-city slums to move to the fringes of the city; or are industrial zones populated by rural workers living in make-shift conditions.

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