Ethnic Minority-Cultured Students and Classroom Engagement

ISCAR Symposium 2011
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> Practice has a logic which is not that of the logician.
> [Bourdieu, 1990: 86]

Abstract

This paper seeks to understand how Bourdieu's theory of social practice can be applied in a mathematics education context, by specifically drawing on a case study analysis of a mathematics classroom in a secondary school. The aim of the paper is to investigate how concepts such as field, capital and habitus can be operationalized in such a given context for the particular classroom under analysis. The findings of the Bourdieusain analysis show that there are three distinctive 'camps' in this classroom: i) those who co-operate with the teacher and engage in mathematics lessons; ii) those whose interest lies in being pack leaders of the 'street crowd'/peer groups and completely disinterest themselves from the lesson; iii) and those who try being part of both. These practices mainly seem to be part of two fields within the classroom i.e. the mathematics education field and 'popularity field', which are at conflict with each other. Although Bourdieu's theory 'aids' the investigation so far by unravelling the above hidden aspects, it does not allow to explore this conflict between e.g. fields in the same fraction of social space further. Hence in the second half of the discussion a CHAT perspective is explored in this given context. It is found that Vygotsky and more so Leontiev's notion of human activity could be interpreted and applied in the above setting, as e.g. two forms of activities differentiated by their distinctive motives i.e. one as 'doing mathematics' and the other as 'being popular' which are misaligned, as a way forward.

Keywords: Ethnic-minority, gender, social-class, mathematics education & engagement.

What's the role of classroom culture in making sense of mathematics?

In recent years, many mathematics educators and researchers have gone beyond the inter-relational link of the psyche and ontology in order to emphasize the role of the social context in the formation of mathematical understanding in classrooms.
In 1977 when Paul Willis ethnographically investigated how a group of working class *lads* got working class jobs, he found that it is their working class *culture* that is at the very heart of the conflict between social mobility, hence re-producing its very conditions of existence, and re-producing the social stratification and cultural

arbitrariness. Drawing on Marxism in his powerful text 'Learning to Labour', he further argued that these conditions of existence were deeply embedded in the pedagogical relationships within and between schools and the labour market. Since decades, this issue of closing the gap between the working class and middle class students' achievement in particular in mathematics (along with other subjects) has persisted and is still at the heart of many research studies[1], (to mention a few see Swann, 1985; Bhattacharyya et al., 2003; DfES, 2006; Noyes, 2009; Strand 2010; etc). These studies show that the landscape of such investigations has now extended to take into account not only social class and gender but also ethnicity.

For example, Noyes' work in the area of mathematics education has predominantly drawn on Bourdieu's theory to explore the relationship of parental perception on learning mathematics to the 'child's approach to the subject' (2004, p.7), whilst also considering role of factors such as ethnicity, gender and social class in such relations. Arguing that there is a need to explore and build upon this to understand the link between the parent's impact on student learning mathematics and the transferral of that knowledge to e.g. secondary schools, he has implemented the metaphor of '*learning landscapes'* to 'illuminate the complexities of learning processes' (ibid, p. 34) specifically in mathematics and how such a metaphor can help to analyze the transfer between two such landscapes e.g. primary school (Key stage 2) to secondary school (Key stage 3) or home to secondary schools. He argues that there are multilayers to *cultures* that need to be explored in the context of such learning landscapes, hence, distinguishing himself from e.g. Bourdieu's concept of field. He further argues that "if one can assume any child to be situated uniquely on the mathematics *learning landscape* then one must ask whether that particular environment is helpful or disadvantageous to each learner situated uniquely on it; is it hostile or friendly?" (ibid, p.39).

Having established via Noyes work (op cit.) the intricate link between the school or classroom *culture* and the students' learning process, Dowling (1998) argues through his own theoretical model (mainly built upon Bernstein's concepts of speech codes and classification and pedagogic devices for pedagogical discourse, see Bernstein; 1971a; 1971b; 1977) that these so-called environment children are situated in is also differentiated by ability, i.e. "essentially, schooling re-contextualizes social differences as differences in 'ability', thereby producing its own hierarchy of educational group" (ibid, p.51). In particular for mathematics, these hierarchies are then seen to be constituted by activity, i.e. "a structure of relations and practices which, essentially, regulates who can say/do what" (ibid, p.20). Dowling further ashows that it is these activities that are produced and re-produced, in particular, disadvantaging students on the basis of 'ability', since 'less able' students are less likely to cross the boundary between everyday mathematics and school mathematics[2] as differentiated by assessments texts and curriculum. His analysis of SMP textbooks (in mathematics) for 11 to 16 years old also showed that students were systematically further disadvantaged not only on the basis of ability but also gender and social class.

This disadvantage can then be seen as becoming "institutionalized through the allocation of pupils to different groups preparing for the different tiers at GCSE" (Kassem, 2001, p. 66). Kassem (2001) shows in his work that, in particular, Black pupils are entered in the lower tier (foundation) GCSE Maths exam regardless of their

[1] The vast breadth of these studies means that they are outside of the scope of this paper, and hence, are not included here.

[2] Also referred to as 'esoteric mathematics' by Dowling (1998).

prior achievement because they are perceived as being *less able*. Thus, Kassem suggests that placing students into ability groups mediates their further success at mathematics achievement. Certain ethnic groups can then be seen to be positioned in a way that hinders access to success e.g. in GCSE mathematics exams. Hence, teacher's perception of student's ability can be seen as playing a significant role in the process of selection of students as either 'high able' or 'less able' and this in return in intertwined with their achievement in mathematics. Similarly, Boaler (2008) argues that certain pedagogic practices based on equitable relations mediate better performances in students' mathematics achievement. Boaler (op cit.) states that these "goals of high achievement and equity were achieved in tandem through a mixed-ability mathematics approach" (ibid, p.168). This also re-inforces Kassem's (op cit.) argument i.e. teaching in ability groups institutionalises patterns of underachievement in mathematics in accordance with ethnicity, gender and social class.
Similarly, Zevenbergen (2005) draws on Bourdieu's theory to argue that placing in students in either lower or higher tiers in mathematics classes (i.e. ability groupings) contributed to the construction of differentiated mathematical habitus partly as a result of their exposure to different parts of the mathematics (curriculum), hence, impacting their mathematics learning trajectories.

> Thus school mathematics is deeply implicated in reproducing social inequality. (Willis, 1995, p.188)

> Often with a psychological brutality that nothing can attenuate, the school institution lays down its final judgements and its verdicts, from which there is no appeal, ranking all students in a unique hierarchy of all forms of excellence, nowadays dominated by a single discipline, mathematics. (Bourdieu, 1998, p. 28)

The above synthesis of some selected background literature predominantly shows that 'perceived ability' can be seen as the intricate link or mediating instrument playing out a hierarchy of positions that regulate learners activity – regardless of the implication of factors such as ethnicity, gender and social class as reflected in the learners' habitus. Schools can then be perceived as playing a significant role in this selection procedure that tends to (re) produce the society in a culturally arbitrary sense.

Research Questions

The above also shows that adopting a social-cultural perspective (by e.g. drawing on Marx, Bourdieu, Bernstein) allows the study of such social patterns, specifically in mathematics education, by linking the micro level analysis to the macro level. Hence, the remainder of this paper will focus on data collected for a pilot study (see Qasim, 2010) to explore:

1. How can Bourdieu's concepts be applied on a micro-level ethnographic style case study analysis (i.e. in the mathematics classroom in the given data set) in order to investigate 'perceived ability' as a mediating link between hierarchy of students' and teacher position and learner trajectory.

a. How can Bourdieu's concepts such as capital, habitus and field operationalized in a mathematics classroom context?

b. How are these reflected in the positions of the students in the observed classroom space and the teacher of this particular classroom?

2. How might Cultural Historical Activity Theory deal with the above differently in the light of the findings?

Bourdieu's concepts of habitus, capital and field in Mathematics Education

> I developed the concept of 'habitus' to incorporate the objective structures of society and the subjective role of agents within it. The habitus is a set of dispositions, reflexes and forms of behavior people acquire through acting in society. It reflects the different positions people have in society, for example, whether they are brought up in a middle class environment or in a working class suburb. (Bourdieu, 2000, p. 19).

The above signifies that a habitus is seen by Bourdieu as the embodiment of the social world (i.e. the social structure and the embodiment of a person's personal history of experience within it). Gender, ethnicity, class etc. shape habitus which is then reflected in one's (objective) position in this world as much as the forces within the *field* (i.e. structures of the *field*) which also enact upon theses positionings (by e.g. determining what is seen as legitimate and valuable –*capital*- within it), and hence, one's experience of it (through their subjective positioning).

The mathematical habitus

> The conditionings associated with a particular class of conditions of existence produce *habitus*, systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them. (Bourdieu, 1990, p. 53).

Bourdieu points out that a habitus is defined in terms of (systems of transposable and durable) dispositions e.g. students' dispositions towards engagement in mathematics tasks. The above quote also shows that (the collective nature of) habitus tends to re-produce social division and re-structure society (at a macro-level) without necessarily consciously aiming at such re-production. Additionally, Bourdieu (1990) gives further insights into the relation of an individual habitus with the collective habitus, as he explained that the 'singular habitus of members of the same class are united in a relationship of homology' (ibid, p.60). Thus the collective habitus of specific social

groups (which may be defined in terms of ethnicity, class and gender and can be delineated at the macro level of society) gives rise to individual sets of dispositions (habitus) that affect the trajectory and position of that individual, which may then be observed in a given field (i.e. at the micro level). This is particularly useful in a classroom investigation where one might seek to connect differential achievement patterns (which may in some way be indicative of the collective habitus) with students' dispositions towards learning and engagement with mathematics. Zevenbergen (2005) operationalizes this aspect of the habitus, i.e. *as structuring structures*, to show how a mathematical habitus (of a learner) is constructed when in dialogue (i.e. through structuring practices) within a given field; hence not only structuring the mathematical educational field in a cultural arbitrary way in terms of lower and higher ability tier/classes groupings, but also re-structuring (or as Zevenbergen calls it *constructing)* the habitus of these students which give rise to such practices.

The Role of the 'Educational Field'

Whereas classrooms can be seen as positioned in a hierarchical way as described above, Bourdieu (& Wacquant, 1989) additionally argue that hierarchy in position is also reflected within classrooms. Hence within a classroom 'field', students are objectively positioned according to the possession of 'capital'/power (e.g. institutional capital – students' prior achievements and grades in mathematics) and such positioning (and their relation with other positions e.g. with the teacher) shape the way that students engage with mathematics 'activities'. In particularly, Bourdieu and Passeron (1977) show that in their given data set students were differentially selected and positioned in schools, courses and ability classes according to their possession of power or status (capital) in the French Education System, which then had an impact on their achievement outcome (as reflected in the patterns found through their statistical analysis), as it either limited or enhanced their access to further capital available in the field. They use cultural and social capital (alongside linguistic) and directly relate the possession of these capitals to the degree of success of students in academia.

Capital as a form of Power within Mathematics Education Mediated by Ability Groupings

Bourdieu & Passeron (1977) also refer to educational qualifications as a form of cultural capital which they define as crucial to the cultural reproduction of class divisions in the education system. Bourdieu (1986) further describes cultural capital in terms of three forms, which can be interpreted in the context of my research as follows:

- Embodied cultural capital: This can be seen as the "dispositions of the mind and the body" (ibid, p.3), e.g. towards engagement in mathematics tasks, and might include values and beliefs about learning and education more generally. Thus, the habitus and embodied cultural capital are inseparable to the extent that one's habitus might be seen as a form of embodied cultural capital in itself if there is a suitable fit with the given field (i.e. the mathematics classroom).

- Objectified cultural capital: This can be seen as the material resources the students have to bring about their learning in mathematics such as books, calculators etc.

- Institutionalized cultural capital: For example, educational qualifications such as National Curriculum Test grades in mathematics and GCSE mathematics grades can be seen as institutionalized cultural capital.

The relation of capital (which as seen above is associated with power) and the field is described by Bourdieu in an interview with Wacquant (1989) as follows:

> A capital does not exist and function but in relation to a field: it confers a power over the field, over the materialized and embodied instruments of production or reproduction whose distribution constitutes the very structure of the field… (ibid, p.39)

The above implies that possession of different forms of capital, which students possess, gives them power or status within and over e.g. the classroom field (in which learning takes place), e.g. who will be listened to in the classroom, who gets to answer the most questions, who gets to give out resources such as books, etc. Similarly, classrooms can be positioned in a school field according to their possession of collective institutionalized cultural capital (in the form of students' teacher assessment results in mathematics). My pilot study (see Qasim, 2010) shows that, in the particular school under investigation, a class with students predicted to be at a borderline C/D grade in mathematics were allocated extra resources (such as staff within the school and hired help outside of the school) and time (in the form of enrichment sessions) in order to maximise their chances of achieving a grade C in their GCSE mathematics exams. Such a potential improvement in results was seen as a contribution to the schools' overall ranking in terms of mathematics achievement (or as before institutionalized cultural capital). Hence there was an unequal distribution of resources, where students predicted a low grade D and below were denied access to these resources. Similarly, students predicted a grade B and above were also not included in these enrichment classes. Noyes (2007) account of Bourdieu's understanding of this threshold is as follows:

> Bourdieu described such boundaries as the General Certificate of Secondary Education (GCSE) C/D borderline as a 'magical threshold' whereby two students, separated by the narrowest of margins, have their future educational and life opportunities differentiated in an instant. Such educational magic divides the 'profane' -grade D and below- from the 'sacred' -grades C and above (to use Durkheim's terms). (Ibid, p. 2)

From a Bourdieusian perspective, this particular classroom (field) had a dominant position in comparison to the classrooms with low prediction of grades. Therefore schools can also be positioned in wider fields (such as Local Authorities or neighbourhoods) according to their accumulated or volume of capital.

> The combined effect of low cultural capital and the associated low propensity to increase it through educational investment condemns the least favoured classes to the negative sanctions of the scholastic market, i.e. exclusion or early self-exclusion induced by lack of success. (Bourdieu, 1991, p.62)

Hence the above synthesis of Bourdieu's concepts of habitus, capital and field shows that the school system can be seen as a field of objective network relations between positions occupied by agents in terms of domination, subordination or homology and the mathematics classroom can be seen as a field within this field (see Bourdieu & Wacquant, op cit.). According to the above, mathematics students with a *middle class* habitus are more likely to possess certain forms of cultural and social capital. For example, these students might have higher prior achievement in mathematics (institutional cultural capital), which they can then re-invest in the classroom field by successfully engaging in and participating with mathematics, thus enhancing their learning experience. Similarly, if parents of middle class mathematics students provide extra resources to them (such as additional books, mathematics tuition, etc. - economic capital and objectified cultural capital), this can then be seen as being re-invested by the students in the field in order to gain more institutional cultural capital (e.g. qualifications in mathematics). On the contrary, mathematics students with a *working class* (habitus) can be seen to lack the possession of these capitals (power) which can then affect the objective positioning of such students within the classroom (field) and lead to their disengagement with mathematics 'activities' or practices. The relation of a mathematics teacher's habitus and cultural/social capital can also be empirically investigated in such an analysis in order to assess their position in the field and the teaching practices that are produced through the interaction of their habitus with the classroom field which then can be seen to influence students subjective positioning (e.g. by classing them as 'high ability' or 'not high ability').
For example, in her earlier study Zevenbergen (1996) argues that the legitimacy of a mathematics education field (which occupies a dominant position in terms of school curriculum and resource allocation) is *re-produced* by those agents whose practices preserve the *status quo* of this field. Furthermore, she argues that in order for students to be recognized as effective learners, they 'must construct knowledge which resembles that which is seen as legitimate in the field' (ibid, p.103), which is then tested in the schools' formal exams (such as GCSE and A level exams). Those students who are then able to *construct* their 'socially recognized mathematical knowledge' (ibid, p. 103), will then be able to gain more prestige by gaining places on higher level mathematics courses.

Mathematics Classroom: A field or a 'site of multiple fields'?

The concept of overlapping fields (as described above) further implies that a classroom can be seen as a site of *multiple fields*. Bourdieu describes that positionings within multiple fields map out the *social space*, which is "constructed in such a way that agents or groups are distributed in it according to their position in statistical distributions based on *two principles of differentiation*…economic capital and cultural capital" specifically in the investigation of the French society which he carried out (ibid, 1998, p. 6).
The above inevitably refers to the three vital properties required for the construction of the social space i.e. fields, power or capital (which can also be symbolic) and

hierarchy between different positions within the field itself and between them. Hence, the positioning of agents within a field and the hierarchy between fields is constructed via the evaluation of the different kinds of capital or power. Therefore the social space reflects the positions occupied by agents in various fields and these positionings are defined according to the capital or power these agents possess; the hierarchy of the positions occupied within a current field is conferred by the legitimacy or value of the capital within it. The difficulty here is to relate the constructed social space on paper to the real world. Agents occupying positions in close proximity in the social space arguably belong to the same class or group. This is not necessarily the case in the geographical sense as, for example, students and teachers find themselves closely located in a geographical space, i.e. classrooms, but not necessarily out of choice but out of necessity. They are not to be taken as 'belonging to the same class or group' because of this accumulation. Hence observations of a classroom or even a school "mask the structures that are realized in them. This is one of those cases where the visible, that which immediately given, hides the invisible which determines it. One thus forgets that the truth of any interaction is never entirely to be found within the interaction as it avails for observation" (Bourdieu, 1989, p. 16). Objective relations of positions cannot be reduced to interactions, but are embedded "between positions occupied within the distributions of the resources which are or may become active, effective, like aces in a game of cards, in the competition for the appropriation of scarce goods of which this social universe is the site" (ibid, p.17).
Adding to this, the next section will focus on the argument that students' socially recognized mathematical knowledge is very much embedded in the relation of these students' positions (between peer to peer and teacher to student) in the field(s) within the mathematics classroom (that can also be described as a fraction of social space) as mediated by ability grouping.

Data Sample

The vignette extracts presented in the beginning of this paper have been taken from a Year 8 mathematics classroom case study consisting of 20 students (see Appendix A). The data, which had already been collected for a previous study (as mentioned above – see Qasim, 2010) consists of 6 lesson observations carried out over a period of two weeks out of which 4 were video recorded. As a result of these observations, 6 students were selected for follow up interviews (which lasted up to 10 minutes) along with a teacher interview that lasted for up to 25 minutes.
The mathematics classroom was selected according to the unique interactive teaching style that was being implemented i.e. an American based pedagogic practice introduced by University x as part of another research project. Such interactive pedagogical innovations[3] could then potentially provide a rich data set. The selection was further supported by a recommendation from the Head of the Mathematics Department as it occupied a crucial borderline position i.e. average predicted GCSE Maths grade C/D.
The aim of this practice was to encourage and facilitate equality in the classroom by mixing different ability students in group settings to encourage collaborative learning within these groups. The class was divided into 5 groups of 4 students each. These

[3] These innovations were being implemented only in selected classrooms as part of another research funded by an external University.

groups were supposed to be re-mixed every half term randomly in order to achieve a mixed ability and gender setting. In this paper, a zoom-in approach has been applied in specifically group B and C of this particular classroom.
In order to maintain an unbiased way of selection of students for tasks, a random number generator was used such as a dice which was rolled before every task in order (students were labelled with numbers from 1 to 4 – ignoring number 5 and 6 on the dice). Furthermore, in order to maintain discipline and gain the attention of the students, Mr. William would raise his hand in the air which indicated that all students were immediately to stop any activities and raise their hands as well. Any such participation was then re-warded points ranging from 1 to 5 or 10 for outstanding contribution. These points were then accumulated by each group on a score sheet and the results were displayed every week on the leader board. The group to come first on would always win a prize e.g. chocolates. Such a pedagogic set up seemed very appropriate for this investigation since it marked the class out as a 'case' distinct from the other classes in the school. Focusing on 4 out of 6 students (selected for interviews), significant moments during the observations have been documented in the form of vignettes, whereas, interview transcripts are used where necessary to provide substance for the discussion.

Findings

Group C

Consulting Group C students' prior achievement i.e. Year 7 SATs results and background information (obtained from the Head of Mathematics Department), the following facts can be deduced.

Names	**Ethnicity**	**Gender**	**EAL[4]**	**FSM[5]**	**Key Stage 2 Maths Test Results**	**Year 11 Target (Grades)**
Abdul-Majeed	Somali	M	Yes	No	4A	B-
Alia	Somali	F	Yes	Yes	4A	B-
Zara	Any other mixed background	F	No	Yes	4C	C+
Pierce	Caribbean	M	No	Yes	4C	C+

Table 1 Group C's assessment results and targets for the future.

Evidently, all four students in Group C achieved a level 4 in their end of Key Stage 2 SATs mathematics test. The average level[6] for the rest of the class is also 4 with the highest achieved being 5B and the lowest achieved being 3C (see Appendix A for a full list of test results). However, Abdul-Majeed and Alia are considerably ahead of Zara and Pierce, which indicates that they have legitimate prior mathematical

[4] English as additional language
[5] Free school meal eligibility
[6] (N.B. each level is divided into three phases ranging from A to C – where A is the highest point in that level achieved and C refers to the beginner phase of that level).

knowledge proven and attested by exams (i.e. institutional cultural capital) that confers power on them as they are able to obtain a higher level in comparison to the rest of Group C. These factors can be understood in terms of capital as following:

- Mathematics cultural capital: This can be understood to be equivalent to e.g. to the students prior achievement in mathematics (such as SATS scores) which they are then able to invest in the mathematics field (in the form of institutional capital) and their legitimate *current* and *prior* mathematical knowledge (in the form of embodied mathematics cultural capital). This embodied form of cultural capital (or habitus) can then be understood as a reflection of the choices made in practice.

- Linguistic capital: English as an additional language can be seen as linguistic capital, as the command over one's mother tongue and English language can be seen as power e.g. in a classroom where most of the students belong to an ethnic minority.

- Social capital: Peer to peer relations and peer to teacher relations can be seen as a form of social capital. Arguably the composition of this capital (and its functional weight) could impact the trajectory of the learner in this classroom.

Now the teacher's maths test scores for this particular group are shown in the table below:

Names	**Teacher Maths Test results at the end of Spring Term (2010)**	**Teacher Maths Test results four weeks into Summer Term (2010)**
Alia	5C	3B
Abdul-Majeed	4B	3B
Pierce	4B	3B
Zara	4C	3A

Table 2 Teacher Test results of Group C in Year 8

Here, we can see a sudden drop in the results from the spring term to summer term tests. Hence the composition of the mathematics cultural capital changes. Alia (previously identified with high prior achievement in maths in comparison to others in her group) went from a level 5C to a level 3B. Similarly, Abdul-Majeed went from 4B to 3B. This is also true for the other two students. Coincidentally (or maybe not such a coincidence), this group was formed during the beginning of the summer term suggesting that that there could be a possible link between the formation between the formation of this group and this dip in grades. Pursuing this line of inquiry, the question (one of many) that inevitably arises to one mind is: Are these changes in the mathematics cultural capital a reflection of the *choices made in practice*[7] by the students and the teacher (as mediated by the embodied cultural capital or habitus)?

[7] I am referring here to the behaviour that was exhibited during the observations by the teacher and the students of this group. This behaviour could then be interpreted as either engagement or disengagement in mathematics tasks participation in the classroom activities or even disruptions during the lessons.

In the following extract of vignette I (lesson 4), Mr. William selects randomly Pierce from Group C to carry out a multiplication starter activity with the help of his group. Depending on the group's performance, this could earn them some points, which are accumulated at the end of every week on a leader board.

Vignette I – An Insight into Group C –Lesson 4

x	9	-7	10
5			
8			
-3			
-6			

Alia and Zara (also members of Pierce's group) are continuously chatting away completely oblivious to Abdul-Majeed's disruptions and Pierre's attempt to solve the starter. It is in this moment, when Pierre looks over to Mr. William and sees him raising his hand right up in the air. Suddenly, the whole class quietens down. Everyone has their hand up (except Pierre's group), as they are still chatting away. Mr. William takes a moment and then gives points to the groups that have quietened down first. This time two groups get two points each. These points are quickly noted down on the performance sheets, which are given to each group. Pierce's group has missed an opportunity to score. Afterwards, the students carry on with their task. Mr. William turns to Abdul-Majeed, who is still involved in the pretend fight, and sends him outside of the classroom. It's only in this moment that Alia (one of the two girls in the group) looks over to Pierce, who is still struggling with the starter (as he has only got the first answer right so far), and shouts the answer (to 9 x 8) out to him. "74", she says. This is quickly followed by an insult by her. "Bullshit", she says. However, she also realizes that her solution is wrong and turns around to other groups for assistance. "72", she shouts this time. "56", she shouts next as an answer to -7 x 8. Pierce writes this down on the board and then solves the last question in that column. The other groups are now keen to progress to the next stage of the lesson, as they have already been given their points for their starter activity. Finally, Pierce returns to his group.

The above vignette shows a complete dis-engagement and non-participation in the actual mathematics activity by Abdul-Majeed. However, he seems to be very 'popular' as other students are more than willing to engage in his pretend fight game and actual throwing around of paper, pencils and rubbers. So his *choices* evident in his practice confer him some power in *a* field within the classroom. Arguably and

evidently, this can be seen as social capital[8] i.e. peer to peer relation and a form of symbolic capital i.e. recognition as the 'popular one' or 'cool one' who has a carefree attitude. However, these powers or capitals are not valued in the mathematics classroom field as they do not align with the behaviour valued by the teacher, and hence, indicating that there are at least two fields at play here, i.e. one which confers power onto students who exhibit *legitimate mathematical knowledge* that aligns with the teacher's expectations (and with their dominant peers) and another that confers power to students who are perceived as popular by their fellow peers. In fact, there is at least one student disrupting the class in each group (with the exceptions of group A and E. During lesson 4 and 5, Raheem (from Group B) is continuously trying to out do Abdul-Majeed in a competition style in order to *win* recognition as the one with the most carefree attitude. However, disruptions from Alia are different in nature, as she is participating in the maths tasks (e.g. the multiplication starter activity). In fact, her choice of practice is to be both cool and trying to engage in the task as shown in the vignette. Throughout the 6 lessons she is continuously trying to get Mr. William's attention by shouting out the answers (which are not necessarily always right – as shown in the vignette) whilst competing within her own group. The shouting and continuous disruptions seem to impact Mr. William's perception of her ability and her potential to gain further mathematics knowledge in the class. Arguably, Alia does not have the socially legitimate knowledge that is required to be recognized as a 'high-ability' student nor do her choices or behaviour put her in a position where she can access such knowledge.

So far the above findings show that Alia's positioning of herself in the field is quite distinctive from Abdul-Majeed's positioning of himself as reflected in their choices of behaviour. Nevertheless they are both perceived by the teacher as 'low ability'. The commonality amongst both of these students is in fact that they are both appealing to the *street crowd* of the peer groups and can be perceived in fact as 'pack leaders'.

Let's look at another group within this class to validate these findings.

Group B

Group B consists of the following members:

Names	**Gender**	**Ethnicity**	**EAL**	**FSM**	**Key Stage 2 SATs Maths Test Results**	**Year 11 Target (Grades)**
Abdul	M	Somali	Yes	Yes	3B	D
Mohsin	M	Arab	Yes	Yes	3B	D
Raheem	M	Other White	Yes	Yes	3B	D
Amin	M	Other Pakistani	Yes	Yes	4B	B-

Table 3 – Group B prior achievements in SATs maths tests.

[8] There are various ways of defining social capital. I am here focussing on two definitions which are seen as most significant and evident in the empirical data.

As evident in the above table, this group's composition of mathematics cultural capital (specifically in the form of prior achievements) is considerably lower than group C (with the exception of Amin). This would indicate that group B members on a vertical scale of mathematics cultural capital would be positioned considerably lower with Abdul, Raheem and Mohsin sharing their position.
Vignette II further shows:

Vignette II – Lesson 4 - An Insight into Group B

It is Group B's turn and the student selected (through the random generator) is Mohammed, who has remained quiet throughout the lesson so far. He is given the task of explaining the concept of multiplication through 'partitioning' of two and three digit numbers using a worked example, which is as follows:
100 x 59

Mohammed does not say anything, but starts to write on the board. He has written the following so far:
59 x 99
5900
At this stage, Mr. William asks Abdul (another student from Mohammed's group) to assist him. Abdul's role in this situation is to not only assist Mohammed but to also act as a translator so that Mr. William can communicate with him with regards to this task (as Mohammed is not a fluent speaker). Therefore, Mohammed tells Abdul what he is doing and adds the following to the board:
59 x 99
5900
59
This leads to further confusion. Prompted by Mr. William's request for clarification, Abdul takes the marker and does the following changes in his attempt to convey Mohammed's communication. He completes the task as Mohammed is telling him to do in Arabic:
59 x 99
100 x 59 = 5900
- 59
5841

Having understood what Mohammed is trying to do, Mr. William then says to Abdul, "Ask him to partition 59", which he does. Mohammed then writes a 50 and a 9 on the board. Mr. William then says, "Mohammed, what have you partitioned there?" Abdul, who immediately starts to give his own explanation, interrupts him. So, Mr. William responds, "I know…I know you know how to do it but I want Mohammed to. What's that number?" At this point, Abdul steps back. Mohammed struggles to respond. Therefore, Mr. William asks Abdul again, "Do you want to help him?" But before Abdul can do so, Mohammed points to the number 50 and says, "Tens". "Ok! He knows it in English", says Mr. William patting Mohammed on the back and giving 5 marks to both boys. This means that Group B have earned a total of 10 marks during this task, more than any of the other groups. A smiling Mohammed walks back to his seat.

Throughout the lesson observations, it was found that Abdul was very eager to participate (mostly volunteering) and also helpful to his group members but also others. The collaborative engagement of Group B was also observed during the following mathematics lesson 5, as Raheem was helped by both Mohsin and Abdul in order to complete the following mathematics problem:

$$\frac{3^{x3}}{4^{x3}} - \frac{1^{x4}}{3^{x4}} = \frac{9}{12} - \frac{4}{12} = \frac{5}{12}$$

This partly happened because Mr. William allowed for such collaboration. Mr. William's recognition of specifically Abdul's effort was mostly demonstrated in the maximum number of scores that were awarded to the group for each task. In the above vignette II, fluency in English language also plays an important role and gives Abdul an extra dimension of significance over Mohsin, hence his linguistic capital seems to be interacting with his cultural capital. Arguably, Abdul does not have prior socially recognized mathematical knowledge as shown in his poor performance in tests, but he is perceived as 'high ability' by the teacher in specifically mathematical areas such as multiplication and algebra. But he does confer power over this mathematics classroom field by demonstrating his expertise in other areas of mathematics.

Abdul as it happens is a migrant student, who came to England during Key Stage 2. In fact 4 out of the 6 interviewees revealed that they were migrants who joined the English education system during their primary school years. All of them also displayed a strong influence of either their parents or older siblings in specifically assisting them with their mathematicss education. Hence, this shows that mathematical knowledge or habitus was *transposed* from one field (external to the school) to another in an embodied form along with a 'know how' in how 'to play the game', which further translated into legitimate practices of these students within the mathematics classroom field. Abdul was able to invest his initial (or primary) capital within the mathematics classroom field in order to gain further capital, hence the conditions of production of his initial capital were aligned with the conditions of use; which can then be seen as impacting his trajectory as a learner in this mathematics education (classroom) field.

Here, Abdul's was able to position himself positively in the mathematics education field. This was further encouraged by the teacher's perception of his abilities, hence, enabling him to occupy a dominant role within this classroom field (as for example, acting as a translator or mediator between Mohsin and Mr. William).

Discussion

Bourdieu's theory: dominant vs. dominant?

The above findings focussed on three students i.e. Abdul-Majeed (Group C), Alia (Group C) and Abdul-Majeed (Group B). It was found that behaviour that these students exhibited was exemplary of the three main dominant forms of practices within this particular classroom:

a) Peer group leaders who are primarily disruptive within the lesson and whose main motive seemed to be to 'lead the pack' (e.g. Abdul-Majeed);
b) those who cooperate with the teacher and engage with the mathematics tasks (e.g. Abdul);
c) and those who try playing both games (e.g. Alia).

Furthermore these students' social profile can be described as following:

⇒ Abdul-Majeed:
- Peer-group leader – appealing to street crowd→ composition of social capital in these terms legitimate in e.g. *popularity field* within the mathematics classroom (seen as a fraction of social space with multiple sites or fields).
- Hence, this composition of social capital is seen as having no alignment with mathematics education field in the same classroom.
- Unable to invest or acquire mathematics cultural capital, hence, impacting the trajectory of the learner.

⇒ Abdul:
- Able to invest mathematics cultural capital acquired from 'family field' into the mathematics education field; therefore has a 'feel for the game'.
- Is a peer group leader of those who have a 'feel for the game'; therefore aligns himself with the dominant peers and the teacher in the mathematics education field → this composition of the social capital contributes to the overall volume of capital possessed by the student positively impacting the student's position within this mathematics classroom field.
- Perceived as 'high ability' by the teacher.

⇒ Alia:
- Social capital in conflict in both fields → peer-group leader appealing to street crowd as well as trying to play the mathematics game (by e.g. shouting out the answers as shown in the vignette I).
- Does not have the right kind of social or mathematics cultural capital to invest in the mathematics education field

or play the game in way that would impact her trajectory positively as a mathematics learner.
- Perceived as 'low ability' by the teacher.

Conflict within composition of social capital vs conflict between fields in the same fraction of social space i.e. the classroom

In Bourdieu's (op cit.) terms, students such as Alia and Abdul-Majeed are disruptive because they lack the right kind of capital or power to acquire further capital that can beu used in e.g. later on in employment situations and, therefore, disruptions are seen as *misrecognized powerlessness.* But the findings above also show that the practices exhibited by Alia and Abdul-Majeed are also dominant in nature, and therefore, can be interpreted as being part of another field at play in this particular given social field i.e. 'the popularity field'. Whereas Abdul's practices align with the mathematics education field. These can be further elaborated as follows:

- Mathematics education field: in which socially recognized mathematics cultural capital (e.g. ability mappings) and social capital (defined in terms of dominant peer - peer and teacher-peer relations) is seen as valuable and legitimate.

- Popoularity field: in which social capital is only seen as valuable in terms of peer to peer relations e.g. by pretending to be the clown in the classroom. Mathematics cultural capital is not seen as valuable here.

These fields can then be seen as conflicting with each other in terms of their interests expressed in the form and composition of capital and, in particular, social capital seems to be at the heart of this conflict. Such a conflict can be presented diagrammatically as follows:

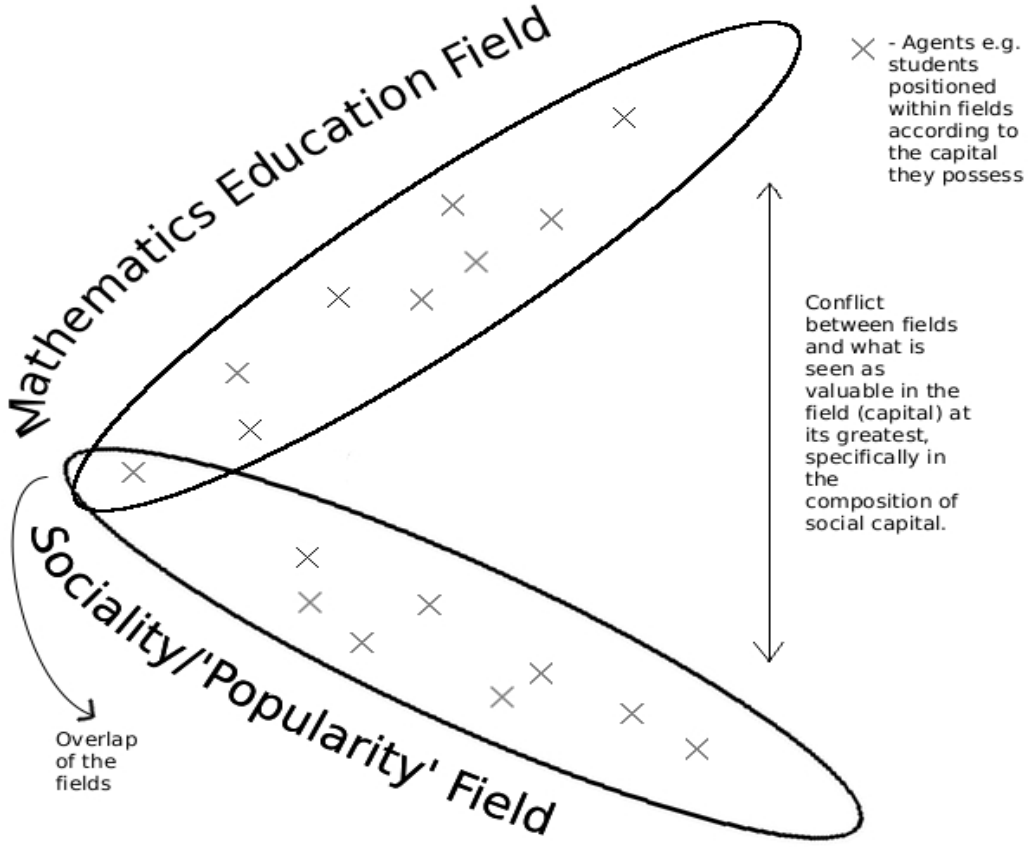

Figure 1 – Interpretation of the conflict between fields as presented in the observed mathematics social space.

Beyond Bourdieu: CHAT Perspective on 'Multiple Sites' within the Education System

The notion of integrating CHAT with other socio-cultural theories (such as Vygotsky with Bakhtin and Bourdieu) has been addressed by many studies before (see Holland, 1998; Williams et al., 2007, etc). Holland et al. (1998) integrate Bakhtin's theory with Vygotsky's developmental approach (along with Bourdieu) in order to introduce their concept of 'figured worlds' as another form of exploring agency and identity in a given social context, as they explain:

> Our use of identities—informed by these two dependent, but non coincident processes, figuring and positionality—leads to another way of conceptualizing personhood, culture, and their distributions over social groups. Figured worlds and their situated realizations, rendered collectively and personally as spaces of authoring, are socially animated by groupings that may not be reified as social groups. (Ibid: p. 286)

Holland et al. particularly draw on Bakhtin's (1981) notion of 'heteroglossia', i.e. 'the simultaneity of different languages and of their associated values and presuppositions'

(op cit., p.170), and 'self authoring' in order to define the 'interrelationship of differentiated vocal perspective on the social world' (ibid, p.173). Integrating Bakhtin's notion of space of self-authoring with Vygotsky's notion of Zone of Proximal Development (ZOPED) and inner speech through the exploration of development in children first through interpsychological (i.e. on a social level) and then intrapsychological level i.e. through directing speech inwardly, then provides room for agency to a certain extent i.e. some control over choices in behavior (ibid, 1978; 1986). Nevertheless, Holland et al. also account for the possibility of multiple figured worlds in the same social space, raising the question 'to which figurine does a particular practice belong'; emphasizing that a Bourdieusian 'field analysis' can be seen as very useful to map out the figured world. Hence the concept of (multiple) figured worlds does not provide you with tools to operationalize in a practical sense beyond Bourdieu.

At the same time, Engestroem et al. (1997) explores Wertsch's (1991) notion of 'multivoicedness' to elaborate the multiple layers within *an* activity system.

> An activity system contains a variety of different viewpoints or "voices", as well as layers of historically accumulated artifacts, rules, and patterns of division of labor. This multivoiced and multilayered nature of activity systems is both a resource for collective achievement and a source of compartmentalization and conflict. (Cole, Engestroem, and Vasquez, 1997: p.4)

Specifically in education, Engestroem (1987) previously argued that contradiction (i.e. tertiary contradiction) within the activity system 'appears when representatives of culture (e.g. teachers) introduce the object and motive of a culturally more advanced for of central activity into the dominant form of the central activity. For example, the primary student goes to school to play with his friends (dominant motive), but the teacher and parents try to make him study more seriously (culturally more advanced form of activity' (ibid, p. 54). Not only can the parents and teacher introduce the shift but also the subject of the central activity, which is in this case the student. This then leads to the expansion of the central system. However, this perspective also emphasizes the notion of a singular central activity system (as a collective), which can be perceived as indicative of no more than one 'central activity system' within a mathematics classroom despite being multilayered. Furthermore, the micro level analysis shown above requires also an individualistic socio cultural approach to e.g. associate Abdul-Majeed's choices in behavior to a certain activity or field in Bourdieusian sense.

Here the simplest form of human activity was described initially by Vygotsky (1978) in the form of a mediating act i.e. a stimulus – response process. The mediating instruments here were in two forms i.e. psychological tools and signs. Later on a student of Leontiev (1981) addressed intricate levels within an activity as shown in the following extract:

> When a member of a group performs his labour activity he also does it to satisfy one of his needs. A beater, for example, taking part in a primaeval collective hunt, was stimulated by a need for food or, perhaps, by a need for clothing, which the skin of the dead animal would meet for him. At what, however, was his activity directly aimed? It may have been directed, for example, at frightening a herd of animals and sending them toward other

> hunters, hiding in ambush. That, properly speaking, is what should be the result of the activity of this man. And the activity of this individual member of the hunt ends with that. The rest is completed by the other members. This result, i.e., the frightening of game, etc., understandably does not in itself, and may not, lead to satisfaction of the beater's need for food, or the skin of the animal. What the processes of his activity were directed to did not, consequently, coincide with what stimulated them, i.e., did not coincide with the motive of his activity; the two were divided from one another in this instance. Processes, the object and motive of which do not coincide with one another, we shall call 'actions'. We can say, for example, that the beater's activity is the hunt, and the frightening of game his action. (Ibid, 1981: p. 210)

Hence Leontiev (1981) structure of activity is as following:

Activity	→ Motive
Action	→ Goal
Operations	→ Conditions

This can then be perceived in the light of the above findings as having at least two activities in this particular classroom, which are distinguished from each other through their motives:

1) One which is characterised by engaging with schooling and pleasing the teacher i.e. the activity of 'doing mathematics' → Abdul.

2) Another which is characterised by impressing the peers and displeasing the teachers i.e. being popular within the 'street crowd'/peer groups → Abdul-Majeed.

Alia would again be seen as trying to be part of both activities. This then suggests that the conflict between activities lies within their motives. The mis-alignment of a school motive with the student's own motive (explored above by Engestroem in terms of tertiary contradiction) is described by (op cit.) as exemplary of a dysfunctional classroom. Hence the above classroom can be perceived from a CHAT perspective as dysfunctional. Nevertheless, adapting Vygotsky and Leontiev's notion of human activity (1978; 1986) further adds to the overall analysis of the findings in the form of a possibility of exploring the issue of conflicts between 'multiple fields' that impact student's trajectories as mathematics learners in terms of two distinctive activities driven by differentiated motives.

Conclusion

The first half of this paper looks into how Bourdieu's theory of social practice, specifically, concepts of field, capital and habitus can be operationalized in the mathematics education context. My review of the literature around his theory shows that e.g. a school or classroom can be seen as a fraction of educational social space (a site of multiple fields) where practices can be observed with particular emphasis of unravelling the hidden aspects of that space in order to understand the positionings of e.g. students within the multiple fields. Hence, students are positioned according to the capital they posses which then gives them either access to further resources (such as access to resources within a mathematics classroom (if their capital is seen as valuable in the given field) or can hinder their access (if it is does not align with what is accounted for valuable within this field). It is these positionings of individual students (and eventually the collective group of students with similar demographics defined by e.g. ethnicity, gender and social class) that tends to re-produce society.

Specifically in terms of capital and habitus, a closer look at the analysis of the case study above reveals that in the given fraction of social space (i.e. the mathematics classroom being observed) students' social capital, if perceived as valuable in the *popularity* field, is in conflict with the mathematics education field - since its condition of production do not align with its condition of use – it is then seen as being at polar ends with the mathematics cultural capital[9] perceived as students' ability, hence, impacting students' trajectory as mathematics learners.
Nevertheless, for group C of the case study classroom it shows that e.g. Abdul-Majeed is not able to invest his institutional (mathematics) cultural capital into the field, as he is unaware how to play the game in order to gain access to further capital i.e. higher scores in teacher tests. Additionally, he is also appears to be uninterested as he does not perceive being cool with demonstration of his mathematical knowledge in front of his peers, indicating that his dispositions (habitus) is inclined to exhibit such behaviour. As a result of this his grades drop. Alia on the other hand has high prior achievement but lacks the capability to invest her social capital in the mathematics education field.
Analysis of group B has revealed that there is another dimension to this classroom field in the form of embodied (mathematics) cultural capital or habitus brought in by the students from home practices. Adding to the previous findings this also shows Abdul's *power* within the classroom is not only defined by his relations with the other agents, but also his *embodied* knowledge (or embodied cultural capital) mediated by his choices in practices. Abdul's position-taking is defined by his accumulation of capital and dispositions which ultimately confer power to him over the classroom field, which is contrary to Abdul-Majeed's experience. This also shows that there is a need to investigate the relation of students' expertise knowledge of specific mathematical concepts (and their source), which is not always socially recognized. Such positioning can then act in students' favour as they then get access to more resources through teacher-student, peer- peer communication, etc.
In conclusion, there are three exemplary dominant practices/camps that can be identified in this classroom through a Bourdieusian analysis i) those who co-operate with the teacher and engage in mathematics lessons; ii) those whose interest lies in being pack leaders of the 'street crowd'/peer groups and completely disinterest

[9] Institutional cultural capital such as SATs tests and teacher tests.

themselves from the lesson; iii) and those who try being part of both. These practices mainly seem to be part of two fields within the classroom i.e. the mathematics education field and 'popularity field', which are at conflict with each other. Here the Bourdieusian framework does not help to analyse this conflict between fields (or even in the composition of capital) any further without leaving an 'orthodox' interpretation of his work behind. Nevertheless, the Bourdiesian framework adapted in the paper has helped to unravel these hidden aspects of a mathematics classroom space, which could be seen as highly significant in order to understand students' dispositions towards learning mathematics.

Exploring the CHAT perspective in terms of these conflicts has revealed that there is scope to implement Vygotsky - even more so Leontiev's notion of human activity to show that there could be potentially two activities happening in the mathematics classroom, i.e. doing mathematics and being popular within the street crowds/peer groups. These are then differentiated by their motives. The interpretation of the findings in terms of this particular viewpoint is by no means complete and only intends to be suggestive of a possible synthesis of Bourdieu's theory with the latter.

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APPENDIX A

Names	Ethnicity	Gender	EAL	FSM	Key Stage 2 Maths Test Results	Year 11 Target (Grades)	Group
Abdul-Majeed	Somali	M	Yes	No	4A	B-	C
Alia	Somali	F	Yes	Yes	4A	B-	C
Ibrahim	Bangladeshi	M	Yes	Yes	4A	B-	D
Abdullah	Arab	M	Yes	Yes	4A	B-	D
Ismail	Somali	M	Yes	No	4B	C+	A
Jamilia	Somali	F	Yes	Yes	4B	C+	A
Ahmed	Somali	M	Yes	Yes	4B	C+	A
Amin	Other Pakistani	M	Yes	Yes	4B	C+	B
Ali	Arab	M	Yes	No	4B	C+	E
Ahmed	Other White	M	Yes	Yes	4B	C+	E
Chena	Other Asian	M	Yes	Yes	4C	C	A
Zara	Any other mixed background	F	No	Yes	4C	C	C
Pierce	Caribbean	M	No	Yes	4C	C	C
Robert	White British	M	No	No	4C	C	D
Fatima	Somali	F	Yes	Yes	3A		D
Abdul	Somali	M	Yes	Yes	3B	D	B
Mohsin	Arab	M	Yes	Yes	3B	D	B
Raheem	Other White	M	Yes	Yes	3B	D	B
Tasleem	Other Asian	F	Yes	Yes	3B	D	E
Mohamed	Refused	M	Yes	No	3A	C-	E