

The Impact of Disadvantage on the learning of Mathematics

A Study of Pupils' Experiences in Low Attaining
Groups

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Blindness to social inequalities both obliges and allows one to explain all inequalities, particularly those in educational achievement, as natural inequities, unequal giftedness. (Bourdieu and Passeron, 1979, p. 67)

We pass through this world but once. Few tragedies can be more extensive than the stunting of life, few injustices deeper than the denial of an opportunity to strive or even to hope, by a limit imposed from without but falsely identified as lying within. (Gould, 1981, p.29)

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ABSTRACT

Good outcomes in school mathematics open up course and career options and later advancement in a society where knowledge of mathematics provides access to opportunities and income. Nevertheless, certain groups are marginalised by mathematics education and thus fail to achieve their potential. This marginalisation might be in terms of gender or ethnicity, about which much has been written, or could be in relation to the social class backgrounds of young people. At the macro level, one form of discrimination in school mathematics relates to how notions of attainment define how learners are grouped, which in turn strongly influences what and how they get taught. Whilst there is much research evidence that indicates the advantages and disadvantages of attainment grouping on achievement and pupils' self-concept there is insufficient attention given to the micro-processes through which these attainment groups operate to reinforce those initial divisions into classes.

This thesis describes the analysis of the learning experiences of Year 10 pupils in low attaining classrooms in two neighbouring secondary schools (approximately 1.5 miles apart) in the same city. Despite their proximity - being separated by train tracks - the communities are socially distanced. This study employed a mixed method approach and draws on a critical sociological framework to illustrate several resonances and variations across the schools to establish the impact of disadvantage on the learning of mathematics.

The findings demonstrate how the micro processes within low attaining mathematics groups are conveyed through the level of mathematical knowledge presented to pupils; the nature of expectations; the focus of lessons and how these by implication impose various constraints on pupils' experiences and trajectories. Nevertheless, this thesis also observes how pupils contribute to their own exclusion by colluding in this process through socialized attitudes and social practices. Together the findings explain the mechanisms that combine to bolster social inequality and how certain groups of learners continue to be disadvantaged.

In conclusion, this thesis considers critically how these findings might inform both contemporary debates on equity in mathematics education and current trends around how learners are organised. It argues in turn for renewed attention regarding how low

attaining groups work to reinforce social distinctions, and therefore identifies the need to seek ways of tackling the issues raised in the study.

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LIST OF ABBREVIATIONS

GTP	Graduate Teacher Programme
NQT	Newly Qualified Teacher
AST	Advanced Skills Teacher
KS	Key Stage
FE	Further Education
GCSE	General Certificate of Secondary Education
A'LEVEL	Advanced Level
TIMSS	Trends in Mathematics and Science Study
STEM	Science, Technology, Engineering and Mathematics
PISA	Programme for International Pupils Assessment
OFSTED	Office for Standards in Education
DFE	Department for Education (1992 to 1995 and 2010 to present)
DfEE	Department for Education and Employment (1995 to 2001)
SES	Socio-economic Status
IDACI	Income Deprivation Affecting Children Index
LSOA	Lower Super Output Areas
BERA	British Educational Research Association

GLOSSARY

Attainment grouping This is used to describe the learning groups pupils are assigned to as a result of their level of performance (in quantifiable terms). In contrast, *ability grouping* is a concept that depicts innate ability, a naive belief that is entrenched within the field of education and I have had to use this on some occasions because it is one easily recognised by teachers and educationalists. There is a need to clearly upset the use of such a term that reifies social characteristics as being innately linked to achievement or “ability”.

Banding This is a less restrictive form of streaming, where pupils are allocated to broader attainment bands, rather than to single classes. Generally, schools have two or three bands and each band includes more than one class, this makes provision for regrouping within a band.

LAMG In terms of low attaining mathematics groups, there is no definition of low attainment that is generally used: different definitions are applicable for different purposes. The intention in this study is to highlight the experiences of pupils with GCSE target grade D, E, F in mathematics. This group is particularly interesting because these are pupils who will get a GCSE grade but not a grade that can surmount the gate-keeping role of mathematics which is associated with the ability to obtain five or more higher grades (A*-C) including English and mathematics in the UK.

Mixed attainment (or all attainment), describes a situation where classes include a broad range of attainment in a particular year group.

- Setting** Pupils are allocated to attainment groups within particular subjects.
- Socio-Economic Status** Family background (place of residence, parental occupation) is used in this study to represent SES because this covers a broader range of experiences and resources linked to the individual.
- Streaming** Pupils are differentiated according to prior attainment and taught in the same attainment classes for all subjects.

1. INTRODUCTION

In this chapter, a case is made for exploring the impact of disadvantage on the learning experiences of pupils in low attaining mathematics groups. This is done by exploring the influence of where one lives, the school attended or the classroom for explaining pupils' experiences in mathematics and their perspectives on the teaching and learning of mathematics. To this end, it takes a theoretical lens from the French sociologist of education Pierre Bourdieu. This chapter is organized into 2 parts. The first part gives an overview of the purpose and focus of the study, why it is significant, how it was conducted, and how it will contribute to professional knowledge and practice. Also, the structure of the thesis beyond chapter 1 is also presented.

1.1 Research Background

The focus of this research lies in understanding the influence of disadvantage upon the learning of mathematics, particularly within low attaining mathematics groups (LAMGs). I am interested in disadvantage not just as an abstract concept but disadvantage as related to a specific place. What it means to live around there, go to school around there or have the opportunities you have around there? In other words, how important is where one lives, the school attended or the classroom in explaining the differences in the learning and achievement of pupils in schools across disadvantaged and affluent communities.

It is also established that different cultural and social groups engage differently with mathematics and have varied levels of importance attributed to mathematics (Noyes and Sealy, 2010) but the question remains how much of these perspectives are affected by the nature of place, school and classroom? How profound are these influences on the learning and attainment in mathematics of pupils in low attaining groups? What factors tend to contribute to the differences in the learning and attainment of these particular pupils?

These research interests make me feel I have come full circle and I will explain why this is the case in a brief sketch.

My experience of teaching mathematics in Nigeria comes largely from a mixed attainment setting where all pupils were taught the same concepts and sat the same examination at the end of six years in secondary school. Everyone aspired to go to university and the system accommodated that ambition, to a considerable extent, through its assessment structures.

My first experience of the UK education system stems from being enrolled on the Graduate Teachers Programme (GTP) for secondary mathematics (in 2009) and also having my children in secondary school. Whilst on the teacher training course, one of the first tasks assigned to the trainee teachers was to go on a community walk scheduled to create an awareness of pupils' neighbourhoods and the places where they came from into our classrooms every morning. Subsequently, we were encouraged to reflect on how we could make our lessons engaging and relevant giving due consideration to pupils' backgrounds both in lesson preparations and our interactions with pupils.

But the harsh reality did not sink in until I was standing in front of the pupils. They were negative and indifferent. My initial reaction was to interpret these actions as disdain for education and authority considering I was coming from a cultural background where the teacher was revered and education was a prized privilege.

The setting practices that I witnessed in secondary schools in England were a form of cultural shock for me. Firstly, I did not understand the peculiar terminology often used by learners, such as 'I'm in top set' or 'I'm a level 6a'. My moment of annoyance and disbelief came when I first observed the so called 'bottom set' class in my first placement school. The low quality of mathematics taught to this group needed to be challenged. I often wondered if my response was unreasonable. But I am reassured to find it was not far-fetched following the quote below.

We feel uncomfortable when we see children labelled as 'less able' placed into 'bottom sets' and fed diets of at worst tedium or at best irrelevant and uninteresting exercises. We feel uncomfortable when the majority of pupils in those bottom sets seem to have had very similar life experiences. We feel angry when we can see they realise that there really is no point in working hard to learn mathematics because the structure of the school means they cannot achieve high GCSE grades or GPAs whatever they do. (Gates and Vistro-Yu, 2003, p. 49)

Furthermore, I grappled with understanding how a system could strongly influence a learner's whole life trajectory by virtue of being placed in a 'bottom set' or not getting a qualification in mathematics. I contemplated the underlying element of injustice that these practices portrayed. In addition, teachers' perceptions/remarks implied that these pupils were never going to make the required grades. Subsequently, I was drawn to this set of children who appeared so powerless and had been labelled 'failures' and I considered the consequences this holds for their future. Bourdieu, whose work is used extensively in this study, explains this paradox clearly;

... the logic of furious competition which dominates the school institution, especially the effect of a final verdict or destiny that the educational system exerts over teenagers. 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 pupils in a unique hierarchy of all forms of excellence, nowadays dominated by a single discipline, mathematics (Bourdieu, 1998a, p. 28).

The fact that mathematics is seen as all powerful because of the symbolic and the cultural capital embedded within it is clear. However, the anger, frustration and self-depreciation of pupils placed in a low set for mathematics as a result of certain assessment criteria over which they have no control (Gates, 2000, 2001) may be warranted. This forms a significant strand of my research, namely that pupils' experience of the teaching and learning of mathematics in low attainment groups may be influenced by factors outside their control.

But the case was different in my second placement school situated in the suburbs, some distance away from the city. The pupils in the 'bottom' sets were different; they seemed more engaged in lessons and were willing to take instructions from the teachers who enforced very strict standards of behaviour and work. Back then, the school boasted of examination results that were well above the national average, with 79% of students achieving 5 or more higher grades at GCSE in 2008, and 61% achieving 5 or more higher grades including Maths and English. Most notably, was its consistent position within the top 25% of schools nationally according to the Fisher Family Trust Value Added scores.

After careful consideration of these differences, the question that readily came to mind was 'why the huge difference in attainment and student performance across the two schools?' Does this have anything to do with the area these schools are located, the teachers, the parents or the students? These were questions that I had to discuss in an essay titled 'Schools and Communities' whilst on the course.

The precis above has traced the origin of my research interests spanning over many years. Consequently, this research presented me the opportunity to explore my interests and perhaps was also, a way of getting involved and making a contribution (Jones and Pope, 2004) that ensures children can reach their potential.

Researchers are in agreement that social factors such as gender, ethnicity and social class (Boaler, 1997a; Walkerdine, 1998) can affect attainment and engagement in mathematics and as such impact on learners' progress and their future life trajectories. However, social class remains the strongest predictor of educational achievement in the United Kingdom (Perry and Francis, 2010) even though, as an area of research, it has become subsumed by a more recent focus on differentiated achievement according to gender and ethnicity (Strand, 2010). Nevertheless, in this thesis, I take on social class as the main axis of analysis, with issues of gender and race incorporated as well.

My point of departure aligns with the argument that the explanations for the differential mathematics attainment and experiences of pupils usually attributed to effective teaching and learning strategies or school leadership practices underestimate the powerful influence on pupils' learning in mathematics that arises from systemic forces and the social spaces within which pupils are located (Gates and Noyes, 2014; Jorgensen et al., 2014a; Thrupp and Lupton, 2006). To this end, Bourdieu's work serves in significant ways towards an understanding of the structural or systemic failure of pupils from marginalised backgrounds and indicates the need to reject explanations that pose the problem as a result of individual deficiencies on the part of certain pupils and parents. In addition, his work demonstrates the part that schools and school systems play in the reproduction of social and cultural inequalities through the concealed connections between scholastic aptitude and cultural heritage (Bourdieu, 1974; Bourdieu and Passeron, 1990).

With particular relevance for this study, this challenges the dominant practice of ability grouping, which is a significant element of the structuring capability of school mathematics (Jorgensen et al., 2014a). In this study, I adopt Bourdieu's theoretical

lens to show the detailed ways in which this process works at a micro level and how it acts as one element of a larger set of social practices and serves to preserve the status quo and therefore provides a further justification for this study. Even so, the structuring of the field of education is also closely linked to the strategies pupils and teachers adopt within the field of school mathematics.

Therefore, this thesis will show, even though it is not often acknowledged, that there is a great level of social interconnectivity and reproduction occurring within and without our education system. This therefore requires taking a sociological ontological stance which does not allow for the individualistic conceptualisation of pupils learning in schools (Noyes, 2004) but one that involves an encompassing and systemic approach. So, although the classroom focus of the empirical work lies with the teaching and learning of mathematics in low attaining groups, the central aim of this project is to explore how pupils' day-to-day experiences and perspectives on learning mathematics are shaped by a combination of school, place and family backgrounds. Consequently, the four case studies used in this study may be seen as a starting point; the theoretical and methodological framework employed here, will permit the 'use of these as cases of larger groups, as fluctuations from larger classed categories' (ibid. , 2004, p. 7). Even so, it is possible to argue that these categories are 'probabilities and not necessarily life sentences meted out to every individual' (Thomson, 2002, p.3). But, whilst the place of agency is not overlooked, the powerful blend of agency and structure in Bourdieu's notions of habitus and field is acknowledged in the process.

Bourdieu's notion of habitus explains how our dispositions are a product of our interactions within our immediate environment. This concept presents an approach to thinking about the social world which offers an understanding of everyday practices as constitutive of social differences (Reay, 1995, p. 354). These dispositions are shaped over time and through varied experiences that they become second nature to us.

Furthermore, these dispositions and experiences happen within social contexts (fields). A classroom may be seen and analysed as a field and the same could apply to a department, school or the entire educational system. The field operates based on particular practices or 'relations between positions anchored in certain forms of power (or capital)' (Bourdieu and Wacquant, 1992, p. 16). In relation to mathematics education, these concepts illustrate the origin and dynamics of classroom

interactions/practice which allows this study to demonstrate how the mathematics learning experiences of pupils are fashioned within the strongly structuring currents of social life. I will come back to this in Chapter 3.

The significance of this study lies in its aim to contribute to current understanding of how the micro processes within LAMG, particularly in socially-disadvantaged contexts, help to strengthen the negative effects. In addition, the study will demonstrate how pupils' attitudes and perspectives, in combination with structural constraints impact on their learning experience and the value ascribed to mathematics. Accordingly, exploring pupils' experiences within classrooms is crucial because these are the most proximate causes of educational success or failure (Cohen, 2000).

1.2 Structure of the thesis

This thesis is structured into nine main chapters. Following chapter 1, the thesis continues as follows:

Chapter 2 – Mathematics Education, Attainment Grouping and Backgrounds

This chapter builds on the introductory chapter that highlighted the significance of investigating the impact of disadvantage on the learning experiences of pupils in LAMGs. Subsequently, the chapter discusses the social role of mathematics and how it operates in the exclusion of individuals. As a result, the significance of the social background of pupils and its relationship with their attainment becomes prominent. Following this, a further review of research is conducted to establish the influence of various factors on the learning experiences of pupils.

The second part briefly explores the literature on the origin of ability grouping. Subsequently, a case is made for exploring how the micro-processes within LAMG reinforce social distinctions for the purposes of this study, focusing on the overlapping influences on pupils' experiences in LAMGs. Gaps in existing knowledge are identified and I argue that a case can be made for examining the teaching and learning experiences of pupils in low attaining mathematics groups (LAMG) in order to explore the hidden influences that impact on pupils' experience. The research questions are then presented.

Chapter 3 – Conceptual framework

In this chapter, I introduce the conceptual perspectives I adopt in the study and discuss the rationale for the adoption of Bourdieu's theory of practice which provides a lens for the study. Following this, I present Bourdieu's theoretical tools of habitus, field and capital and explain their relevance for my study. Lastly, I discuss how these concepts are operationalised and how they influence the chosen methodology.

Chapter 4 - Establishing the Field of Investigation

The theoretical concepts that have framed the empirical research are discussed in this chapter. Firstly, the adoption of a Critical Theory paradigm is justified. I discuss the research that link Critical Theory and mathematics education. Then, I look at the practical issues of sampling and access. This is followed by, the data collection procedure including the design and application of various methods for navigating and negotiating pupils' experiences within LAMG. Next, I explain my analytical approach, describing how the theoretical framework serves as a foundation for subsequent analysis, the ethical considerations and limitations of the study are also discussed. Finally, I present my personal reflections from the field.

Chapter 5 – Contexts

A brief introduction to Pearl Lake and Cedar Park schools is given and the case selection and participants are presented. This contextual background lays the foundation for interpreting pupils' experiences within mathematics classrooms in these schools.

Chapter 6 and 7– Findings

In these chapters, the findings from the quantitative and qualitative aspects of the study are presented. Firstly, the survey results are presented. Subsequently, the 4 case study classes (10G; 10F; 10B and 11R) are reported as class portraits to illustrate pupils' experiences of learning mathematics in these classrooms and their reflections on their experience within LAMGs.

Chapter 8 - Analysis

In Chapter 8, a cross-case analysis examines the shared features and correspondences in the presented survey results and the narratives drawn from the previous two chapters. This is presented under three main themes: school level

processes; Attainment groups: imposing limits and the impact of pupils' backgrounds. Thereafter, I provide a critical overview of pupils' experiences and a framework that seeks to explain the relationship between the differential attainment of pupils and the social influences and origins of pupils' (un) achievement.

Chapter 9– Reinforcing Disadvantage

The research findings are examined in the light of extant literature, the theoretical and conceptual framework employed in the study. A summary of the findings resulting from the analysis is presented with a view to draw conclusions and to discuss the implications for current practice. The study's contribution and areas for further research are also discussed. I end the chapter with some personal reflections.

2. MATHEMATICS, ATTAINMENT GROUPS AND BACKGROUNDS

This chapter critically examines the social context within which mathematics education may be understood and the need to challenge the inequities that prevail through what, whom and how it is taught. It considers the key research debate and explanations for the differential experiences of pupils by considering the interactions between the distinctive nature of places, schools and classrooms. This subsequently lays the foundation for the conceptual framework that guided the study.

2.1 Introduction

This chapter firstly looks at the question of social justice in mathematics education and thereafter, the trend and distribution of attainment in mathematics to establish the link between social class and attainment. Thereafter, I attempt to illustrate what this means and how the literature portrays social class. As a result, the need to consider the significance of the place pupils live and the schools pupils attend becomes crucial. Also, the different structuring practices which define how learners should be organized and taught, particularly in mathematics education leads me to briefly explore the literature on the origin of 'ability' grouping. Subsequently, a case is made for exploring how the micro-processes within LAMG reinforce social distinctions for the purposes of this study, focusing on the overlapping influence of place, schools and families on pupils' experiences in LAMGs. The review at this stage informs this study's diagnosis of the impact of disadvantage in relation to pupils' experiences within LAMG. Thereafter, the research questions are presented.

2.2 Social Justice and Mathematics Education

Mathematics has been remarked upon as playing a special role in sorting out students and preparing them for and directing them to different social stations (Dowling 1978, Ernest 1991, Ruthven 1987). Indeed, Sells (1978) coined the term critical filter for this social function of mathematics. Thus the teaching and learning of mathematics seems to occupy a special place in the provision of social justice – or its obstruction – within the education system. (Ernest, 2007, p. 3)

Mathematics education is directly linked to social justice through the role it plays in discriminating, segregating and excluding (Skovsmose and Valero, 2001) children either through what is taught, how it is taught and to whom it is taught (Sealey and Noyes, 2010). Thus, as a 'critical filter' (as indicated in the quote above);

Mathematics serves as gatekeeper to participation to the decision making processes in society ... to deny some the access to participation in mathematics is then also to determine, a priori, who will move ahead and who will stay behind (Volmink, 1994, p. 51).

Hence, the decision to focus on issues around social justice in the teaching and learning of mathematics is in response to an understanding that we need to break away from the 'illusions that the ways in which our societies and the educational apparatuses are organised currently can lead to social justice' (Apple *et al.*, 2009, p. 3). I concur with Apple and his colleagues' assertion that there is a need for a re-positioning process that requires us to 'see the world through the eyes of the dispossessed and act against the ideological and institutional processes and forms that reproduce oppressive conditions' (p.3). This mandate signifies the need to expose relations of power and inequalities in education and aligns with the stance stated below,

When the normalised practices within education are not challenged and the status quo is preserved, then the most disadvantaged groups suffer through symbolic violence (Bourdieu, 1972) whereby they take on board the value-laden processes of education and become victims of those approaches through which they are effectively excluded and marginalised. (Jorgensen et al., 2014b, p. 222)

Trevor Gale's (2000) prompt to rethink what social justice in school means culminates to this question, 'How will we recognise it when we see it?' The use of concepts of social justice depends on the various definitions (Atweh, 2007; Gewirtz, 1998) adopted and needs to be examined to develop a meaningful perspective on social justice and mathematics education. For a broad discussion on the relationship between justice, equity and equality see Hutmacher, Cochrane and Bottani (2001)

Gates and Jorgensen (2009) have proposed a three level operational framework for the diverse ways in which social justice is being constructed as an ideological field(see also Gillborn and Youdell, 2000; Lynch, 2000). These include 1) Moderate forms of social justice that focus on fairness and equity 2) Liberal forms of social justice that focus on structural inequalities 3) Radical forms of social justice that recognise structural inequality and strive to amend the ways in which inequality is constructed into existing practices. They argue that altering these structures will give greater access to, and success with, mathematics to those groups of students who have been excluded from participating in mathematics and overcome situations where class differences are couched under notions of abilities and are accepted as a normal outcome but these ultimately have harsh consequences:

Mathematics education plays its part in keeping the powerless in their place and the strong in positions of power. It doesn't only do this through the cultural capital a qualification in mathematics endows on an individual (see Bourdieu, 1991). Mathematics carries through this stratification through the authoritarian and divisive character of mathematics teaching ... but an accusation or admission that you 'can't do maths' is more than just plain fact of capability; it is a positioning strategy ... It locates you as unsuccessful and lacking in intellectual capability; ... on the edge of the employment and labour market, ... Mathematics education thus serves as a "badge of eligibility for the privileges of society" (Gates and Jorgensen 2003, p.49;emphasis in original).

How is this 'positioning' plausible? How is it that issues like this creep into school mathematics teaching and learning? Exploring these issues therefore requires adopting a critical theorist stance that allows for the consideration of the social and political implications of the contexts within which mathematical knowledge is constructed and how the marginalisation of certain groups is legitimized.

2.2.1 Who succeeds in mathematics?

The most effective indicator of future attainment in mathematics is family income, followed closely behind by the parents' educational background. (Gates and Vistro-Yu, 2003, p. 61)

The link between pupils' socioeconomic status (SES) and their educational outcomes is well recognised in the research literature (Jencks et al., 1972; Marjoribanks, 2017; Noel and De Broucker Patrice, 2001; OECD 2004; Sirin, 2005). In addition, school mathematics has been criticized for the role it plays in structuring social, economic and educational rankings (Hodgen and Marks, 2009; Jorgensen et al., 2014a; Noyes, 2012; Skovsmose, 1994a; Sriraman and Steinhorsdottir, 2007).

For example, Goodman and Gregg (2010) have shown the large gap in performance at GCSE level between the poorest children and those from affluent backgrounds.

For example, only 21% of the poorest fifth (measured by parental socioeconomic position; SEP) manage to gain five good GCSEs (grades

A-C, including English and maths), compared to 75% of the top quintile – an astonishing gap of 54 percentage points. (Goodman and Gregg, 2010, p. 7)*

This is also similar to the findings from a research study on GCSE performance conducted by Connolly (2006).

Specifically, in relation to mathematics evidence from Noyes' (2009, p. 177) study on GCSE mathematics attainment show a relationship between the level of income deprivation and attainment. He reports that pupils from households in the lowest quintile of the Income Deprivation affecting children Index (IDACI) scores (the least deprived areas) were more than twice as likely to attain a grade C in GCSE compared to in the most deprived fifth of households (Gates and Noyes, 2014).

GCSE Mathematics	IDACI quintile				
	1	2	3	4	5
A*	5.7	3.8	2.8	1.7	0.8
A	18.9	14.1	10.5	6.6	3.8
B	42.5	34.3	27.7	19.7	13.2
C	68.6	60.3	52.2	41.6	31.8
D	83.5	77.1	69.9	59.1	48.6
E	92.9	89.5	84.9	76.7	67.9
F	97.3	95.6	93.6	89.1	83.3
G	98.4	97.7	96.8	94.7	91.9
–	100.0	100.0	100.0	100.0	100.0

Figure 1:GCSE Mathematics Grade and Income Deprivation. Source: Noyes 2009, National Pupil Database. 1= least deprived; 5=most deprived

These results have serious consequences; for instance, low levels of numeracy have been linked with unemployment levels (Bynner and Parsons, 1997; OECD 2016b). This implies that those that do well go on to get better paid jobs, hence the rankings and categorisations that are obtained within school mathematics also plays a role of organising social classifications in the future (Gates and Noyes, 2014).

A recent report on the impact of disadvantage on pupils in England based on a joint analysis of Programme for International Pupils Assessment (PISA) alongside the Trends in International Mathematics and Science Study (TIMSS) indicates the gap between the most and least disadvantaged is equivalent to over three years of schooling (Wheater et al., 2016).Whilst all these data is analysed and reported at the

national level and also strongly indicate the impact of SES on outcomes in mathematics, there are other factors that are also involved, i.e. school related factors. The conclusion is that schools have meaningful scope to make a difference (Macleod et al., 2015; Wheeler et al., 2016).

In similar circumstances with the headline statistics above, Flores(2007) writing about disparities in mathematics education points out that, whilst it is vital to recognize a symptom such as low achievement, 'it is even more critical to understand and address its underlying causes' (p.29). Consequently, the challenge lies in evaluating the way in which the disparity of achievement in mathematics among different groups of pupils within and between schools is framed as a problem, this needs to be such that promotes research into understanding the causes for these disparities and how to address them.

2.2.2 Analysing Educational Inequalities

The political undertones echoing through the current policy direction suggests that testing, accountability, league tables are approaches that will raise standards (Francis et al., 2017) and also equate to improved state education for all; a situation that will see '... "successful" schools "pulling up" those seen as "failing" (Jorgensen et al., 2014a, p. 222). In the same vein, the existing policy discourse about the need for social justice aimed at supporting learners from less affluent backgrounds appears to be nothing more than mere rhetoric, purporting to raise attainment and tackle social exclusion. Research however, suggests that these strategies have fallen short of expectation on the grounds that they do nothing to challenge deeper social and cultural inequalities (Whitty, 1997;2001).

In seeking to address these issues, there is the need to discern that the differences between schools or classes cannot be explained by mere circumstances (Wrigley, 2000). There is a strong direct relationship between social class background and success in education (Gillborn and Mirza, 2000). Nevertheless, social class is a multifaceted, fluid and disputed notion, which often means it is not acknowledged and as such makes its impact difficult to appreciate and measure (Gates and Noyes, 2014). However, in the literature, this is often categorised in terms of *socio-economic status* (SES); although one argument holds that it is a convenient label researchers append to various variables to indicate SES (White, 1982). In contrast, Gates and

Noyes (2014), argue that the term '*socio-economic*' simplifies the issues at hand, and in its place offer Bourdieu's notion of capital which comprises cultural and social capital (these terms are explained below) which extends the notion of capital often depicted as financial resource or economic capital.

Given the difficulties associated with measuring social class status, various forms of proxy indicators are often adopted. Gates and Noyes (2014) have categorised these as *occupational, economic indicators, aggregated geographical measures and geodemographic segmentation* (p. 39) The *occupational indicators* are closely related to parental occupation and income. Next, the *economic indicators* reflect some form of disadvantage or deprivation of opportunities or economic resources which is also difficult to measure. Consequently, the proxy indicator used in this case is the eligibility for free school meals (FSM). The FSM eligibility is extensively used in social policy research (Gorard, 2012; Hobbs and Vignoles, 2010) as an individual indicator of potential disadvantage based on a measure of low parental income, although it is useful to know that not all families who are eligible essentially receive FSM (Smith, 2003). FSM eligibility is also used as a platform for judging the individual and school-level attainment as well as an indicator of school composition (Strand, 1997). The *aggregated geographical measures* which are based on postcodes and censuses output areas. An example of this is the UK government's Income Deprivation affecting Children index used to measure the proportion of children under the age of sixteen living in low -income households in a particular area and used to calculate the school contextual value added scores. Finally, the *geodemographic segmentation* indicates consumer spending habits using the MOSAIC system. In like terms with the IDACI, this is based on the assumption that people tend to live near individuals that are similar to them.

Other research evidence have shown that measures of socioeconomic status (SES) such as parent education and income are related to student outcomes (Marks et al., 2006; Teachman, 1987; Toutkoushian and Taylor, 2005; Valero et al., 2015; White, 1982). The reason parent education and income variables are used most often is that family economic status can vary over time, a multidimensional measure of SES comprising variables that are more stable are often used to indicate family economic status (Foster et al., 2005). Other variables used have been based on occupational prestige, nature of work, skill, educational requirements and social distance (Gorard

and See, 2009). But some researchers have criticized this narrow definition and have brought forward other factors such as parental expectations and aspirations, family structure (two –parents/single parent, number of siblings, quality of stimulation in the home, etc. As expected, the list cannot be comprehensive (Gorard and See, 2009). In contrast, Teachman (1987) advocates the use of the concept of family background because this covers a broader range of experiences and resources linked to the individual.

Previous studies that have focused on 'disadvantage' draw strongly on social theories (Ballantine and Spade, 2007), one of such theories useful for my study is that of Pierre Bourdieu. However, there remains a notion that the various processes through which socioeconomic backgrounds impact on educational outcomes are not clearly understood (Marks et al., 2006). However, there are four types of explanations illustrated by Marks et al., (2006) that indicate the significance of material, cultural, social factors and school systems

Material, Social and Cultural Resources

The main focus for material resource explanations is based on the roles of wealth, poverty and income. There is empirical evidence that indicates that wealth and income are related to student outcomes (Hirsch, 2007). The argument is that differential access to material resources leads to differential student performances. This means that low income families may not be able to afford the educational resources children need compared to high income families who can ensure their children's success by buying houses in desirable catchment areas, or pay for extra tuition outside school. Teachman (1987) showed that the level of educational resources was related to results in tests after parental education and other factors have been controlled. The effect of family income on achievement is however much weaker compared to that of parent's education.

The social factors explanations highlight the importance of relationships to educational success. The quality of social capital found within a community can influence educational outcomes. In addition, the kind of networks young people are exposed to, influences the provision of relevant information, opportunities, and resources (educational and material). Nevertheless, there is weak empirical evidence for the impact of social capital on students' achievement.

Thirdly, these set of explanations centre on the cultural difference between families, whether high or low status and the impact this has on students' performance. Bourdieu's (1974, 1984) theory of cultural capital aptly portrays the cultural explanations for differential educational outcomes and the wide-ranging issues of class reproduction in society (DiMaggio, 1982; Lareau, 2003). Bourdieu argues that the educational system privileges the people who have similar cultural dispositions with the system and therefore positions some others at a disadvantage. Hence, the amount of cultural capital accumulated has a strong influence on how well young people do in schools. The explanation for this considers that each economic class develops a related "class culture" that influences ways of doing or seeing things within that world. These approaches are particular to, and grow out of, each class' experiences in the social world. In other words; children from high SES are better positioned to do well in school as a result of their early and privileged exposure to forms of participation that mirror what is expected in the formalized institution of schools (Evans, 2006). In essence, children from lower SES may be at a disadvantage because they do not possess the required cultural capital that allows them negotiate the forms of participation they have from their background with the forms of participation required within the school walls. Bourdieu's theories have significant pointers for this study in the way it bridges the macro level and micro level explanations which illustrate how larger societal structures are sustained in everyday interactions (Ballantine and Spade, 2007).

School systems

Finally, the school systems may also offer some explanations for the socioeconomic inequalities in education. The role of schools in all societies is significant because they are a setting and a source for both formal and informal learning experiences that demonstrates for pupils what it takes to identify, belong and function in society (Lemke, 2002) and in this instance, how might this be done through mathematics education for pupils in LAMGs? These explanations give room to challenge the curricular provisions made available, the organization of student groups, the pedagogical practices adopted and the relationships within the school.

Bernstein (1975) explains how educational knowledge plays a significant role in structuring experience and also the impact of disadvantage on these experiences. He explains that formal educational knowledge is acquired through three message

systems: Curriculum (what counts as valid knowledge), Pedagogy (what counts as valid transmission of knowledge) and Evaluation (what counts as valid realisation of this knowledge on the part of the taught). He asserts that the biases within society are often reproduced within educational systems:

How a society selects, classifies, distributes, transmits and evaluates the educational knowledge it considers to be public, reflects both the distribution of power and the principles of social control (Bernstein, 1975, p. 85)

In relation to pedagogical practice, Bernstein's concepts facilitate the understanding of 'social class differences in access to the regulative and instructional discourses' (Lubienski, 2004, p. 120) used in mathematics classrooms. Bernstein (2003) demonstrates that much of the contexts of the school system are unwittingly drawn from aspects of the symbolic world of the middle class, and so when a child steps into school he is stepping into a symbolic system which does not provide for him a linkage with his life outside. This is made possible through the employment of a pedagogical practice, a uniquely human device for both the reproduction and the production of culture (ibid., 1990, p. 64) such that class inequalities still prevail. For Bernstein, pedagogical practices with its social assumptions have a way of stratifying children such that the children from the lower working-class families are disadvantaged because they are not able to 'exploit the possibilities of the pedagogic practices' (ibid., 1990, p. 74). He draws attention to the relation between the local (context dependent operations) and the less-local (context -independent operations based on principles and application in a new context as is the case in schools), showing how children from lower working class are limited to the local context-dependent skills.

In other words, children from poor families, who have no opportunities or access to enriching activities will adopt restricted codes or language with implicit and context dependent meanings unlike children from rich families who adopt elaborate codes or language with meaning that are explicit and relatively independent of context. This forces us to turn our gaze on to the home front where depending on the control and support available, the child may struggle to negotiate the context-independent school arena. Hence, the tension between the influence of the home and school resurfaces again especially where there is a lack of 'effective official pedagogical context and

discipline' (ibid., 1990, p. 77) in the home as is the case for children from poor homes, it inevitably making success a distant reality for them.

Various other research findings have shown that specific facets of the pedagogic practice support the advancement of the elaborated coding orientation required for learning context-independent school knowledge (Hoadley and Muller, 2010). For example, Morais and colleagues (2004) investigated modalities of pedagogic practice that favour all children's scientific knowledge acquisition and competences. Their results show that the effect of pedagogic practice can prevail over the effect of children's social background. Similarly, Lerman and Tsatsaroni (1998) contemplating the question of systematic failure of certain categories of pupils, advocate for 'a place of intervention towards greater equality and access'. They adopt Bernstein's theoretical framework to analyse and show how the pedagogic (mathematical) text is constructed, distributed, acquired and assessed and its consequences.

In summary, Bernstein uses *pedagogical* structures to explain how social structures work. In effect power articulates through discursive practices; schools, through their pedagogic practices (essentially entrenched in language) limit the access of certain groups to the language of power and symbolic control (McFadden, 1995, p. 302). In contrast, my study looks mainly at *social* structures within the contexts of LAMGs and how these structure pupils' experience.

The preceding section has highlighted significant areas through which social class may be related to educational outcomes and these are illustrated diagrammatically below.

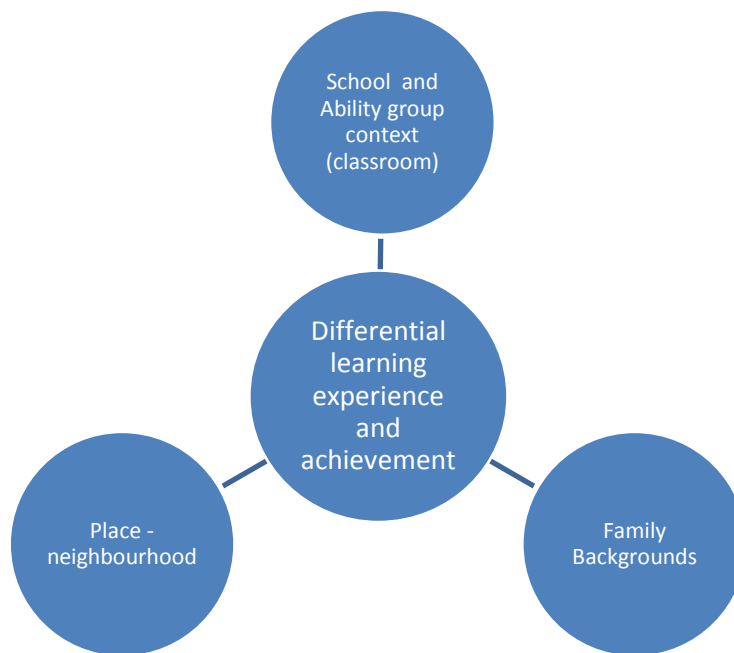


Figure 2: Factors related to differential experience and achievement

The combination of all these elements together allows for the examination of the barriers, opportunities and discontinuities that feature in students' experiences within specific contexts. In the following sections I discuss these areas in greater detail in order to understand the implications these have for the conceptual perspectives that frame this study.

2.3. The value of place

An important part of my study is to consider schools situated in particular social and cultural contexts. Of great relevance here is Wilson's (cited in Catsambis and Beveridge, 2001, p. 1) urge for social scientists to develop new frameworks that examine the complex interrelationships between individual behaviours and social-structural characteristics, especially those that capture structured social inequality.

There is evidence that where one lives can greatly affect the opportunities available to that person (Kintrea et al., 2011). For those living in areas of need, quality of life can be severely limited by what has been called *postcode poverty* (Bradshaw, 2005), in the sense that where one lives affects how healthy they are, their school grades, income and probably their self-esteem. Whilst it may be said that social disadvantage is no justification for poor achievement in educational terms, it might offer an explanation (West-Burnham et al., 2007). Earlier, Power et al. (2002) reported that

Educational outcomes in deprived areas are worse than those in non-deprived areas, whether they be measured in terms of qualifications, attendance, exclusions or staying on rates; Inner city areas in particular feature as having low outcomes (p.26).

There are therefore clear implications for social justice if academic success is dependent on where you live.

Lupton's (2003) concept of neighbourhood explains that 'neighbourhoods incorporate both place and people and that it is the interaction of people and place that creates neighbourhood characteristics' (p.4). Hence, the place where one lives has been put forward as a better proxy for social class because it gives better consideration to current conceptions of social difference than standard measures (occupational, educational, income) of social class. This is better understood from the premise that if behaviour is socially influenced, it follows that residents will adopt the prominent behavioural characteristics of their neighbours whether affluent or not. In addition, it does appear that people choose to live among people with similar behaviours to theirs regardless of their occupational status. To this end neighbourhoods are described as self-selecting (Webber and Butler, 2005).

Thus, it comes as no surprise that there is evidence that suggests that neighbourhoods may influence social mobility and quality of life by virtue of its sway on the educational outcomes of young people (Ainsworth, 2002; Bell, 2003; Ellen and Turner, 1997; Wilson, 1987). Although it is empirically challenging to measure neighbourhood effects on educational outcomes (Ellen and Turner, 2003; Gibbons, 2002), it is crucial to appreciate the extent to which these neighbourhood characteristics influence educational outcomes so that the processes that reproduce social inequality can be understood and perhaps redressed to some extent. Even so, research findings also suggest that neighbourhood effects are not independent of individual background characteristics (Rutter *et al.*, 1979).

A significant amount of research on the characteristics and potential influence of disadvantaged neighbourhoods build on Wilson's (1987) work on the social transformation of inner cities into areas of concentrated disadvantage. These neighbourhoods are known for socio-economic disadvantage, high rates of unemployment, income benefit claimants, single parent households. These characteristics have also been linked to pupils' behaviour and educational outcomes amongst others such as teenage pregnancy, academic underachievement and disengagement and truancy. This suggests that the social context of disadvantaged neighbourhoods can influence young peoples' behaviour where there are high occurrences of undesirable behaviours, low levels of social control, low quality or a dearth of social amenities such as schools or recreational centres.

Literature on Urban and education fields point out some mediating processes of neighbourhood effects on educational outcomes. These include collective socialization, social control, social capital, perception of opportunity and institutional characteristics. However, the most prevalent within the relevant literature remains the collective socialization theory (Ainsworth, 2002). These processes are discussed below.

The collective socialization theory is focused on the kind of role models young people have around and the influence they have on them. In neighbourhoods where most adults do not work, Ainsworth (2002, after Wilson) points out the life of incoherence young people face as a result of the 'lack of structuring norms modelled by working adults' (p.119). In contrast, young people from advantaged neighbourhoods exhibit behaviours and attitudes that make them succeed in schools as a result of their association with adults who exemplify the importance of education, work and civility.

This brings a different perspective to the school related behaviours and attitudes of students from disadvantaged neighbourhoods(Lupton, 2006). The point is made in Evans' (2006) argument that if these young people are pathologised, an opportunity to analyse an inherent social phenomena is missed. She argues that it is pertinent to recognise that these young people have to grapple with the competing forces of mainstream belief and the structural constraints that deprive them of opportunities that help them achieve success. Even though these young people want to succeed, they do not have appropriate role models to emulate, hence it becomes easy to revert to adaptive attitudes that discourage success (ibid, 2006).

Similarly, the levels of social control available may influence educational outcomes of young people. In disadvantaged neighbourhoods, as a result of weak or non-existent monitoring and sanctioning of deviant behaviour, inadequate adult supervision or lack of appropriate activities to occupy young people, peer group influences may begin to supersede parental influences which may result in young people developing antisocial and anti-school behaviours and attitudes (Crane, 1991). Furthermore, the quality of social capital and the kind of networks available to young people influence their access to relevant information, opportunities, and resources as surmised in Wilson's (1996) assertion about what obtains in disadvantaged neighbourhoods,

children are disadvantaged because the social interaction among neighbours tends to be confined to those whose skills, styles, orientations, and habits which are not as conducive to promoting positive social outcomes as are those in more stable neighbourhoods (p. 63).

This orientation, coupled with general lack of opportunity, means young working-class pupils may not persist in such subjects as school mathematics. This might explain why working class pupils reject education, including school mathematics, seen as irrelevant as they are convinced they will never use it outside of the classroom and also do not see how it fits with their future goals (Chazan, 2000). However, this does not imply that there are no exceptions. It is a different case for young people from more advantaged neighbourhoods because they can take advantage of more beneficial networks realized through being in contact with well positioned people in society. This is closely related to what Wilson terms occupational opportunity, not only does this

make young people realize education pays off, it also translates into academic effort and a motivation to succeed.

Gruenewald (2003) describes 'place' (*neighbourhoods*) as social constructions filled with ideologies, and the experience of place shapes cultural identities. Also, students' interpretation and construction of classroom life has to be seen in the light of the influence of historical, cultural and economically-based material conditions that prevail in pupils' lives. Jones (1989) explains the difference between students' cultural interpretations of doing school work in terms of the influence of parents' experiences in the labour market, which defined the value they ascribed to education, the notions of compliance or assertiveness and the modes of acquiring knowledge which then shapes pupils' approach to learning.

Research evidence shows that disparity in attainment levels of schools could be explained by factors which include the pupils' attitudes, aspirations and family perceptions of education in any particular area (Gates *et al.*, 2007; Kintrea *et al.*, 2011). However, some schools, particularly those in disadvantaged areas face the constant challenge of tackling low attainment as well as raise aspirations. Whilst the motive for raising aspirations may be justified, there is an element of making value judgments that tends to place the blame for educational failure at the doorsteps of families rather than the educational system. It is argued more often than not that the young people do have aspirations but do not see how these can materialize beyond their immediate constraints which include actual attainment levels, financial circumstances and negative perceptions and experiences of significant others (Cuthbert and Hatch, 2009; Gates *et al.*, 2007; Kintrea *et al.*, 2011).

Consequently, attitudes to school and educational achievement may be closely linked to the history of the school to work transition (Gates *et al.*, 2007; Rutter *et al.*, 1979). Thus, the effect of the perennial history of a particular community can steer the inclination towards employment or qualifications (Gates *et al.*, 2007). As a result, academic and intellectual approaches to schooling may be considered irrelevant to pupils' future life trajectories, with perhaps much preference for the vocational route.

Thus, the ongoing discussions on academic achievement and the implied failure of pupils, parents and schools calls for a consideration of whether it is appropriate to focus on academic achievement for these pupils who are already socially and perhaps

cognitively challenged. Beyond this level, low attainment becomes deep rooted; hence reifying the link between the poor outcomes and the inter-generational reinforcement process (Anger and Heineck, 2010; Björklund and Jäntti, 2009; Black *et al.*, 2009).

The residual local/cultural values borne out of unrelenting and continued failure leaves an enduring impact on individuals, families and generations yet unborn. Perhaps a way forward could be drawn from Willis' (1977) *Learning to Labour*, where he stresses the fact that disaffected pupils are likely to respond more to the structure of the school and the dominant pedagogy. These he argues must fall within the framework of their overall class cultural experiences and location than to the content of the curriculum or the individual styles of teachers.

In relation to mathematics education, most studies on the influence of neighbourhood and school effects on pupil attainment in mathematics have focused on explaining how home, parental experiences and socioeconomic background impact on students' performance in mathematics and also how very often schools do make a difference. The conclusion is that attainment is negatively related to living in an area of deprivation (Catsambis and Beveridge, 2001; Gutiérrez, 2007; Noyes, 2012; Webber and Butler, 2005; Webster and Fisher, 2003). However, there are only few studies that explicitly focus on pupils' experiences of learning mathematics across high poverty areas (disadvantaged) and affluent communities (Kitchen *et al.*, 2007).

The place of residence may have important consequences for pupils in mathematics through parental practices which may also influence the academic success and the resulting life chances of young people. Also, disadvantage at the neighbourhood and school level could influence pupils' achievement in mathematics via a twofold process (Catsambis and Beveridge, 2001);

- (a) Lower levels of mathematics achievement (net of individual-level backgrounds) are associated with neighbourhoods and schools characterised by concentrated disadvantage and high levels of pupil poverty and absenteeism
- (b) Pupils' achievement in mathematics may be indirectly influenced by parents' ability (as a result of the influence of the neighbourhood) to help pupils succeed in school

Hence, the level of pupil poverty, absenteeism and the level of parent involvement have implications for the learning of mathematics.

More recently, Noyes (2012) writing on student-centred teaching and its link with the enjoyment of learning mathematics, has also argued that students' mathematical experiences may differ between schools and between classes within schools. He points out that students may become more engaged in mathematics if we refuse 'place-independent analyses of students' attitudes to mathematics' (p.286).

In this section, I have laid a foundation for understanding the significance of place and how it is able to shape pupils' views and experience of learning mathematics. Later in Section 2.6, I consider how this influence manifests within classrooms. Also, in view of the evidence (shown in Section 2.2.1) that indicates that there is a significant correlation between the Index of Multiple Deprivation (IMD) of an area and the percentage of good GCSE grades achieved (Gates et al., 2007) it is permissible to start questioning what might be happening in various schools in these areas and at a fine grain level and with particular relevance for this study, what might be the mathematical experiences of pupils in LAMGs?

2.4 Unequal Schools

By treating all schools as being the same and thus capable of achieving the same, they render unimportant, perhaps even invisible, the social and economic inequalities that really prevent some pupils from doing as well as others. As a result, they help to perpetuate unequal schooling and unequal outcomes. (Thrupp and Lupton, 2006, p. 322)

Much research into schools in recent times have come to focus on those serving socio-economically disadvantaged communities in line with most government policies aimed at tackling child poverty, disadvantage and underachievement in schools. In the UK, these schools are described as 'facing challenging circumstances' (Chapman and Harris, 2004) whilst in the US these schools are described as 'high poverty' schools (Kitchen et al., 2007). For many of the studies on high poverty schools, proxy indicators, such as the number of students eligible for free school meals, socio-economic status of students and parental education and occupation were used to determine the degree of challenge faced by these schools (Chapman and Harris, 2004). The striking characteristic of these schools is that their intakes of students

reflect higher levels of social deprivation and disadvantage often found, but not exclusively, in large inner-city areas (DETR, 2000).

Nevertheless, the school effectiveness research (SER) and the school improvement research (SIR) have stressed the significance of school and teacher effects for pupils' achievement without much attention given to context until only recently (Thrupp and Lupton, 2006). Whilst much prominence has been given to schools' internal organisations and practice; aspects of leadership, management and pedagogy (Harris et al., 2006), little significance has been attributed to the different external contexts (i.e. pupil intake characteristics and school and area characteristics) that could indirectly account for them. The challenge according to Thrupp and Lupton (2006) is that the factors put forward by school effectiveness and improvement research as contributing to pupils achievement may be difficult to replicate because whilst these may possibly be 'school-based, they may however not be school-caused' (Thrupp and Lupton, 2006, p. 310).

The preamble at the beginning of this section establishes that 'context' is significant because it challenges the 'neutral' discourse on schooling that tends to overlook the social injustices reproducing educational inequalities. The generic perspectives described in educational literature assume schools are much the same and downplay their distinctiveness. For instance, schools are measured on various criteria, ranked into "league tables" (in the UK) based on their level of success on national tests that could in due course classify a school as failing or requiring significant improvement (Jorgensen et al., 2014a). Shifting the frame from looking at measures of educational outcomes to examining what pupils actually experience in schools may result in a very different way of describing disparities among pupils and across schools. This is significant because this level of granularity is not captured in the league tables and therefore obscures significant within-school variation in teacher quality, pupils' engagement and learning outcomes (Noyes, 2007a).

Yet the question remains why it is that these 'failing schools' are hardly ever located in middle-to-affluent suburbs? Research evidence shows that they are most frequently located in poor, working-class and/or multi-ethnic areas (Bell, 2003; Lupton, 2004); this raises the need to consider the impact this would have on the schools concerned and the teaching and learning of mathematics.

In mathematics education, Opdenakker and Van Damme's (2007) investigation of the relationship between school characteristics and school outcomes have shown that: 1) effort and achievement of pupils are related to characteristics of the pupils themselves (family and personal characteristics); 2) and the characteristics of classes and schools; 3) schools influence the effort and achievement of pupils in two ways: by means of their influence on class characteristics and by means of their influence on the relationship between class characteristics and achievement.

With respect to school characteristics, they make a distinction between three kinds of characteristics:

1. characteristics referring to the composition of schools (pupils population, teaching team, and school leader),
2. the school practice (educational framework, organisation and management, work and learning climate) and
3. context characteristics (e.g. denomination, school size, study programme offerings, facilities)

From their model (overleaf), the relationships between these three kinds of characteristics are illustrated: school practice is influenced by school composition and school context.



Figure 3: A model explaining achievement in secondary education. Source: Opdenakker and Van Damme 2007, p.181

What they have referred to as 'context' in their study is notably different from Thrupp and Lupton's (Thrupp and Lupton, 2006, p. 309) description of context which comprises:

- pupil characteristics (e.g., ethnicity, looked after children, special educational needs and refugee status,);

- area characteristics (e.g., urban/rural, housing market, labour market structure and history) and
- school characteristics (e.g. LEA admissions policies, school type and history and market position compared to surrounding schools,).

In addition, the relationship between pupils' background and the class/group they ended up in is not indicated, although what they have described as 'school composition align with Thrupp's (1999) stance on the impact of the socio-economic status (SES) composition of school intakes on school processes:

SES composition affects school processes in numerous ways which would cumulatively boost the academic performance of schools in middleclass settings and drag it down in low socio-economic settings (Thrupp and Lupton, 2006, p. 309)

Similarly, in Webster and Fisher's (2003, p. 316) model below, their 'pupils level' comprises socioeconomic status, attitudes towards mathematics and beliefs about success, the home and/or neighbourhood elements do not feature in this model even though what they have termed pupils level may largely be dictated by where the pupils come from, thereby raising the question of what influence a place has on the learning of mathematics.

Secondly, Webster and Fisher's Classroom level factors define teachers' attitudes which influence what or how they teach and have great impact on pupils' belief about success or the attitudes they develop towards mathematics and the achievement outcomes. This is significant for this study as it aims to capture how this occurs in some classrooms in two contrasting schools and addresses the question of the importance of the classroom for the learning of mathematics.

Thirdly, Webster and Fisher maintain that school level factors (e.g school level environment) can directly affect classroom-level factors as is seen for instance when teachers' attitudes influences their pedagogy. In addition, school level environment can also affect pupils achievement directly particularly when school size and socio economic status affect pedagogy.

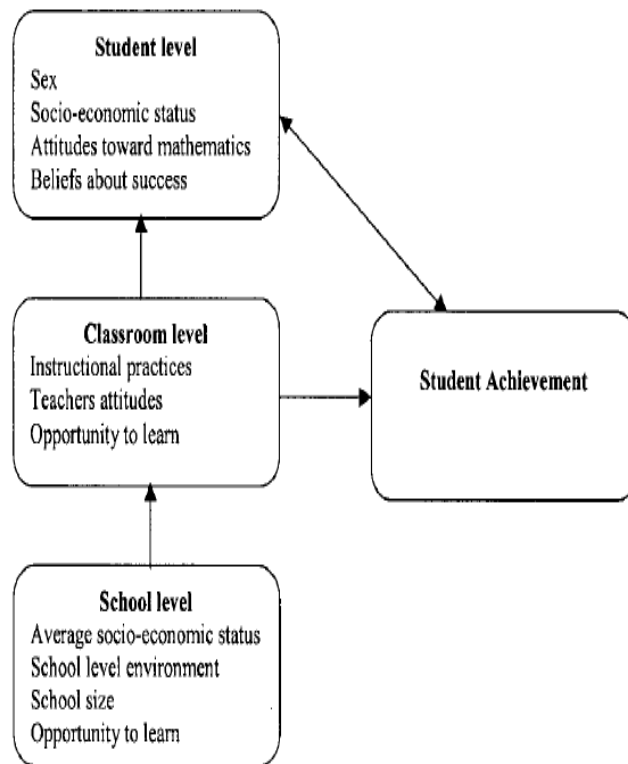


Figure 4: Factors associated with student achievement (source: Webster and Fisher 2003, p. 316)

This raises the question of what difference can schools make for pupils in low attaining mathematics groups. Although there is evidence that schools with conducive environments are academically more successful with pupils, researchers are in contradiction about this relationship as data on school level environments and pupils outcomes have been muddled up by numerous issues (Bosker, 1999) such as methodological differences or errors and measurement lapses in variables used.

These notwithstanding, there is much evidence that points out that schools and classrooms matter for mathematics learning (Lamb and Fullarton, 2002; Noyes, 2012; Opdenakker and Van Damme, 2006; Wenglinsky, 2002). However, with relevance for this study, research evidence shows that for pupils' achievement in mathematics, it is not necessarily the school that matters but the 'set' (attainment group) the pupil is allocated to (Linchevski and Kutscher, 1998; Noyes, 2012; Opdenakker et al., 2002; Wiliam and Bartholomew, 2004)

Yet, what happens within 'sets' needs to be viewed in relation to inequalities in the larger society and in the organization of the school. Moreover, inequalities at the

societal level slip into inequalities at the classroom level in complex ways (Cohen, 2000). Stratification of the larger society has indirect effects on the way learners are organized, taught and assessed in mathematics education. These effects combine with the inherent power attached to 'doing well' in mathematics to generate a new set of inequalities that raise barriers to learning for some students including career options and future advancement.

This is equally shown in a significant study carried out by Dunne et al (2007), which involved a survey of schools in 12 Local Authorities (LAs) and in-depth case studies in 13 schools in four of these LAs. The survey collected data on Years 8 and 10 pupils and additionally Years 6 and 7 pupils to reinforce its analytical power around a key assessment and school transition point. They report that,

Social class is a significant predictor of set placement. Pupils from lower socio-economic backgrounds have a higher probability of being placed in lower sets irrespective of prior attainment. (ibid., 2007, p. xii)

Hence, in the next section I consider the development of 'ability' grouping in the UK and its impact on pupils' experience.

2.5 Attainment Grouping and Class Inequalities

Recent proposals to improve the mathematics curriculum in England stems from several concerns namely; the relative low levels of performance in international comparative studies such as the Programme for International Student Assessment (PISA) and the Trends in Mathematics and Science Study (TIMSS); low participation rates in mathematics at advanced level (Smith, 2004) and declining numbers of STEM (science, technology, engineering and mathematics) graduates (Roberts, 2002; Sainsbury, 2007). This impact could mean England loses its competitive edge globally and could suffer from lack of a competent and skilled workforce. Hence the need for improvement in mathematics education, which is also necessary to combat a reported high percentage of innumerate adults (Ofsted, 2012) aimed at reducing costly consequences for their employability (Bynner and Parsons, 1997) and their capacity to function as citizens and consumers (Moser, 1999).

The drive to raise standards has brought schools and educators under the line of fire and given rise to the existing models of accountability which, according to Maguire and Dillon (2007) judge teachers' competence based on their pupils' exam results, their ability to execute centrally imposed standards and numerous 'performance indicators and measurable outcomes' (Ball 1999, cited in *ibid.*, 2007, p. 37). This drive has also encouraged the use of setting in schools as a 'panacea to underachievement' (Boaler, 1997a, p. 577). But the question that arises is 'at what cost?'

There are few if any studies which demonstrate that setting raises attainment for all pupils and there is a growing body of evidence to suggest that the unintended consequences for pupils in various subgroups in terms of gender, ethnicity, socio-economic status and age, should give cause for concern. And yet, setting by 'ability' remains the default position. (Boyd, 2007, p. 293)

This 'default' position has been hinged on several factors. According to (Hodgen, 2007), these include the ever-increasing emphasis on targets and comparing schools using the league tables as a yard stick; the school inspection regime, which has stressed the use of attainment grouping; the pressure from middle class parents and

teachers' perceptions of the requirement of the National curriculum has not helped matters.

The concept of 'ability' is a potent discourse that pervades UK educational policy and practice, consequently, the notion that individuals have a fixed ability linked to hereditary and genetics is common place assumption within and even beyond education profession (Hodgen, 2007). This discourse of ability has informed the common forms of classroom organization obtained in the UK. Therefore, there are valid reasons to consider the ensuing consequences both for individuals and for groups of students with regards to their learning, attitudes and achievement.

The consequences of setting and streaming decisions are great. Indeed, the set or stream that pupils are placed into, at a very young age, will almost certainly dictate the opportunities they receive for the rest of their lives. (Boaler, 1997a, p. 594)

The relative advantages of ability grouping in schools are, nevertheless, an enduring issue that have resulted in persuasive debates in the educational literature (Wilkinson and Penney, 2014a). The educational value of ability grouping has been disputed (Ireson and Hallam, 1999; Kulik and Kulik, 1982; Slavin, 1990; William and Bartholomew, 2004; Wilkinson and Penney, 2014a) on the grounds that there is inadequate evidence that setting results in 'a net improvement in student attainment' (Gillborn and Youdell, 2001, p. 86). Furthermore, there is convincing evidence that setting allocation procedures may have some unintended consequences for some particular groups of pupils (Hallam and Ireson, 2007). For instance, low attainment groups tend to be disproportionately represented by pupils from low socio-economic backgrounds (Boaler, 1997a, 1997b; Dunne and Gazeley, 2008; William and Bartholomew, 2004)

The research evidence shows the adverse effects of streaming for students in low attaining groups, nevertheless these practices are still widespread (Francis et al., 2017). From an equity standpoint, the notion of fixed attainment is essentially unsound and discriminatory, whilst also exerting a potent force within school and classroom processes (Hart et al., 2004; Ruthven, 1987). These processes can only change if there is a clear understanding of how they are (in-built either through the curriculum, pedagogy, tasks and assessment processes) structured to marginalise

particular social and cultural groups in ways that are coercive and barely visible (Jorgensen et al., 2014b).

2.5.1 Discrimination through the Curriculum

It is naive to think of the school curriculum as neutral knowledge. Rather, what counts as legitimate knowledge is the result of complex power relations and struggles among identifiable class, race, gender/sex and religious groups. (Apple and Christian-Smith, 2017, p. 2)

Scholars have expounded on different reasons why we should teach mathematics. Ernest (2001) succinctly suggests that mathematics can become a thinking tool for viewing the world critically such that it empowers the learner both politically and socially and helps them overcome internal inhibitions and perceptions of inadequacy since it is agreed that if students from deprived backgrounds feel powerless as learners, they will continue to have disappointing educational results. Furthermore, he suggests some aims for mathematics teaching to include;

1. Acquiring basic mathematical skills and numeracy and social training in obedience (authoritarian, basic skills centred)
2. Learning to solve practical problems with mathematics and information technology (industry and work related)
3. Understanding and capability in advanced mathematics, with some appreciation of mathematics (pure mathematics centred)
4. Gaining confidence, creativity and self-expression through maths (child centred progressivist)
5. Empowerment of learners as critical and mathematical literate citizens in society (empowerment and social justice concerns)

Leaning on the understanding that curriculum and pedagogy are not neutral, Noyes (Noyes, 2007b, pp. 6–9) articulates some of the prevailing principles that have been used to position the teaching of mathematics:

1. Mathematics for the Academy; ensures the supply of science, technology, engineering and mathematics (STEM) undergraduates; participation in A-Level mathematics

2. Mathematics for employment; equip and produce a mathematically competent workforce so as to maintain global competitive edge
3. Mathematics for general education; cultivates attributes needed for later life e.g. cognitive and affective attributes
4. Mathematics for education for citizenship; upholds importance of relationships and practices of mathematics classrooms to promote social justice
5. Mathematics for social justice; uncovers the value-laden nature of mathematics and therefore allows for a critique of societal power relations
6. Mathematics for the information age; contemplating the effect of information technology on mathematics teaching and learning in for instance two decades time.

Noyes (2007a) has also argued for the need to rethink mathematics education in England, for example, with regards to the mathematics curricula aims; recognising that children's social, moral, spiritual and cultural development influences all facets of learning (see also Winter in Gates, 2001). He argued that such concerns are not highly prioritized in lesson because schools were perhaps more interested in developing classroom learning of mathematics for assessment and therefore focus on content- knowledge acquisition in the place of general education that will ensure students have the required mathematical knowledge, skills and understanding that will enable them to participate effectively in a democratic society, a stance this study strongly upholds. Ironically, the mathematics curriculum offers minimal advice on achieving these curricular aims, thereby relegating its importance as it is not assessed. Thus, teachers focus on curriculum coverage instead – 'a content driven, linearly structured, heavily tested and examined, competitive pursuit' (p. 64). This might help to explain why students say mathematics is difficult, boring and irrelevant (Brown et al., 2008; Nardi and Steward, 2003).

All the positions described above can be justified depending on the purpose outlined. But it can be argued that some hold greater sway over the present curriculum than others, producing varied tension (Brown, 2011) levels implicit in the formulation of a curriculum that involves various interest groups. The tensions that occur in the

process of constructing the curriculum revolve around the selection of content, how it should be taught and assessed or what forms of knowledge are valued.

Nevertheless, Mathematics education plays a covert role in the segregation of pupils from diverse social groupings through the curriculum when the notion of 'ability' determines the organisation of groups of learners and what they get taught (Gates and Vistro-Yu, 2003) despite evidences that show the adverse effects of ability grouping (Boaler et al., 2000; Gamoran and Berends, 1987; Ireson et al., 2002; Sukhnandan and Lee, 1998) and the unintended consequences that arise (Macqueen, 2013; Marks, 2014; Wilkinson and Penney, 2014a).

Furthermore, what is meant by 'ability' has not being made clear, which leaves it open to different interpretations that align with teachers' own beliefs and values (Hart et al., 2004). A case in point, which may explain findings that setting restricts attainment, is the assumption that a homogeneous group is an advantage because it narrows the range of ability in the group which in turn, helps the teacher treat the class as a whole unit. Research findings have shown that this scenario allows teachers to overlook the difference in individual pupils ability levels, pitching the lesson to a reference group or an 'imaginary model pupils' (Boaler, 1997a; Rowan and Miracle, 1983) who works in a certain way and at a certain pace (Boaler, 1997c).

In setted classes, pupils are brought together because they are believed to be of similar 'ability'. Yet, setted lessons are often conducted as though pupils are not only similar, but identical—in terms of ability, preferred learning style and pace of working. In the setted lessons we have observed, pupils have been given identical work, whether or not they have found it easy or difficult, and they have all been required to complete it at the same speed. (Boaler et al., 2000, p. 640)

This 'one size fits all' (Wilkinson and Penney, 2014, p.418) approach to teaching with regards to content and pace was the default position teachers adopted which (Boaler et al., 2000) have argued is a source of disaffection for both pupils who found the pace too fast or too slow due to the restriction on pace and level of work imposed on setted lessons. Teachers have been known to use words like bright, hardworking and interested to describe top set students whilst students in low set are looked at in

negative light and described as lazy, lacking aptitude (Ireson and Hallam, 2005; MacIntyre and Ireson, 2002). The downside of this labelling is that it is usually done in public, a situation pointed out clearly below,

Teachers act in fishbowls; each child can see how the others are treated (Lortie cited in Doyle, 2006, p. 99).

So, the students tend to know about each other's ability or challenges as the case may be, which could place pupils in an awkward position. This is closely linked to the subject of stigmatisation which Wilkinson and Penny (2014b) assert rises in concurrence with setting that sees 'boundaries blurred between notions of ability, student behaviours and attitudes' (p.420).

...indications of a lack of motivation in low sets is perhaps not a reflection of a student's personality or preferred ways of being or acting (Hart 1998), but rather may be a result of their despondency as a corollary of low teacher expectations and the powerful and harmful restrictions on their potential achievement. (Wilkinson and Penney, 2014a, p. 420)

Being in a lower ability group meant restricted access to the curriculum for these pupils because they were served a mathematics diet that was not stimulating, largely remedial (Hodgen and Marks, 2009, p. 31); comprised mainly of unconnected facts and procedural methods; a structured approach to teaching with a lot of repetition and minimal opportunities for discussion. Also, the evidence suggests that this is based on what teachers perceive might match the level of pupils' level of prior attainment (Boaler, 1997b, 1997c; Dowling, 2002; Oakes, 1982, 1990).

Oakes (1982) had shown that pupils in lower tracks received less of both quality and quantity of curricular content compared to other pupils. Using data collected from 222 English and mathematics classes in 25 secondary schools in the US, she explored the relationship between tracking and educational inequality within schools. Her purpose was to understand how what she described as high-status knowledge (that which provides access to power) and effective instruction were disseminated between various tracks and how classroom relationships differed between different tracks.

She showed that with regards to the quantity and quality of curricular content in relation to tracks, there were significant differences between tracks. To assess differences in pupils' access to curricular knowledge, Oakes carried out a multiple discriminant analysis of tracking and the quantity and quality of curricular content based on a set of seven variables: topics of classroom instruction; cognitive levels of skills and activities listed by teachers; teachers' expectations regarding pupils' homework time; teachers', pupils', and observers' perceptions of the relative amount of class time spent on instruction; and observers' reports of class time spent in non-instructional activity. The high track pupils were exposed to instructional topics that afforded them access to higher education, encouraging non-subject related behaviours that involved critical thinking and independence. In contrast, pupils in low track classes were exposed to knowledge that required basic literacy and computation topics useful for everyday life and work. In addition, the activities and skills used by teachers involved low level cognition whilst also encouraging non-subject related behaviours that involved conformity to rules and expectations.

In the context of British mathematics education, Dowling (2002) draws attention to the marked difference in the nature of textbooks (i.e. British textbook series SMP 11-16) used with middle class pupils and those from working classes. Dowling's empirical evidence reveals that these texts focus on real world relevance for lower attaining pupils and in contrast, for high attaining pupils, the texts focused on preparation for further education and as such ignored real-world relevance.

Also, Hallam and Ireson (2005) compared secondary school teachers' pedagogical practices in mixed and attainment grouped classes and explored whether pedagogical practices were influenced by the type of grouping practices adopted in the various school. The sample involved over 1500 teachers from 45 schools divided into three groups based on their attainment grouping practices in years 7-9. Their findings indicated that the curriculum was differentiated along the lines of content, depth, the activities undertaken and the resources used as being more prevalent in attainment grouped classes.

This is also seen in relation to mathematics, where there is a tendency to adopt processes that conflate challenge and difficulty with notions of attainment and discrimination (Hodgen and Marks, 2009), which then inevitably influences the kind of curricular provision made for pupils in low attaining groups. The strong orthodoxy

of ability that underpins the English education system (Marks, 2014), by implication, supports a curriculum that is structured to make assessment easy rather than reflecting the various ways mathematics is employed in society.

Even so, some scholars have advocated for mathematics to be taught using realistic concepts which the pupils can relate to. The argument is pupils in mathematics classrooms should not be considered passive recipients of ready-made mathematics. Instead, pupils should be guided toward using opportunities to reinvent mathematics by doing it themselves. This theory underlies Hans Freudenthal's (1973) concept of mathematics as a human activity and challenges the mechanistic approach to mathematics education. However, Cooper (2001) argues that adopting realistic contexts into the teaching of mathematics brings about the difficulty of interpretation and which for cultural reasons may be a disadvantage for pupils with low socio-economic status (see also Cooper and Dunne, 1998).

Following this, Dowling (2002) contended that using realistic contexts was a myth, attempting to describe the 'non-mathematical world in mathematical terms' (p.6) which result in varied individual interpretations, and therefore lacks the genuineness of situations that occur in the real world. This mythologisation results in the potential alienation of pupils whose worlds are distant from the world constructed in mathematics education.

Gates and Vistro-Yu (2003) illustrate the role mathematics plays as a filtering device, drawing from the works of Costello (1991) and Willis (1996), their characterisation of mathematics education is apt;

- School mathematics is generally taught in a narrow context, with little concern for its historical and cultural setting;
- The way mathematics is taught discriminates against the needs, values and best interests of certain ethnic and other minority groups;
- School mathematics is remote from the familiar experiences of many pupils (Gates and Vistro-Yu, 2003, p. 48).

Furthermore, Gates and Vistro-Yu note that this also includes a situation where textbooks with decontextualized elements are given authority and real-world contexts do not feature in assessment questions – a 'suspension of sense-making' (De Corte et al., 2008a, p. 25); Gates and Vistro-Yu highlight three issues here,

mathematics education places limits on acceptability by limiting the utility of the context, by limiting the forms in which pupils are expected to respond to mathematical problems and by limiting the attachment to pupils' everyday reality. (Gates and Vistro-Yu, 2003, p. 54).

Similarly, Sullivan and Zevenbergen (2003) point out that, deciding on the suitability of context is complex and multidimensional given the varied cultural and linguistic needs of students in a class at any point in time. Yet, it is difficult to imagine which contexts these are when you consider that this curriculum will still be taught in the classroom following the usual mathematics classroom style (Wake, 2005).

Alienation from mathematics has been extensively recognised by educational researchers, who as a result have repeatedly advocated for a more engaging mathematics curriculum (Wright, 2017). There are also debates that propose the need to teach mathematics so that it generates quality and meaningful opportunities which equip pupils to become critical and transformative participants in society.

A crucial aspect of teaching mathematics ... is what students do with the mathematics that they learn. (Gutstein, 2006, p. 14)

In addition, Heyman's (2010) notion of mathematics education as an aid for preparing for later life contends that whatever mathematics is taught should satisfy the condition that it has practical usefulness such that its absence constrains normal everyday life. Beneath the ever-present moan of pupils expressed in the statement 'I just don't get this' is the confusion about how the mathematics being taught connects with their lived reality and therefore its purpose and questions the suitability of the mathematics curriculum (Sealey and Noyes, 2010; Wake, 2005).

Ole Skovsmose (2011) draws attention to the fact that mathematics education is empowering, this is seen through its applications in technology and other applications that are part of everyday routines. The fact that mathematics is a part of everyday routine should suggest its relevance but it is still regarded as abstract and complex. This suggests that there is a need to challenge the way mathematics is seen and taught to demystify the teaching and learning of mathematics that occurs at arbitrary level of abstraction which has no relevance or meaning to pupils.

This exceeds the need to focus on content of the curriculum beyond the usual quest for equal access for all pupils; the significance of the knowledge gained is equally potent, because they may be essential to achieving a socially-just system. However, according to Lupton and Hempel-Jorgensen (2012) interventions that promote equal access to schooling, provide funding, infrastructure and technology in a bid to compensate for social disadvantage and poverty are not necessarily adequate to pursue justice in terms of opportunity or outcomes 'unless the process of school-based learning becomes inspiring, enlightening, liberating and knowledge producing' for all pupils irrespective of social background' (Lupton and Hempel-Jorgensen, 2012, p. 602). This gives prominence to content and not simply access to curriculum alone.

2.5.2 Pedagogy and Class

In relation to teaching approaches adopted, there is the argument that sometimes tasks are designed for the efficient production of academic work (Doyle, 1988). This meant task was familiar and easy (which Good *et. al* (1987) describe as 'busywork'), content was atomised, and instruction was stepwise, all preconditions for achieving and sustaining classroom order and also preparing pupils to excel at examination style questions or what is best described as *teaching to the test*.

Nevertheless, Watson and De Geest have previously argued that teachers still need to 'take account of reality' (Watson and De Geest, 2005, p. 227) in the sense that pupils also need to show that they have acquired a level of mathematical proficiency and also be seen to successfully jump the hoop of public evaluations and accountability. Also, Berry and Sharp (1999), writing from a higher education context, observed that it was unnatural for their pupils to construct knowledge for themselves due to the narrow view of the subject which they linked to the 'teach-test' nature of the school mathematics national curriculum.

The significant aspect of teachers and the instructional methods they adopt is that it generates the prevailing classroom culture and the limits and possibilities of pupils' experiences and achievement (Dowling, 1991). For instance,

The dominant teaching method in mathematics - alternatively called chalk and talk, direct instruction, teacher-centred, transmissive teaching - is most undemocratic. This method of teaching assumes

that the teacher is the sole expert in mathematics and is therefore, responsible for transferring the expertise to the students. Such authoritarianism stifles students' creativity, deprives them of their individual freedom to learn more responsibly and hampers social interactions. The condition gets worse when the teacher either does not know enough mathematics or has poor teaching skills. That becomes a very oppressive situation for students. (Gates and Vistro-Yu, 2003, p. 44)

Similarly, Nardi and Steward's (2003) study constructed a profile of quiet dissatisfaction in secondary school mathematics; its characteristics include Tedium, Isolation, Rote learning (rule-and-cue following), Elitism and Depersonalisation (T.I.R.E.D). They demonstrated through the rote learning element, that pupils resented learning mathematics through the manipulation of unquestionable rules, unique methods and answers to problems that required memorisation and mimicking of correct procedures as cued by the teacher (as obtains in tests and examinations). However, for pupils, using these approaches had limited intellectual appeal as it meant tolerating drawn-out explanations by the teacher. They have suggested that pupils may be longing for a deeper understanding beneath this resentment towards mathematical activity as task completion via rule-and-cue following, hence, they argue that:

Within school mathematics, reducing mathematical learning to an execution of cues and procedures is often intended as simplifying complex mathematical thinking. However, devoid of a rationale for their use, these procedures are then perceived as mystifying-hence-alienating by the learners. (Nardi and Steward, 2003, p. 362)

This situation does not take into consideration the research evidence that promotes a focus on conceptual understanding and mathematical reasoning. Skemp's (1972) concept of relational understanding shows the need to establish understanding of the rationale behind mathematical procedures and its application in novel contexts. The Cockcroft (1982) report also critiqued the use of individual learning schemes which though widely used had its attendant problems; a lack of oral work and discussion were real issues to be confronted. This was further reflected in Boaler's (1998) stance on the advantages of open-ended, project-based approached to learning.

In addition, the way mathematics is communicated is crucial because studies of language and social class show that the forms of linguistic competence favoured by schools define to a large extent the access to the modes of communication in our classroom which Zevenbergen (2000) maintains favours some and not others. The explanation for this lies in the fact that the patterns of interactions within middleclass families mirror those of the formal school setting, therefore students from the working-class families are intrinsically disadvantaged. Consequently, this hampers the ways they engage in the classroom where they are required to learn a new 'language' made up of cues, nuances, verbal and non-verbal interactions, on top of the language of mathematics' (Gates and Vistro-Yu, 2003). Ernest's (2002, p. 4) view that 'mathematical empowerment consists of power over the language, symbols, knowledge and skills of mathematics and the ability to confidently apply this in mathematical applications within the context of schooling, and possibly to a lesser extent, outside of this context' is relevant. In practical terms this could mean,

For example, one needs to know how to "read" mathematical questions as real or imaginary contexts..., and by extension, one needs to learn to interpret examination questions to be successful at certification; "hence", "show", "prove", "find", etc. each carry specific nuanced calls for type of mathematical thinking and behaviour. (Gates and Vistro-Yu, 2003, p. 44)

Jorgensen et al (2014a) maintain that the problem of interpreting language within test questions is indicative of a difficulty with understanding the language used within the school mathematics. They suggest that the challenge of understanding test questions is much less of an issue compared with understanding what is expected in school mathematics. The implication then remains that students stand to be included or excluded, depending on their backgrounds, of which the use of language is an integral part.

2.5.3 Stratification through Assessment Practices

Mathematics has been described as a social filter (Davis, 1993; Howson and Wilson, 1986) particularly as a result of the role it plays as a *gatekeeper* (Volmink, 1994, p. 51) that determines an individual's prospects. This reflects what Skovsmose (1998) has described as the 'formatting power of mathematics', which has an indiscernible

role in the structuration of society (p. 199). The concept of societal structuring is a fundamental issue for many sociologists and Bourdieu (I discuss this more in Chapter 3), whose extensive works established the reproductive role of educational systems (Bourdieu, 1989; Bourdieu & Passeron, 1977; Bourdieu & Saint-Martin, 1974), and the distinct power mathematics wields through the examination system is emphasised:

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)

Bourdieu's assertion illuminates the context that obtains in the UK where two students, divided by the narrowest of margins, can have their future educational and life opportunities differentiated as a result of boundaries dictated by the General Certificate of Secondary Education (GCSE) C/D borderline – the 'magical threshold' (Noyes, 2007a). This is also closely linked to students' 'ability' groups. Previously, William and Bartholomew (2004) used matched data on Key Stage 3 test scores and GCSE grades for 709 pupils from six schools in London over a four-year period, and these data were analysed in terms of the progress from Key Stage 3 test scores to GCSE grades. They reported that within each school, the progress made during Key Stage 4 varied to a great extent, from set to set. They compared pupils with the same Key Stage 3 scores and discovered that pupils placed in top sets averaged nearly half a GCSE grade higher than those in the other upper sets, who in turn averaged a third of a grade higher than those in lower sets, who in turn averaged around a third of a grade higher than those students placed in bottom sets.

The ability to obtain five or more higher grades (A*-C) including English and mathematics in the UK illustrate the gatekeeping status of school mathematics. However, this is mostly achieved by less than half of the cohort (Noyes, 2009; Wolf, 2011), a position Noyes (2007a) argues is aided by the perpetuated myth that mathematics is relatively difficult, and as a result, many more pupils may find mathematics to be the stumbling block for their future education and employment plans.

Yet, schools adopt various strategies ranging from choice of syllabus adopted, to focusing on the pupils recognised to be at the thresholds that will satisfy performance tables'(Maguire and Dillon, 2007) requirements (i.e. Grade C), in what has been described as the educational triage (Gillborn and Youdell, 2000). Under this scenario, some pupils were ruled off as 'hopeless cases' depending on the capacity to obtain the much-demanded A-C grade, practices that will influence the school's position on the performance tables.

Previously, GCSE mathematics was assessed using a three-tier system. The ranges of grades on the three papers were D to G, B to E and A* to C, whilst a U grade was awarded to pupils who failed to attain the lowest grade on any of the papers. This was critiqued (Burghes, Roddick and Tapson 2001) on the basis that pupils could only achieve a grade within a particular range and also the fact that sitting the foundation paper allowed pupils to obtain a ceiling of a grade D, consequently 'falling short of the magical C threshold' (Noyes, 2007a, p. 3). This led to the introduction of the two-tier system, first taught in 2006. This made provision for pupils sitting the foundation paper to obtain grades C to G, or a higher paper on which can be obtained any grade from an A* to an E; once more a U grade is awarded to pupils failing to attain the lowest grade on the papers.

The problematic nature of formal assessment in mathematics has long been discussed as demands for reliability, comparability and transparency have to be seen in the aggregation and awarding methods (Ward-Penny, 2013). Whilst, the advantage of tiered assessment lies in its affordance of a degree of specificity; even then, it does not surmount the argument that 'a tiered GCSE paper is structured to allow students to demonstrate more of what they do know, rather than reminding them of what they do not' (Ward-Penny, 2013, p. 212).

At the classroom level, the criticisms levelled against teacher assessments include, the inadequacy of the measures used to evaluate pupils:

The use of cold, standardised, objective tests and the over-reliance by teachers on test scores rather than on students' real understanding of mathematics create the unnecessary division between students who know how to take tests and those who don't. Teachers' insistence on

using a single score to measure achievement is oppressive because it limits students' chances for growth. (Gates and Vistro-Yu, 2003, p. 46)

In addition, these evaluation practices in classrooms build inequity through a process of 'social comparison' (Cohen, 2000, p. 271) such that students identify themselves as arrayed on a single dimension of ability in schoolwork. Similarly, Nolan (2012) points out the concealed messages that arise:

Such a culture of tests works to separate and label those who have it and those who do not... Acceptance of the characteristics of speed, individualization, and efficiency as markers of being good at mathematics misrecognizes the objective truth that these markers reproduce the culturally arbitrary practices of sorting, ranking, and ordering. (Nolan, 2012, pp. 209–210)

This reiterates Bourdieu's portrayal of the dominance and power mathematics exerts through its role as 'gatekeeper' to social progress (Gates and Vistro-Yu, 2003); so, what is complicit in this case may not be students' ability but the social and cultural differences between them (George, 2012).

2.6 The Impact of Pupils' Backgrounds

The learning of mathematics (directly related to attainment) in classes is closely linked to who the learner is, considering that they bring to the enterprise what Bishop (2001) describes as personal dimensions – individual histories, culture and family backgrounds. These dimensions, though different are equally sufficient *virtual bags* (Thomson, 2002) filled with unique skills and experiences that have played a major role in their personalities. Accordingly, a change of perspective in mathematics education has driven the focus on the mathematics classroom culture following a recognition that the social enterprise of teaching and learning mathematics is considered crucial and under researched (Dunne, 1999; Knippinget *al.*, 2015). At one level, classroom culture comprises classroom norms and practices, teacher's and pupils' beliefs, conceptions, values and activities (Cobb, 1994; Cobb and Yackel, 2004). On another level it involves stepping outside the classroom culture to understand the influences that have come to bear on the culture that obtains within the classroom (as discussed in Section 2.3).

The literature has long shown that tensions and contradictions arise when there is a clash between the school and the pupils' cultures. For example, Jackson (1968) pointed out the tension that exists between the formal (academic demand) and the hidden curriculum (the social, evaluative and political dimensions of classroom life) and made a pertinent observation in his assertion that 'the relationship of the hidden curriculum to pupils difficulties may be more striking than is its relationship to pupils success' (p.34). In the next section I consider how SES is manifested in pupils' experiences within classrooms.

2.6.1 Response to Instructional Discourse

In relation to pupils' mathematical experience, Lubienski (2000, 2002) has explained how socioeconomic status (SES) influenced their experience (see also Reyes and Stanic, 1988). Lubienski's study explored ways a pedagogy based on problem-centred materials, panned out with a socioeconomically diverse group of 18 seventh-grade pupils. Contrary to her expectations of finding SES differences in parental support and fluency with the contexts used within the problems, she found differences in pupils' experience with whole-class discussions and open-ended mathematics problems, two crucial aspects of pedagogy and curriculum. She reports that the purpose of discussions was viewed differently by the lower and higher SES pupils. Whilst the former group were less confident in their contribution to the discussions, more pupils wanted teacher-led directions and seemed to focus on the role as obtaining and giving the right answers to problems; the latter group were more confident in their contributions, felt they could sort out difficulties and saw discussion as opportunities to be exposed to different mathematical ideas and analyse these ideas. In addition, Lubienski reports the challenges encountered within the open, contextualised mathematics problems. The lower SES pupils found it difficult to cope with the level of ambiguity of the problems; causing them high levels of frustration which made them give up. Conversely, the high SES pupils thought harder and construed the solutions in practical ways.

The distinct responses described above have been associated with pupils' home environments (Lareau, 2003). Middle class parenting practices tend to allow for independence and creativity, whilst also being suggestive and accepting of reason and discussion; as a result high SES pupils develop into individuals that are assertive and

willing and able to take charge of their lives and these dispositions make it easier for them to relate with certain pedagogic approaches. In contrast, low SES parenting practices tend to be more directive, requiring more obedience, therefore engendering subservience and dependency, a situation where conformity and obedience prevail (Gates and Noyes, 2014).

Drawing on a Bernsteinian framework, Lubienski argues that there is a need to understand how pupils' social backgrounds enable or constrain access to the 'regulative and instructional discourses' (Lubienski, 2004, p. 120) used in mathematics classrooms. Hence, she argues that there is a need to unearth the cultural suppositions that form the basis of particular discourses within mathematics classrooms.

This is similarly portrayed in Jones' (1989) study that maintains that a discussion of what happens within classrooms and its implication for social change requires an understanding of the structured, collective cultural interpretations of students. In her study of the working class, Pacific island girls and the middle class Pakeha (European) girls, she shows how the students' conception of 'doing school work' varied between the two groups. In Jones' study, the '5 Mason' girls ranked their teachers on their ability to provide notes to copy and regarded any form of class discussion that required their input as a waste of time and triggered disinterest and lack of cooperation. They would punish or reward the teacher who failed to provide what they considered appropriate work. In this case, Jones maintains that the girls' conception of what could be judged as teaching and learning influenced what happened in the classroom, not only the teachers' beliefs about appropriate pedagogical strategies.

In contrast, the '5 Simmonds' girls saw their teacher as more of a 'manipulable resource' and regarded schoolwork as involving active engagement in curriculum knowledge and did not want to be spoon fed. They employed various strategies to get the teacher to conform to their own demands such as asking for elaboration on a subject, demanding for a handout instead of getting notes for example.

Jones explains these differences in terms of the influence of parents' experiences in the labour market which defined the value ascribed to education, the notions of compliance or assertiveness and the modes of acquiring knowledge which then shapes students' approach to learning. In addition, the opportunities (or lack of) for self-

direction and autonomy experienced at work is linked to the values, orientations to self and society and cognitive functioning (Kohn and Schooler and Kohn cited in Jones 1989, p. 28). Her argument centres on the significance of the historical, cultural and economically-based material conditions that prevail in students' lives and how these provide the means for their interpretation and construction of classroom life.

In the subsequent sections, I look at how pupils' backgrounds influence their attitude in lessons and engagement in lessons.

2.6.2 Attitudes

Students implicitly and sometimes explicitly distinguish between on the one hand education, and especially its credentialist, utilitarian value, and on the other the form and content of actual pedagogy, curriculum and organisation of schooling. They react to the form of schooling rather than the substance of education. (Weis cited in McFadden, 1995, p. 296/7)

In addressing pupils' attitude in lessons, there are different aspects to consider; firstly, pupils are not passive participators in the schooling process; secondly, they also respond to the prevailing classroom culture. The first aspect is closely linked to the influence of pupils' background. The ease or difficulty pupils experienced as pupils come to terms with school rules is linked to their family cultures and values including the quality of the home environment (Lareau, 2003). Where there is a misalignment, a sense of difference and exclusion (Furlong, 1991, p. 302) sets in and this often marks the start of disaffection in many cases.

Given the way schools are structured to inculcate and reward middle class ethos, some teachers tend to judge their working class pupils based on these standards which could often lead to reactions that highlight deficit on the part of pupils (Ball, 1981; Hargreaves, 1967; Lacey, 1970). These expectations or ability stereotyping (Nash, 1976; Ruthven, 1987) are not happenstances but they 'reflect and support expectations of students that are deeply ingrained in societal and ideological values' (Nieto, 1994, p. 395).

Furthermore, Brophy (after Good and Brophy, 1978; 1980) argues:

... student responsiveness to lessons and assignments probably depends in part on the kinds of expectations that teachers communicate about the meaningfulness, interest value, or practical value of those lessons or assignments. In short, teachers routinely model and communicate expectations about a variety of matters in addition to student achievement. (Brophy, 1983, p. 656)

On the other hand, seminal studies of schooling (Hargreaves, 1967; Lacey, 1970; Ball, 1981) have shown that students' predispositions towards school were largely dependent on the type of ability grouping they experienced. The conclusion was that homogeneous grouping brought about a distinct polarization of students with pro and anti-school factions such that high attaining students conform to schools demands, accepting these as the standard definition of behaviour whilst students in low ability groups resist and undermine the school rules (Gamoran and Berends, 1987; Sukhnandan and Lee, 1998).

However, Gamoran and Berends (1987) have argued that there is no evidence that tracking causes polarization of student attitudes (since attitudes and motivation would have been the grouping criteria in the first place) because different studies (Everhart, 1983; Willis, 1977) have shown that the development of pro and anti- school attitudes may be connected to the stratification that occurs in society rather than the stratification that occurs in school.

This then, allows a different interpretation to students' attitude,

An alternative interpretation then of the evidence on student resistance is that students from certain kinds of backgrounds have experiences of schooling which restrict their opportunity to extend their knowledge. The response to this form of schooling for many students is to resist it. What students are constantly rejecting, or sometimes at best, merely complying with regardless of class, gender, race and ethnicity is schooling which depowers them. (McFadden, 1995, p. 297)

For example, by virtue of being in a low attaining class, students were already labelled as deviant and trouble makers (Laws and Davies, 2000; Lupton and Hempel-

Jorgensen, 2012). This meant a teacher came into class with preconceived notions of students passed down from previous teachers or based on their experience/history with similar attainment groups (Noyes, 2004). This in no way discountenances the fact that teaching in schools, particularly in disadvantaged areas is fraught with a lot of challenges (Lupton and Hempel-Jorgensen, 2012; McFadden and Munns, 2002; Thrupp, 1999; Thrupp and Lupton, 2006). Consequently, both teachers and students adopt strategies to deal with different scenarios:

Faced with these extra demands and internalising the problem as their own, teachers tend to fall back into modes of pedagogy with which they can, in various senses, succeed. These include ...strong classification and framing so that students know what they are supposed to be learning and can be kept on task, whole-class teacher-led activities in which the teacher can maintain surveillance and control, seating strategies, short and superficial activities which do not allow the possibility of going off task and extensive behaviour management measures. (Lupton and Hempel-Jorgensen, 2012, p. 611)

However, in response to these teacher strategies, pupils' adaptations (Woods, 1990) include: for example, the use of humour and theatrics in lessons.

Alpert (1991) writing from the context of students in upper middle-class high school classrooms who work toward achieving school success, points out a dialectical attitude of resistance and compliance and argues that this could be linked to a teaching approach that attributes superiority to academic school knowledge and that promotes a recitation style of classroom interaction. Furthermore, some modes of resistance are illustrated:

- Reluctant participation (Silence and Mumbling), a situation where pupils did not respond to the teacher's questions that attempted to stimulate discussion, and
- Arguing, demonstrated when pupils' express disagreement with the teacher's perceptions of content, and criticise evaluation policies.

Alpert points out the gap between adolescent culture and the teaching approach which according to him leads to pupils' resistance. Nevertheless, this resistance is curbed by

the recognition of the importance of conformity and compliance with the educational system. This element of compliance is necessary for academic success (also pointed out by Woods (1979) which also aligns with the norms and aspirations of middle-class groups to which these pupils belonged.

On the other hand, for pupils from the lower class, two kinds of gaps that are also potential sources of aggressive resistance include 1.) the gap between the school's emphasis on academic knowledge and the adolescents' culture and 2.) the gap that occurs when the school's norms and values, which represent those of the dominant, upper middle-class does not accommodate but excludes working class pupils' norms and values. In this case, Brantlinger (2007), citing Willis (1977) maintains that, resistant actions tend to worsen pupils' school and life situations even if this accomplishes pupils' short-term goals (e.g., task avoidance, reducing their sense of powerlessness).

From the literature, it is clear that teachers and pupils play critical roles in the classroom. Secondly, pupils' engagement in class may also be closely linked to their perception of the relevance of the work done in school and I discuss this in the next section.

2.6.3 Pupils' Perspectives and the Relevance of Mathematics

Pupils from deprived backgrounds typically have less access to a good, broad curriculum and related extension activities, and may find their curriculum irrelevant to their future (Callanan et al., 2009, p. 67).

The element of relevance and intrinsic motivation is useful in the learning environment because it analyses how young people rate their experience of schooling. Crumpton and Gregory (2011) have explored the effects of academic relevancy on engagement and achievement and explain that there is greater steer to learn if pupils find that schoolwork is relevant for their future success. Although academic relevance is understudied, it is deemed to be protective for pupils with a record of low achievement (ibid 2011). This is important particularly because pupils in low attaining groups have been described as more inclined to be disengaged in lessons, be involved in truancy and suffer more exclusions from school.

However, with particular reference to truancy, James' (2012) report drawn from young people's perspectives, explains that reasons for truancy are undoubtedly complex, multifaceted and multi-layered, 'Yet the weight of reasoning was evidently concentrated among institutional 'push' factors. Un-engaging, and 'irrelevant' lessons and learning tasks, as well as particular teachers were the most strongly implicated...' (p. 281). One conclusion that can be drawn here signifies the importance of pupils' perspectives and this is also reflected below,

School is not working for very large numbers of young people, and this need not be the case. Young people themselves are powerful and insightful analysts of what works and what does not work for them in school and the conditions that need to be brought into existence for them to have a meaningful education. The problem is that adults, and education policy makers and politicians in particular, largely choose not to listen to what these young witnesses of schooling have to say (Smyth, 2007, p. 635).

Pupils' perspectives about their learning can indeed reveal much more (Cooper and McIntyre, 1994) than are known and it is ironic that that are left out of matters that concern them the most. Perhaps this is because there is a lack of acceptance of the fact that what it takes to educate pupils now is very different and complex compared to what it was in the past (Nieto, 1994) and that the implications of the changes are yet to be fully grasped. Rudduck and Flutter (2000) assert that the structures of secondary schools do not accommodate the levels of responsibility and autonomy students show in the complex lives they have outside school, lives filled with conflicting demands; multiple roles and responsibilities; and relationships. There are no reasons that excuse ignoring student's perspectives about their learning because as individuals they are observant and possess 'a rich but often untapped understanding of processes and events' (ibid., 2000, p.82).

There is currently much research into 'pupil perspectives' with the realization of the impact it has on students' learning in general (Rudduck and Flutter, 2000; Smyth, 2007) and in mathematics (Edwards and Jones, 1999; Lee and Johnston-Wilder, 2013; Roesken *et al.*, 2011). Pupils' perceptions of themselves as learners of mathematics have been described as a vital parameter for their engagement and

attainment in school (Roeskenet *al.*, 2011). In addition, pupils' perspectives can inform the developments of teaching and learning in schools (Cooper and McIntyre, 1994).

However, Lee and Johnston–Wilder (2013) have pointed out that even though pupil voice is an evolving force for transformation and improvement in many UK schools, its influence is yet to be realized within the context of mathematics departments. Equally, Gutierrez (2013) maintains that a critique of what has been normalised is what makes subordinated peoples' perspectives significant. Consequently, this lends support to enlisting the views of pupils in low attaining groups, which could provide different perspectives into the practices within school mathematics that end up marginalising or excluding them (Hughes, 2002).

In line with this stance and in discussing the importance and usefulness of mathematics, Onion (2004) showed that 11-16 year olds in schools thought the mathematics they were taught was only useful in mathematics lessons and for examinations. Interestingly, this view aligns with the notion that learning is situated (Lave and Wenger, 1991) within the context in which it occurs. The pupils did not see the link between the mathematics they were doing and their current or future existence beyond the school. In addition, the report indicated that the schools pupils were in and not necessarily their aspiration influenced the extent to which pupils thought that mathematics would be useful in their future careers. This could suggest that this aspect of their attitude to mathematics is not drawn from direct knowledge of the uses of mathematics in the work place, but may be based on guidance from their teachers. Another worrying aspect pointed out was the fact that when pupils were asked directly about the usefulness of mathematics in their future careers, a few thought that they would not need mathematics in their jobs while some others thought that it might form part of their qualifications.

In a different setting, Hernandez-Martinez et al.(2008) report on how pupils talk about their aspirations in relation to higher education (HE); influences on these choices, and the place of mathematics in this process. They describe four 'repertoires' pupils use to facilitate this discourse, and how pupils' predominant 'repertoire style' relates to their cultural background. They characterise pupils' views of mathematics as depicting 'exchange' value, or 'use' value. The 'exchange value' element presents mathematics as instrumental to achieving their goals; as a high status discipline that is able to

position one on a respectable career path (see also Williams, 2012). In this case mathematics was described as 'hard', 'not relevant to everyday life', but as a 'pre-requisite' for their future plans, or helpful in their future rather than now' (Hernandez-Martinez et al., 2008, p. 157). On the other hand, the 'use value' describes mathematics as being highly useful and relevant to what they were doing now and wanted to do in the future.

In contrast, Sealey and Noyes (2010) have explored how young people perceive the relevance of their school mathematics and how these perceptions might influence learner trajectories in mathematics. They list three factors they consider to be important in discussing the relevance of mathematics to learners: (1) school context; (2) the departmental culture and pedagogy (which is related to the school context); and (3) the different meanings that 'relevance' has for different students. They have put forward three categories of relevance: usefulness (practical relevance – useful in daily work and life), transferable skills (process relevance – useful for problem solving) and exchange value (professional) (p.240). From their work, we understand the role schools, teachers, peers and families play in pupils' interpretation of the relevance of mathematics and the consequences that follows.

...it is problematic that pupils from the high attaining suburban school see the relevance of a mathematics qualification in its exchange value while pupils in relatively disadvantaged communities have far less understanding of the hierarchy of academic subjects. This latter group tend to express far more insightful views of a mathematised society but seem to be subject to its power, partly due to the kinds of careers they aspire to and in which they see their families and neighbours engaged (ibid., p.241).

Thus, the interpretation of the concept of relevance may be related to cultural capital and social position. Even so, according to Noyes and Sealey, a singular emphasis on any one form of 'relevance' may not be the solution (as this may reinforce the social divide between types of pupils), there is however, a need to consider firstly, how pupils' views of curricular relevance shapes their attitudes to mathematics (Sealey and Noyes, 2010) and secondly how to make the curriculum connected to what pupils find important (Crumpton and Gregory, 2011; Smyth, 2007).

2.7 Linking Pupils' Attainment groups and Backgrounds

The school experience is more than the sum of its parts.(Jackson, 1968, p. 111)

Mathematics classrooms like other classrooms are too complex to view or be discussed from a single perspective. Consequently, in seeking to understand the experiences of students in LAMG, the significance of reading, observing, talking, listening and reading between the lines became a major preoccupation. This is coupled with the understanding that school experience involves much more than meets the eye as suggested in the prelude to this section.

Previous research findings and explanations for differential attainment seem to adopt the homogenization of contexts, presuming that some of the issues are about low attaining schools and children from areas of deprivation, as if they are all the same. Consequently, I want to explore these issues by looking at two schools that are geographically proximate and share overlapping geo-demographic qualities, but to explore the differences that exist between these schools.

In the same vein, contextual sources of inequality that occur as a result of the internal organisational processes of schools cannot be dismissed. Attainment grouping is a practice within education that creates avenues for reproducing social distinctions by curtailing the opportunities available to pupils in LAMG. Whilst there is much research evidence that indicates the advantages and disadvantages of attainment grouping on achievement and student self-concept there is insufficient attention given to how LAMG work to reinforce social distinctions and perhaps in some cases, even make it worse.

So, whilst previous research reveal that pupils' backgrounds are important such that pupils from diverse backgrounds often perform differently, it is however not clear how this comes about in LAMG. The need to understand how this works is clearly expressed by Dunne et al.'s (2007) evaluation that there is a need for research that seeks to address this shortcoming 'at a time when low attainment groups are so widespread, yet knowledge of how they work is so limited' (p.105).

Additionally, it is also established that different cultural and social groups engage differently with mathematics and attribute varied levels of importance to mathematics

(Sealy and Noyes, 2010). If we are to understand the nature of disaffection and disengagement in low attaining mathematics classrooms, then there is a need to look beyond the current explanations that highlight differences based on innate ability; a cognitive (psychological) perspective that tends to promote deficit thinking. Besides, the notion of fixed ability does not recognise the range of individual needs and the diversity that obtains within classrooms (Francis et al., 2017).

Furthermore, Valero (2004) writing from a socio-political perspective argues that the construction of knowledge cannot happen in a vacuum which will imply a disregard of the contextual foundation. This view builds on Mellin-Olsen's (1987) stance that a study exploring how people live their lives within a particular structuration for instance, should not overlook the relationships between the social construction of the individual and the way the individual lives their life. These lived experiences are a combination of diverse (and opposing) relations and therefore makes the case for exploring the 'macro-sociological space that has an influence on the more focalised interactions of mathematical teaching and learning in micro contexts such as the classroom' (Valero, 2004, p. 17) with the intention of revealing the social and political import of the educational practices of mathematics.

Based on the findings drawn from previous research and other theoretical and practical considerations, I want to explore the impact of disadvantage on the learning of mathematics by examining what the importance of place (neighbourhood and families), school and classroom is for the learning of mathematics. I am particularly interested in exploring how it is that some pupils fare better in some schools and not in others.

The research questions of this thesis can thus now be constructed as follows:

1. What similarities and differences are there in the mathematics learning cultures of the two schools these pupils attend, including curriculum, pedagogy, relationships, groupings, etc.?
2. How do the micro-processes within LAMG operate to reinforce initial divisions into classes?
3. How do the characteristics of pupils' background impact upon their learning, engagement and achievement in LAMG?
4. What are pupils' perspectives about their learning experiences and their views of the relevance of mathematics to their futures?

The next chapter will detail the Bourdieuan framework that I will adopt as a lens through which to explore the impact of the interrelated factors mentioned above, on the learning experiences of pupils in LAMGs.

3. CONCEPTUAL FRAMEWORK

Within this chapter I explore the conceptual perspectives that framed the empirical research, which is drawn from Bourdieu's theory of practice. The tools of habitus, field and capital are introduced and these provide a lens for exploring the complex factors that contribute to pupils' differential attainment and experiences. This is beneficial for my study because Bourdieu's conceptual framework explains the mechanisms through which social structures and practices are perpetuated 'without consciously obeying rules explicitly posed as such (Bourdieu, 1990, p. 76).

3.1 Applying a Bourdieuan Conceptual Framework

Pierre Bourdieu (1930-2002) was a French sociologist whose work covered a number of fields including education (Webb et al., 2002). Bourdieu's approach was never to theorize for the sake of it (Bourdieu and Wacquant, 1992; Wacquant, 1989) and almost all of his work can be seen as a response to an actual practical context, with an ardent mission to explain the social, political and cultural practices that surrounded him; in brief, to 'restore to people the meaning of their actions' (p. 50).

Bourdieu's (1986) theoretical concepts (Habitus, field and capital) have been employed to clarify differential educational outcomes and the extensive issues of class reproduction in society (DeMaggio, 1982; Lareau, 2003) which may be detrimental to the aims of social justice. Bourdieu's theory for the dialectical analysis of practical life permits the examination of social structures and the dispositions of the agents who live within these structures.

Therefore, his work that conceptualises the conservative role of the school is significant, as he provides a theoretical perspective on the relationship between the culture of the home and that of the school (Bourdieu, 1974; Bourdieu and de Saint Martin, 1974; DeMaggio, 1982). Bourdieu's work aptly illustrates the part schools and school systems play in reproducing social and cultural inequalities (Harker, 1990). Consequently, and with much relevance for my thesis, adopting a Bourdieuan lens will allow for the illustration of the connection between attainment grouping and pupils' social backgrounds; whilst also enabling a serious challenge to the notion of ability which constitutes one of the most hegemonic discourses in school mathematics (Jorgensen et al, 2014). It will also explain how attainment groups work to reinforce and exacerbate social distinctions.

In addition, his theory of practice also makes provision for the comparison of different social arenas as there is a high degree of similarity in the structuring and restructuring processes involved. The implication for my thesis is that the findings from this study have very strong parallels to other mathematics and LAMG contexts.

Bourdieu's concept of social action, knowledge and structure can be described as anti-dualistic in its quest to overcome the inherent dichotomy that pervades social theory; subjectivist and objectivist modes of theorising, between the material and symbolic

dimensions of social life and micro and macro levels of analysis (Wacquant, 2008). Bourdieu transcends the oppositions of objectivism and subjectivism, into a dialectical relationship between structure and agency. He overcomes these dichotomies in his adoption of the conceptual tools of habitus, capital and field. These components of Bourdieu's theory are subsequently considered in more detail.

3.1.1 Habitus

*The habitus constitutes a mechanism for responding to the troublesome distinction between macro and micro levels of society.
(Reay, 1995, p. 359)*

For Bourdieu, the dispositions resulting from early socialisation within the family and the immediate settings are categorised as part of one's habitus. The habitus implies a disposition or habit that operates at unconscious level or 'unthinking-ness' in action and disposition (Grenfell and James, 2003, p. 14); resulting in the production of practices, hence it generates 'the experiences that frame interpretations and fresh ways of acting in novel contexts' (Zevenbergen, 2002, p. 2). These experiences then predispose individuals to think, act and interpret the world they live in 'without consciously obeying rules explicitly posed as such (Bourdieu, 1990, p. 76). These unconscious dispositions are internalization of external constraints and possibilities. This implies that they are shared by individuals who are subjected to similar experiences even though each individual is a unique variant (Wacquant, 2008). Hence the habitus is described as,

an acquired system of generative schemes objectively adjusted to the particular conditions in which it is constituted, the habitus engenders all the thoughts, all the perceptions, and all the actions consistent with those conditions and no others. (Bourdieu, 1977, p. 95)

Whilst there is room for creativity, there is restricted capacity for improvisation which exposes both 'the dynamic structure of social reality and the constraint of social conditions where many of us believe there to be choice and free will' (Mills, 2008, p. 81).

The habitus may be seen as a product of history, derived from social inheritance (Robbins, 1993). However, the habitus is permeable and reactive to the environment or context surrounding them.

The habitus acquired in the family is at the basis of the structuring of school experiences...; the habitus transformed by the action of the school, itself diversified, is in turn at the basis of all subsequent experiences...and so on, from restructuring to restructuring. (Bourdieu 1974 cited in Bourdieu and Wacquant, 1992, p. 134)

Consequently, the habitus even though stable and durable, 'is continually modified by individual's encounters with the outside world' (DiMaggio, 1979, p. 1464). The role schools and homes play in constructing wider social organisation is significant, in the sense that whilst the habitus is being transformed, its possibilities are limited; being 'reproductive rather than transformative' (Gates, 2006, p. 352). This does not imply that the habitus is deterministic; however, it is a function of the social fields that constitute the habitus.

The notion of habitus shows that an individual's habitus is an embodiment of far-reaching social struggles and structures (Noyes, 2004) indicating the tensions involved at every point. The habitus becomes a form of capital (cultural) when it aligns with the practices of the field (school mathematics). By implication, pupils whose dispositions do not align with those valued within school do not stand a chance at being successful if the school approaches these dispositions as constraints and not possibilities for transformation (Jorgensen et al., 2014b; Reay, 1995). This is further explained through Bourdieu's concept of symbolic violation which explains how the habitus of some pupils clashes with and limits their access to, school mathematics. How this works stems from the understanding, that the habitus of pupils which is a form of culture can be exchanged for capital when it aligns with practices in the field of mathematics which values particular dispositions over others and thereby impose structure upon those participating in the field. Consequently, success at mathematics becomes a function of social and cultural backgrounds aligning with disposition valued in the field of mathematics. Conversely, the lack of success for certain social groups can be seen as 'a non-random event; it is a product of institutionalised practices of which participants may be totally ignorant' (Jorgensen et al., 2014b, p. 228).

The habitus allows individuals to generate and interpret practices as they respond to the diverse, unanticipated and ever changing social situations they face every day. This results in 'a system of lasting and transposable dispositions which, integrating past experiences, functions at every moment as a matrix of perceptions, appreciations and actions and makes possible the achievement of infinitely diversified tasks' (Bourdieu, 1977, pp. 72, 95). This explains why we act or respond the way we do at every point in time. The strategies adopted by way of language, choice, behaviour or body postures could therefore reflect social and cultural differences. This is significant for this thesis where I am interested in the influence of pupils' backgrounds on their learning either through their attitudes (dispositions), values or the choices they make. This by implication would require the adoption of a methodological framework that provides access to such deeply ingrained characteristics.

3.1.2 Field

Bourdieu's notion of field stems from an understanding that our dispositions are drawn from both historical and social contexts; so particular practices need to be seen as 'the product of the relation between the habitus, on the one hand, and the specific social contexts or "fields" within which individuals act, on the other' (Thompson, 1991, pp. 13–14). In essence, the habitus needs to function within a set of socially organised rules within contexts which Bourdieu characterised as fields. This is aptly illustrated in his conception of the social world using a topology of space. Thus, social space comprises multiple fields which have some relationship to each other and points of contact. Every individual's social space can be traced through time to a series of fields within which people struggle for dominance (Harker et al., 1990). Consequently, the notion of society in Bourdieu's term combines that of field and social space – an 'ensemble of relatively autonomous spheres of "play"' (Bourdieu and Wacquant, 1992, pp. 16–17).

Each field proposes its particular values and retains its own regulative principles. Bourdieu's (1992, pp. 98–99) depiction of field as a 'game' is interesting and highlights significant issues. According to him, every field defines its stakes and interests (Bourdieu, 1993). Whilst the rules of this game are not contested because there is an underlying complicity, it connotes a sense that every person is free to play and negotiations are allowed yet, in actual sense, the rules of this game are not

determined by everyone involved but by individuals who have the 'power'. To compound issues, the rules of the game (field) are 'only ever partially articulated, and much of the orthodox way of thinking and acting passes in an implicit, tacit manner' (Grenfell and James, 2003, p. 20). Therefore, to win in this 'game', the need to know the rules is crucial to avoid failure; this however poses a challenge the marginalised have to overcome particularly when they do not know the rules (Mills, 2008). This immediately places them at a disadvantage. For example the language competencies or contexts embedded within mathematics tasks can alienate some working-class students (Cooper, 2001; Sullivan et al., 2003).

This makes a field 'an arena of struggle; the site of a more or less openly declared struggle for power and influence between the dominant and dominated who are unequally endowed in the objects and the weapons of struggle: capital' (Mills, 2008, p. 86). For Bourdieu, this forms the basis for any classificatory system of society. However, material possessions here does not constitute class, a perspective that distances Bourdieu from Marx' more economist view of class; whilst also not fully embracing Weberian lifestyle perspectives. Thus, For Bourdieu,

Social classes do not exist... What exists is a social space, a space of differences, in which classes exist in some sense in a state of virtuality, not as something given but as something to be done. (Bourdieu, 1998b, p. 12)

An illustration of how this works is given by Crossley (2014) who explains that, every individual, on Bourdieu's account, has a portfolio of capital with a particular amount or volume of capital and this capital has a particular composition. This corresponds to economic and cultural capital (this is discussed later). Consequently, every individual is positioned subject to their individual volume and composition of capital. Therefore, individuals whose positions are close in the social space are more likely to live and socialize in the same places and are therefore more likely to form 'real' groups as families and neighbourhoods. Also, they are inclined to develop similar lifestyles, outlooks, dispositions and an implicit sense of their place in the world or 'class unconsciousness', also known as class habitus and what is, and is not, 'for the likes of us'. This is relevant for my research where the concept of place and its influence is explored.

In other words, social fields may be seen as the system or set of objectively defined, social relations of power between those holding different positions by virtue of their possession (or lack) of power or capital within the field, but who share the same dispositions (Griller, 1996; Jorgensen et al., 2014b). In relation to this, some crucial aspects of a Bourdieuan sociology include the relational dimension of social life and the notion of distinction or difference, which is a significant element of class-analysis in Bourdieu's work (Crossley, 2014; Moore, 2014; Noyes, 2004).

Bourdieu's concept of power and field is demonstrated in mathematics education for example, where social practices become accepted because they are products of the interactions between various individuals within the field. Jorgensen *et al.*, illustrate how this occurs in mathematics education

The field of mathematics education is a particularly appropriate unifying field because it encompasses and defines a clear set of rules that hold the discipline together. For example, the mathematics curriculum is structured in a particular way that privileges certain forms of thinking, pedagogy is structured to distinguish between different learners, expectations become organised around visions of different futures, behaviours are shaped around the image of the ideal pupil, relationships with parents place teachers in very specific positions of authority and so on. All of which, when taken together, define the practices we see in classrooms and relations between the learner and teacher, the home and school contexts and between government and schools. (Jorgensen et al., 2014b, p. 224)

This clearly marks out the social relationships involved in mathematics education, at micro and macro levels, shaping and reproducing social activity in diverse forms (Grenfell and James, 2003). Furthermore, mathematics education with its unique practices may be regarded as a field. These practices include for example, the specific language patterns used, the heavily structured teaching and hierarchical nature of skills taught with little consideration given to applicability (Jorgensen et al., 2014b). In addition, these practices also ascribe value and status to particular dispositions and learning, resulting in a differential evaluation of these practices within the field. In response the field imposes 'an objective structuring upon pupils and teachers through curriculum, pedagogy and the organisation of learners' (ibid., 2014b, p. 225).

Thus, my study is not only focused on the field of education but also family and place culture fields. The adoption of these three fields in combination, allows for the analysis of the influences in operation within the particular learning context in this study. In order to do this, I adapt Grenfell and James (1998) and Noyes (2004) means of utilising a Bourdieuan framework for educational research shown in Figure 5. This illustrates the interplay between my three proposed fields: school (also related to political power), family and place culture. These three (distinct and interacting) cultural layers discussed earlier, comprise the dominant influences on pupils.

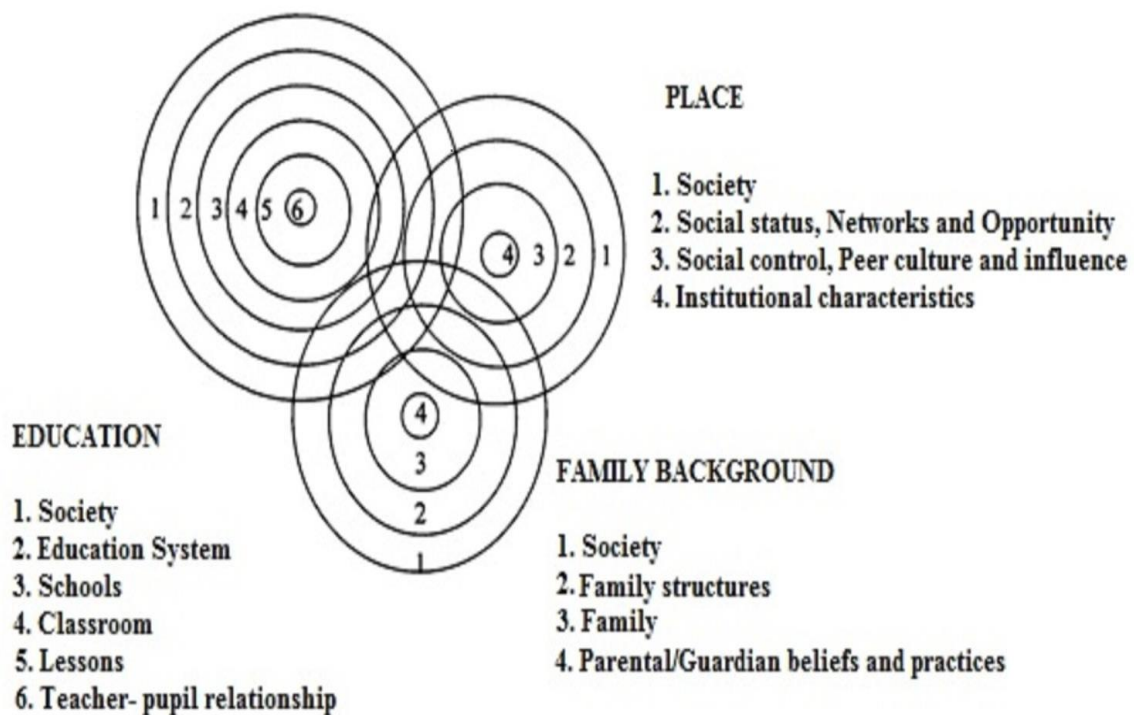


Figure 5: Field analysis of differential attainment (adapted from Grenfell and James, 1998; Noyes, 2004)

The complexities of the social context of learning mathematics may not be fully appreciated in this two-dimensional representation. Nevertheless, it is useful in illustrating how these fields interrelate and the complexities involved in this study that seeks to determine the influences on pupils' experiences in relation to these three fields and in addition, how this relates to their learning in LAMG and their perspectives on their experience.

3.1.3 Capital

The dispositions of individuals depend on the positions they occupy in society. Bourdieu (1986) used the economic metaphor of capital to illustrate how the volume of and composition of capital can define social position (class).

On the other hand, capital is best understood in economic, cultural and social terms. Cultural capital presents itself in three guises:

the embodied state, i.e. in the form of long lasting dispositions of the mind and body; in the objectified state, in the form of cultural goods (pictures, books, dictionaries, instruments, machines, etc.) which are the trace or realization of theories or critiques of these theories, problematic, etc.; and in the institutionalised state, a form of objectification which must be set apart because, as will be seen in the case of educational qualifications, it confers entirely original properties on the cultural capital which it is presumed to guarantee (Bourdieu, 2006, p. 106).

Bourdieu argues that the educational system place the people who have similar cultural dispositions with the system at an advantage and therefore positions some others at a disadvantage. He explains that the volume of cultural capital stored has a strong impact on how well young people do in schools. This means that 'the most privileged pupils ... owe the habits, behaviour and attitudes which help them directly in pedagogic tasks to their social origins' (Bourdieu and Passeron 1964, translated by and cited in Grenfell and James, 2003, p. 21). In other words, 'scholastic success is a function of the cultural capital inherited from the family' (Bourdieu and de Saint Martin, 1974, p. 357). Research findings show that most marginalised groups are subjected to and judged by educational systems that do not reflect their values or perspectives and therefore makes it difficult for instance for working class learners to succeed (Reay, 2001).

Jeffcoate (1984) touched on this issue when he criticised the perverted 'preoccupation with the academic destinies of an intellectual elite' (p.73) under the disguise of equality of opportunities as seen in some liberal societies. The critical issue here according to Gillies (2008) is the fact that 'by accident or design, educational systems

create, for the working class and the marginalised, a situation'(p.15) whereby they face disadvantage by a 'discontinuity between the values of home ... and the values of school' (Jeffcoate, 1984, p. 46). In other words, children from high SES are better positioned to do well in school as a result of their early and privileged exposure to forms of participation that mirror what is expected in the formalized institution of schools (Evans, 2006).

Cultural capital according to Mills and Gale (2007) illustrates stored traditions that influence one's thinking about and understanding of life, where the:

expected behaviours, expected language competencies, the explicit and implicit values, knowledge, attitudes to and relationship with academic culture required for success in school are all competencies which one class brings with them to school. (Henry et al., 1988 cited in Mills and Gale, 2007, p. 435)

In essence, children from lower SES may be at a disadvantage because they do not possess the required cultural capital that allows them to negotiate the forms of participation they have from their background with the forms of participation required within the school walls. In other words, 'any other background, however rich in experiences, often turns out to be a liability' (Henry et al., 1988 cited in Mills and Gale, 2007, p. 435). Consequently, the diffusion of cultural capital takes on a critical role in maintaining distinction or differences in society (Noyes, 2004).

Economic capital may be described as money which is recognized and accepted in society. With an understanding that capital is not freely available to everyone on equal basis, cultural and economic capital can jointly influence parents' choice of school for their children. Drawing on Marks *et al.*, (2006) material resource explanations (discussed in Section 2.2.2), the roles of wealth, poverty and income is well portrayed in the affordability of homes within choice areas for instance.

Social capital links the importance of relationships to educational success. The significance of social networks and social relationships illustrated in the social capital theory explains the existence of different social outcomes for different individuals. It connects to SES in the sense that high status families have greater probability to

know people who can affect their children more positively in terms of education and labour market opportunities.

3.1.4 Reproduction

Bourdieu's work aptly illustrates the part schools and school systems play in reproducing social and cultural inequalities (Harker, 1990) through the concealed connections between scholastic aptitude and cultural heritage (Mills, 2008). In Bourdieu's terms, the ideology of the school as a *liberating force* and a means of *social mobility* is misleading:

It is in fact one of the most effective means of perpetuating the existing social pattern, as it both provides an apparent justification for social inequities and gives recognition to the cultural heritage, that is, to a social gift treated as a natural one. (Bourdieu, 1974, p. 32)

Bourdieu attributes the acceptance of this ideology to cultural inertia, which Gates (2000) describes as a reductivist allotment of accountability, that precludes the likely existence of other forces at work.

Bourdieu's conception of cultural capital described the familiarity with bourgeois culture, which even though unevenly distributed was initiating social hierarchies under the cloak of individual talent and academic meritocracies (Wacquant, 2008).

The injustices of allowing certain people to succeed based not upon merit but upon the cultural experiences, the social ties and the economic resources they have access to, often remains unacknowledged in the broader society. (Wacquant, 2008, p. 216).

This of course acknowledges the need to look beyond the notions of fixed ability and also gives support to the aims of this study. I have previously discussed how schools do not reflect the values or perspectives of marginalised groups. On the contrary, by inculcating middle class culture (a form of symbolic violence), schools actually take up the mandate 'to do anything other than reproduce the legitimate culture as it stands and produce agents capable of manipulating it legitimately' (Bourdieu and Passeron, 1990, pp. 59–60). This form of symbolic violence is often misrecognized (Bourdieu, 1984) because the practices are disguised from participants, rendered invisible

through a dislodgment of understanding and recreated as something else that 'goes without saying' (Harker et al., 1990, p. 19).

This symbolic violation is not overt but involves forms of 'compliance' and 'a recognition of boundaries but a misrecognition of boundaries as natural rather than oppressive' (Gates, 2000, p. 89). This could be looked at from two angles. Firstly, that there are various roles implicated:

Even though teachers have a key part to play in this reproductive process they are only partners with politicians, parents, pupils and their peers, i.e. the broader socio-scape. All of these groups comprise the system and all contribute, possibly unbeknownst to them, to this cycle of class biasing. (Noyes, 2004, p. 99)

Secondly, this element of 'compliance' (which is significant for this thesis) is seen where for example, the belief that ability grouping raises attainment is widely accepted on the basis that it benefits the students. This is a form of symbolic violence, given that the use of ability labels impact on the development of students' habitus by providing them with particular ways of seeing the world of mathematics and even positioning themselves as learners (Gates, 2000; Zevenbergen, 2002). Consequently, this influences students' trajectories and constrains the curriculum and as a result set the limits of equality of opportunity (Jorgensen et al., 2014a; Reay, 2001, 2006; Reay and Wiliam, 1999).

With regards to equality of opportunity, Bourdieu argues that:

...in fact, to penalise the underprivileged and favour the most privileged, the school has only to neglect, in its teaching methods and techniques and its criteria when making academic judgements, to take into account the cultural inequalities between the different social classes. In other words, by treating all pupils, however unequal they may be in reality, as equal in rights and duties, the educational system is led to give its de facto sanction to initial cultural inequalities. The formal equality which governs pedagogical practice is in fact a cloak for a justification of indifference to the real inequalities with regard to the

body of knowledge taught or rather demanded. (Bourdieu, 1974, p. 37)

The message here is clear; equality of education disguises indifference to or a dismissal of cultural differences (Harker, 1990). Where the pedagogical practices adopted disregard these differences, the consequences for some students are critical.

Many research scholars in mathematics education have used Bourdieu's theories of habitus, cultural capital and field. In relation to how mathematics as a social practice functions at different levels; how mathematics engenders structural exclusion of a certain class of students (Jorgensen et al., 2014b); to project the interaction of social class, gender, ethnicity and attitudes towards mathematics, and their impact on mathematical achievement (Quaye, 2015); to provide a structural view of the backdrop to mathematics education and school transfer (Noyes, 2004); to show how the objective and subjective structuring practices of ability grouping make for stratified learning (Zevenbergen, 2002) and to analyse teacher belief systems (Gates, 2000, 2006).

Whilst Bourdieu's theories still have currency in educational research, there is much controversy that these theories attempt to ascribe pupils' failures to issues of cultural deprivation and genetic inferiority (Nieto, 1994). This is not in any way denying the harsh realities of children who live in abject poverty and hardship. In addition, Bourdieu's work has been criticised for 'apparently mechanistic notions of power and domination; an overly determined view of human agency; and the over-simplification of class cultures and their relationships to each other (Giroux, 1983, p. 271). Several supporters of Bourdieu's work have countered these claims (see Grenfell and James, 2003; Harker, 1984). Bourdieu has also been criticised for neglecting issues of gender and race. However, Reay (2004) has demonstrated that the habitus can be used to reveal how class, race and gender are embodied, reflected through individuals' actions, attitudes and also in a whole array of bodily gestures.

3.2 Summary

This chapter has drawn the notions of habitus, field and capital together and provided the conceptual framework which underpinned the research that has been conducted. This allows for an alternative perspective on pupils' differential attainment and

experiences for the purpose of building a picture of the influences on the learner of mathematics, particularly within LAMGs and subsequently, uncover the mechanisms that combine to bolster social inequality, including how certain groups of learners continue to be disadvantaged.

The next chapter operationalises this conceptual framework into issues that influenced the fieldwork.

4. ESTABLISHING THE FIELD OF INVESTIGATION

The differential attainment and experience of students need to be seen from a perspective that exceeds explanations that highlight cognitive ability as a key factor and to consider explanations that maintain social and contextual factors as major influences on students' experiences within mathematics classrooms. Consequently, the possible lines of study and analysis are diverse and are equally, undergirded by different paradigms of educational research. This chapter presents the theoretical considerations given towards the research design and the principal assumptions that have shaped the research process.

4.1 Introduction

School mathematics (as portrayed in Chapter 2) has frequently been criticized for the part it plays in constructing social, economic and educational positions. It was against this backdrop of the socio-political role of school mathematics and the privileges it confers that I wanted to explore the mathematical learning experiences of students in low attaining groups across schools in order to illuminate the tensions and contradictions that characterised their experiences within this group. My purpose was to establish how certain factors influenced students' experiences within low attaining mathematics groups which may eventually lead to varied levels of student social and economic trajectories or social exclusion. For the purpose of reiteration, the study was guided by the following questions;

1. What similarities and differences are there in the mathematics learning cultures of the two schools these pupils attend, including curriculum, pedagogy, relationships, groupings, etc.?
2. How do the micro-processes within LAMG operate to reinforce initial divisions into classes?
3. How do the characteristics of pupils' background impact upon their learning, engagement and achievement in LAMG?
4. What are pupils' perspectives about their learning experiences and their views of the relevance of mathematics to their futures?

This chapter is sub-divided into five parts. Firstly, I position my research within a critical theory paradigm. Next, the range of approaches, techniques and procedures which Cohen, Manion and Morrison (2007, p. 47) describe as 'methods' in their discussion of methods and methodology and how these are used to gather data which are to be used as a basis for inference and interpretation, for explanation and prediction is discussed. Next, I discuss how the data was analysed including ethical considerations and limitations of the study. Lastly, I focus on the challenges I as the researcher grappled with during the study.

4.2 Critical Theory

A fundamental significance of the researcher's understanding of the world (Cohen et al., 2007) is depicted through the values, attitudes and beliefs that have prompted

the study and by implication influenced the choice or rejection of several available research methods (Burton, 2002; Clough and Nutbrown, 2012). Based on different philosophical assumptions, different paradigms prevail in the research literature (Grogan and Simmons, 2007; Morrison, 2007). Paradigms are belief systems or 'world views' (Creswell and Clark, 2007, p. 21) that researchers draw on in making sense of research data (Morrison, 2007). A paradigm has three foci: ontology, epistemology and methodology (Denzin and Lincoln, 1998, p. 185/186); each of these is influenced by basic beliefs (Guba et al., 1994).

- **Ontology** – the nature of reality and what we know about it; pupils' experiences are nested within various historical and social contexts (Gibson, 1986) and are therefore being shaped in response to social, cultural and political contexts which either enable or constrain their choices (Smith, 1987).
- **Epistemology** – how we come to know the world; knowledge is seen as a social construction, giving value to human experience that helps define what is meaningful, in other words, the study upholds a theoretical underpinning that meaning is interdependently constructed through people's interaction with the social and physical world and is constantly being revised (Bryman, 2008; Crotty, 1998). This highlights the relationship between the knower and the known; in other words, I am closely and interactively connected to the people I research.
- **Methodology** - attempts to describe, understand and analyse the process of gaining knowledge not for its own sake. Hence my analytical objective goes beyond description of the classroom experience of students to ask (critique) how these experiences are produced, sustained and the unintended consequences that arise. Hence it seeks to expose domination and marginalisation experienced through structures and frameworks within mathematics education (Mills and Gale, 2007). This highlights the significance of the context within which these experiences are generated. This therefore, requires a methodology that allows for a close and in-depth account of what Ball (1995) described as the 'mobile, complex, ad hoc, messy and fleeting qualities of lived experience' (p. 259).

This profile locates my study in a Critical Theory paradigm (Guba et al., 1994).

The theoretical stance stated above and the issues of social justice and contemporary mathematics education discussed previously, which have also guided the choice of a conceptual framework can to a large extent only be meaningfully evaluated through the use of critical theory.

A Critical theory paradigm supports a multi-disciplinary survey and the critique of the rudiments of society (Ward-Penny, 2013), with a central tenet that recognises social phenomena and interactions, and in addition, the act of research, as socially and historically embedded (Gibson, 1986). According to Cohen, Manion and Morrison (2011), it is “explicitly prescriptive and normative” (p.31) in its quest to reach beyond description or understanding, but rather to advance society and individuals to attain the goals of social justice and egalitarianism; in other words, its aim is not merely observation, but transformation (Delanty, 2005). This supports the point that social research is political in its pursuits:

critical theory argues that in human affairs all 'facts' are socially constructed, humanly determined and interpreted, and hence subjected to change through human means. (Gibson, 1986, p. 4)

What is known as a Critical Theory approach to research builds upon the work of Karl Max and Max Webber and since the start of the millennium, with particular reference to mathematics education has emerged through varied perspectives such as, the formatting power of mathematics (Skovsmose, 1994a); Class and Gender (Walkerdine, 1990); the use of mathematics to explore and critique societal power relationships; and to challenge inequalities in society (Frankenstein, 1995; Gutstein, 2006; Skovsmose, 1994b); in relation to pupils' SES and testing techniques (Cooper and Dunne, 1998); relating mathematics to pupils' homes, communities, and/or cultural identity (Kitchen et al., 2007; Lubienski, 2000; Martin, 2000; Valero and Meaney, 2014).

Nevertheless, the label 'critical mathematics education' connotes different meanings (Skovsmose and Borba, 2004). Skovsmose (1994b) explains the implication of being 'critical':

... to be critical means to be directed towards a critical situation and to look for alternatives, perhaps revealed by the situation itself. It means

to try to identify possible alternatives. Positivist research looks for what is actual; critical theory looks for what is possible in light of what is actual and critical. (p.17)

This suggests the need to recognize that within the prevailing societal status quo, there lies power relations and inherent harms which must be exposed and challenged. Thus, 'Critical social research involves a perspective which sees social structure as an oppressive mechanism of one kind or another. This oppression is legitimated via 'dominant ideology' (Harvey, 1990, p. 32). Hence, a critical epistemology of necessity, involves a consideration of the political roles of mathematics education as well as the exploration and analysis of its influence.

4.3 Selecting a Methodological Approach

The evidence for the conceptual framework features drawn from the theoretical perspectives can be captured by examining the various influences that impact on the learning experiences of pupils in LAMGs. This type of data is going to be held mainly by pupils (and teachers), expressed through their dispositions, mannerisms and gestures; their interactions and attitudes, relationships and perspectives. Therefore, the research access required data collection processes which could gather manifestations of these factors. Hence, the use of a Bourdieuan framework in this study will require the analysis of the fields discussed in Section 3.1.2 with the various levels of complexities involved. Specifically, Bourdieu's clear account of what it is to analyse a field involves three distinct levels:

- 1.) Analyse the position of the field vis-à-vis the field of power;
- 2.) Map out the objective structure of the relations between the positions occupied by agents who compete for the legitimate form of specific authority of which the field is the site.
- 3.) Analyse the habitus of agents, the different systems of dispositions they have acquired by internalizing a determinate type of social and economic condition. (Bourdieu and Wacquant, 1992, pp. 104–105)

These three levels are interconnected and it is not possible to consider one level without due consideration given to the other two. This demonstrates the interrelationship between the habitus, field and capital. On the other hand, it is not

always systematically possible to present analyses on each level concurrently. They have to be separated to a degree (Grenfell and James, 2003). Thus,

In order to construct such a field analysis, the issue of the traditional dichotomy between qualitative and quantitative approaches becomes less significant. Indeed, the researcher needs to obtain the best data analyses to undertake the construction of a relational analysis; both within and between fields. (Grenfell, 2014, p. 27)

The qualitative/quantitative debate is a reoccurring discussion point in educational research as Murphy and Dingwall (2003) comment in this context, 'the decision about whether to commission and use qualitative or quantitative methods, or a combination of both, is a pragmatic one' (Murphy and Dingwall, 2003, p. 49/50). In other words, given the different dimensions of this study and the conceptual framework, it made logical sense to adopt the methods that helped me answer my research questions.

This point is not far from Johnson and Onwuegbuzie's (2007) conception of what they refer to as contingency theory for research approach selection. As they explain, this contingency theory acknowledges that quantitative, qualitative and mixed-method approaches are each superior under diverse circumstances. Hence it is the researcher's task to make a judgment on appropriate research approach or combination of approaches adopted based on the prevailing contingences.

For example, Pragmatism according to Morgan (2007) emphasizes certain concepts; "lines of action" (from William James and George Herbert Mead) and "warranted assertions" (from John Dewey), along with a general emphasis on "workability" (from both James and Dewey) (Morgan, 2007, p. 66). If we looked at this from Dewey's point of view; 'inquiries' are what we set out to assess, either the workability of any potential line of action or the bases for what we claim as warranted assertions. For the pragmatist, these lines of action are the research methods deemed as appropriate for understanding the phenomenon of interest (Mertens, 2009).

Consequently, the research paradigm adopted is not the issue for the pragmatist but 'the essential emphasis is on actual behaviour (lines of action), the beliefs that stand behind those behaviours (warranted assertions), and the consequences that are likely to follow from different behaviours (workability)' (Morgan, 2007, p. 67). The search

for useful points of connection becomes the guiding light for the pragmatist (Mertens, 2009). These connections become evident in my methodology that attempts to explain issues at 'the abstract level of epistemology and the mechanical level of actual methods' (Morgan, 2007, p. 68). The aim then is to establish a connection between my epistemology, methodology and methods.

In essence, as a researcher, I am not just focused on acquiring knowledge for its own sake but acknowledge that the influence of my beliefs and values show up in my choices about what is important to study and what is an appropriate way to go about the study. Morgan (2007) illustrates this point;

... research questions are not inherently "important," and methods are not automatically "appropriate." Instead, it is we ourselves who make the choices about what is important and what is appropriate, and those choices inevitably involve aspects of our personal history, social background, and cultural assumptions. Furthermore, I do not believe for one moment that the participants in any research field ever represent a random assortment with regard to personal history, social background, and cultural assumptions. So we need to continue the reflexive outlook toward what we choose to study and how we choose to do so (p.69).

I have previously discussed the rationale for my research interest based on my personal experience as both a learner and teacher of mathematics. So my choice of what was important to study and how to go about carrying out the study was not random but stemmed out of personal experience and a real intent to grapple with issues as they presented themselves so long as it gave insights into the issues under study.

This allows me to reject what Onwuegbuzie and Combs (2010) describe as philosophical dualisms and dogmatisms of the qualitative and quantitative research debates. This proposal sounds reasonable if one considers that on one hand, Biesta (2010) commenting on the different levels in the discussion on mixed methods research argues that the distinction between quantitative approach and qualitative approach are essentially crude. For example, at the point of data collection, the quantitative approach (which is often synonymously associated with data expressed

as numbers that can be measured) and qualitative approach (often equated to data qualities expressed as texts that need to be interpreted) are two forms of information or two modes of representation and should present no issues combining them. At the point of analysis, one can assume that 'measurement is itself a form of interpretation' (p.101), and hence blurs any apparent distinction.

Given this lack of a steady middle ground between these two approaches, I want to follow Biesta's view that the purpose of research should be given more prominence compared to the ardent focus given to the controversies around the (im) possibility of mixed methods research particularly. After all the decisions on the research purpose precedes the framing of research questions. Therefore it is not considered strange or new to adopt both qualitative and quantitative approaches to examine different aspects of a research issue (Johnson and Onwuegbuzie, 2004), and this most importantly aligns with the theoretical principles of a mixed method approach (Biesta, 2010).

... The goal of mixed methods research is not to replace either of these approaches (quantitative or qualitative, emphasis mine) but rather to draw from the strengths and minimize the weaknesses of both in singular research and across studies. (Johnson and Onwuegbuzie, 2004, p. 14/15)

To draw out the strengths of the mixed methods approach requires that one gets past the qualitative versus quantitative research debates to adopt approaches that allow the use of multiple approaches to answer one's research questions. The immediate advantage here is that this removes any constraints on researchers' choices and presents the researcher with the best of both worlds.

This sits well with Bourdieu's approach to conducting research, one that is not method prescriptive but guided by a particular philosophical stance. In other words, Bourdieu promoted methodological polytheism; deploying whatever procedures of data collection and analysis that was best suited to the particular question at hand (Wacquant, 2008). For him, what was crucial was 'not whether a particular method should be used... rather, the intention behind it and the validity claims laid on it' (Grenfell and James, 2003, p. 172). It is therefore not surprising to note that

Bourdieu made extensive use of both qualitative and quantitative methods in his research.

4.3.1 Mixed Method Approach

The use of the mixed method approach has gained much momentum in educational research (Creswell and Clark, 2007) in recent years, health (Doyle et al., 2009) and social (Symonds and Gorard, 2010) although the exact definition remains a discussion point.

Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. (Johnson et al., 2007, p. 123)

Johnson *and colleagues'* (2007) conclusion on the definition of mixed methods research given in the quote above is a culmination of their analysis of 19 mixed methods research methodologists' criteria for defining mixed method research. This brings to the fore the lack of consensus at arriving at a definite prescription for mixed methods research (Bazeley, 2010).

This dilemma notwithstanding, Onwuegbuzie and Combs (2010, p. 411) cite Green *et al.*'s (1989) typology of mixed methods research purposes to show nuanced reasons to use mixed methods:

- Triangulation(i.e. compare findings from the qualitative data with the quantitative results);
- complementarity (i.e., seek elaboration, illustration, enhancement, and clarification of the findings from one analytical strand [e.g., qualitative] with results from the other analytical strand [e.g., quantitative];
- development (i.e., use the results from one analytical strand to help inform the other analytical strand);
- initiation (i.e., discover paradoxes and contradictions that emerge when findings from the two analytical strands are compared that might lead to a reframing of the research questions); and

- expansion (i.e., expand breadth and range of a study by using multiple analytical strands for different study phases)

On the basis of all these reasons given above, the implication is, I have more room to be creative by employing both quantitative and qualitative methods depending on what each aspect of my research questions may require.

4.4 A Comparative Case Study Research

*A case study is expected to catch the complexity of a single case.
(Stake, 1995a, p. xi)*

This study focused on particular pupils and schools at a particular time. The decisions that led to these choices will be discussed later in this chapter. For this study, I needed a site that allowed for an in-depth study of a particular phenomenon, relations and practices within a critical framework. Thus, the context of the particular case was especially important and as such, would therefore define my study as a 'case study'.

Case studies are one approach that supports deeper and more detailed investigation; an approach that proffers answers to how and why questions (Yin, 1994), in a real life context with several uncontrollable variables (Simons, 2009; 1995b, 2013). A case study is described in different ways by various writers; a method, a strategy and an approach (Simons, 2009) and characterizing a specific area under study (Stake, 1980). Yet, a 'case' is typically portrayed as a contained system: 'a unit around which there are boundaries' (Merriam, 1998, p. 27).

For Yin,

*A case study is an empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident.
(Yin, 1994, p. 13)*

The significance of the context to the study of the phenomenon makes case study design appropriate. Therefore, my study employed to some extent, ethnographic (two Greek words combined that mean 'people and 'writing' – writing about people) methods to investigate the mathematics teaching and learning culture within these

classroom. Although case study is closely related to ethnography and derives most of its rationale and methods from same, a distinguishing characteristic is worthy of mention at this point; the ethnographic approach required the researcher to spend long and intensive periods in the study environment to gain insights that helped to make sense of the data already gathered, a process Atkinson and Hammersley (1998, p. 110) describe as a quest to explore 'the nature of a specific social phenomena and not necessarily about testing out a hypothesis about it'. In contrast, this study draws on a literature based theoretical framework to guide data collection and analysis, and as such, it may be regarded as a case study (Noyes, 2004; Wyness, 2010; Yin, 2003) rather than ethnography. More so, the specificity of the case could therefore, to an extent make it inappropriate to apply grounded theoretical approaches where the theory is not rooted in a framework that reaches beyond the case itself.

Furthermore, a case study may be described as intrinsic if the study is undertaken out of interest in a particular case, whilst it is instrumental if it provides insights into broader issues (Stake, 1995b, 2000). This study draws on a theoretical framework largely based on Bourdieu's theory of practice to provide insights into the learning experiences of pupils in LAMG and as such may be described as an instrumental case study. Also, Stake (2003) refers to a case study design as a collective case study. In this sense the individual cases in the collection are distinct, bounded by place (Cresswell, 2003); definition and context (Miles and Huberman, 1994). Since each one of the contrasting schools has its own boundaries whether in terms of geography, culture or its own teachers with various pedagogical inclinations, it is reasonable to see the classes within the schools as individual cases within a collection. They were selected on the basis that they could help the understanding of a larger collection of cases (Wellington, 2000) and also allows for analysis within each setting and across settings (Baxter and Jack, 2008).

In addition, the learning of mathematics goes beyond learners within classrooms, within schools and within neighbourhoods. For example, schools have histories, habits and culture, what teachers teach or how they teach it draws on policy and as such our understanding of any context is built on particular social and historical situations (Ragin and Becker, 1992). Furthermore, pupils do not come to school as empty vessels, they come with their own beliefs, attitudes and values – these make up pupils' backgrounds. The emphasis is on vantage points and the perspectives of the

research participants which then situate the study within a particular group of pupils across particular schools. Thus, understanding pupils' experiences of the teaching and learning of mathematics within the classroom involves a complex amalgam of forces in operation at any given time. Thus, adopting a case study approach is appealing as it is also considered an excellent opportunity to research in a Bourdieuan way.

Case studies of individuals indicate particular habitus constituents and life trajectories. Individuals are also always positioned in some field or other at any one time and place. There is then the possibility of researching the interaction between habitus and field in empirical terms. (Grenfell and James, 1998)

On the other hand, contextualizing the elements of diversity within these situations becomes complex and multifaceted given the various comparative dimensions to the analysis (Wyness, 2010) as it seeks to illuminate the reader's understanding of the issues (Parlett and Hamilton, in Stark and Torrance, 2005, p. 33) involved in this instance and also provides the opportunity to obtain robust data with the added analytical benefit that helps to build a more compelling evidence base (Yin, 2009).

It is also pertinent to point out that although the quest for transferability may not be obvious between these cases, (which as expected have different cultures) the comparative case study offers the opportunity to look at an aspect of a phenomenon in one context and to consider its relevance in another instance (Wolcott, 1995). This is one of the strengths of the case study design.

One of the advantages cited for case study research is its uniqueness, its capacity for understanding complexity in particular contexts. A corresponding disadvantage often cited is the difficulty of generalising from a single case. Such an observation assumes a polarity and stems from a particular view of research. Looked at differently, from within a holistic perspective and different perception, there is no disjunction. What we have is a paradox, which if acknowledged and explored in depth, yields both unique and universal understanding. (Simons, 1996, p. 225)

In addition to the criticism of the limited generalisability of the findings, is also the researcher's influence on the research contexts as a result of his or her long-term participation (Denscombe, 2003). One possible way to address these issues is for the researcher to provide a 'thick description' of the case to help the readers to understand how the findings might be applicable to other similar contexts. In contrast, Yin (2009) argues that case studies are not meant to specify frequencies but to be generalizable to theoretical propositions and not to population or universes. He describes this process as 'analytic generalization' (p.43), adopted to generalize a particular set of results to some broader theory which in this instance is focused on the interrelationship between place, school, classroom and how these influences impact on the mathematical learning experience of pupils in low attaining groups. Adding to this argument, with regards to obtaining generalizability, Silverman (2010) offers an answer by explaining that combining qualitative research and quantitative measures of population by obtaining information about relevant aspects of the population of cases and comparing one case to another, provides a firmer basis to any generalizations. Nevertheless, I acknowledge Wellington's (2000) assertion that the stance on generalization of any findings, places responsibility on the door step of the reader with the expectation that the validity of the study be judged and assessed by the reader, in the light of the reader's knowledge, wisdom and experience.

Even so, in a case study, decisions still need to be made on what to include or exclude. Stark and Torrance (2005) comment on the difficulty associated with drawing boundaries around a phenomenon under study:

The other major epistemological issue to be addressed by case study is where to draw the boundaries- what to include and what to exclude and, thus what is the claim to knowledge that is being made – what is it a case of? (p.34)

As pointed out earlier, the learning of mathematics goes beyond learners within classrooms, within schools and within neighbourhoods. The inter-relationships between these are closely linked and complex. So, a case will no doubt be a combination of influences arising from within and outside the case. Yin (2009) makes distinction between multiple case studies and what he terms *embedded* studies but I prefer the term 'nested' because it paints the picture of a subunit fitting in with a larger unit (Thomas, 2011). Thus the overall approach employed in this study could

be described as 'nested' (Thomas, 2011); firstly, the two schools, nested within were the three classrooms, within which we get the individual students.

This research required a comparative case study approach as a result of my intention to explore a context in depth but this also indirectly included the wider context in which it was situated. Whilst my interest lies with LAMGs, these are situated within schools. Although the schools selected for this study are very close – almost but not quite in walking distance - one is the most over-subscribed in the city, the other a school previously closed and academised. It is quite possible that pupils in some neighbouring streets will be allocated to one or the other of these schools. Whilst one school may have a slightly different demographic in terms of house prices etc. the subgroup I looked at in each school looked very similar and would have come from very proximate geographical areas – in the overlap between two catchments. A comparative case study design provides a good opportunity to see how school cultures and practices differ and how they might influence pupils' experiences. Hence, the study may be described as explanatory; as it seeks to explore the mechanisms within LAMGs that combine to bolster social inequality.

4.5 Sampling and Negotiating Access

Following my interest in understanding whether the school, class/teacher or where pupils came from was critical for the learning of mathematics for students in LAMGs. I wanted to understand pupils' attitudes and motivations within LAMG. Consequently, when I decided to undertake this research, it was necessary to consider two schools that were socially and culturally different. I approached two such secondary schools.

Pearl Lake and Cedar Park schools are located in two geographically proximate but demographically contrasting neighbourhoods (A more detailed description of the schools' context is presented in Chapter 5). The case study schools were selected to portray contrasting yet proximate localities and differential mathematics attainment.

The research was not meant to evaluate the effectiveness of the schools involved in the study, but rather it was meant to report the learning experience of pupils in low attaining mathematics classrooms within these schools. In addition, this project involved different aspects that required different case selection and sampling

strategies. Also, various approaches were employed in the triangulation between and within the different aspects of the study.

Access into one of the schools was made possible by my supervisor who introduced me to the assistant head of mathematics whilst the other school was one where I had worked as a trainee teacher. In this particular school, many members of staff had left for various reasons. Hence, I was known to only one member of the current mathematics department and a few of the pupils. An introduction letter and the project information sheet were sent to each head of department and a meeting was also held with both heads of mathematics where the project was explained in detail.

4.5.1 Case selection and the pupils involved

To facilitate my understanding of the mathematics teaching and learning culture in these classrooms and to identify its significant features and to capture these in all their richness, the research took the form of case studies of four mathematics classes across two schools. This sample could be described as a purposive sample as it afforded not only the opportunity to study a case in depth but also to explore a particular phenomenon with the intent to discover what made each case 'typical or unusual' (Mertens, 2014).

There are fourteen state funded secondary schools in the city. Given that this study focuses on disadvantage and mathematics attainment, the schools expected to participate in this study were selected to provide contrasting localities depicted by levels of family income of pupils, the ethnic mix and how much progress is being made in mathematics. It is crucial to point out that a particular area (around CPS) was an important part of the research study because it was an area of great concentration of deprivation and poverty. It may be that the schools come from slightly different areas.

PLS and CPS were two neighbouring secondary schools approximately 1.5 miles apart in the same city. Despite their proximity, they were on different sides of the tracks – the main intercity railway line dividing the two communities, meaning the two school communities were socially distanced. However, my design looked to focus on pupils in relatively similar social and demographic positions in each school- those in LAMG. Whilst the proportion of affluent pupils in PLS was much higher than CPS, they were

still in evidence. Consequently, my intention was to investigate a roughly similar demographic group of pupils within two very different school settings.

The index of multiple deprivation (IMD) across the city shows the areas of highest deprivation which includes most of the area around Cedar Park School and large parts of the inner city. Specifically, in social and economic terms there appears to be complex underlying issues in this area known for high levels of deprivation, and low levels of educational attainment and aspirations.

Evidence shows that there is a significant correlation between the IMD of an area and the percentage of good GCSE grades achieved across the city. A look at the GCSE pass rate in CPS shows that it stills lags behind the city and the national levels. At the individual school level, there is a large disparity between the mathematics performance across low and high attainers and the performance of disadvantaged pupils. What is significant at this point is the variation between schools and perhaps by implication the considerable differences in the mathematical experience and attitudes of these pupils.

So it is permissible to start questioning what might be happening in various schools in these areas and at a fine grain level and with particular relevance for this study, what might be the pupils' mathematical experiences, with particular reference to low attaining pupils?

Given that this study focused on disadvantage and mathematics attainment, I concentrate on groups within the schools that have a high proportion of free school meals (a proxy for disadvantage). Initial work was carried out with two groups in each participating school, same set in both halves (parallel) of a Year 10 group, pupils with GCSE target grade D, E, F. I want to point out firstly that although the aim is to get the same level of pupils in terms of attainment, it will not necessarily give the same level of disadvantage or same kinds of pupils in the group. Whilst disadvantage may be one aspect of the study, primarily my comparison is at the attainment levels of these pupils.

This group is particularly interesting because these are pupils who will get a GCSE grade but not a grade that can surmount the gate-keeping role of mathematics discussed earlier. I was curious to know what their experience of learning

mathematics was like given their attainment levels. Secondly, involving parallel groups meant I could compare pupils' experiences of learning mathematics from two different groups within the same school. Also, I could get a larger sample of the group of pupils (and also different teachers) that may not cross over the GCSE C grade threshold. These are the pupils that have probably been subjected to messages of failures for as long as they have been in school.

I was aware that given the design of the study, it would require that I spent some time in classrooms observing and getting to know the pupils and their teacher. This was in some respect going to place a demand on the teachers and the pupils and so I considered that the practical choice will be to work with Year 10 pupils who were now in their penultimate year in secondary school. This meant these pupils and their teachers were not constrained by the pressures that came with preparing pupils for their final GCSE examinations in Year 11. However, it provided the opportunity to work with pupils who had clear ideas of what their experiences had been like and also understood the implications of their performance in their forth coming final examinations in the coming year.

4.6 Selection of Methods and Data Collection Process

In order to meet the requirements for the study, my main research tools would need to be those that allowed me to explore and compare students' mathematics learning experiences within schools, classrooms and as individuals. If I take the classroom as a starting point, it is crucial to remember that classrooms are an integral part of schools; what happens in classrooms is to a large extent dependent on the whole school ethos. So, I needed to understand the school contexts as a whole and in relation to other schools within the city and nationally.

The need to examine the mathematics classroom learning culture of these specific groups of students, and to properly attend to the socio-cultural aspects of learning, required self-immersion in the mathematics classrooms/lessons, a stance Eisenhart (1988) takes in advocating for an ethnographic approach to classroom research. This provided an opportunity to collect data from the context where pupils learn as a group. Nevertheless, I needed to position this in relation to other classes within the year group in order to get pupils' views of their experiences and the distinct

pedagogical, cultural or curricular aspects of mathematics learning. This allowed for a broad feel of the mathematics teaching and learning culture in these schools and not just the case study classes.

To meet these requirements, the approach I adopted was to gather **documentary evidence** that helped build a context for the selected schools. This was followed by **lesson observations** that captured pupils' day-to-day experiences within these classrooms. Furthermore, to explore more deeply areas of contradictions or misrepresentation, I needed to get pupils views from across the groups by way of **a questionnaire survey** and **in-depth interview** with individuals.

The implications of my main data collection techniques are discussed subsequently.

4.6.1 Documents

The documentary analysis of publicly available (secondary) data is beneficial as it helps to unlock an area of inquiry, making researchers aware of the key issues and problems that abound in that field (Wellington, 2000). My aim was to examine how the concept of disadvantage impacts on the learning of mathematics by investigating the trend and distribution of mathematical attainment across the two schools. The crucial feature of documentary analysis hinges on its provision of additional data that complements other methods (interviews or observations) making it efficient and cost effective. As these documents are publicly available, it also serves as a means of triangulation which enhances the validity, trustworthiness and reliability of the research (Wellington, 2000). But this also has implications for the analysis, ethics and writing up the research and this will be discussed under ethical considerations later. However, literature on research methods point out some issues (Newby, 2010; Wellington, 2000) that need to be addressed when using secondary data. These include connecting the researcher's background and theoretical stance to the position of the documents and its authors. Consequently, Wellington's caution for analysis of any document is helpful as it involves the interrogation of a document's 'context, authorship, intended audiences, intentions and purposes, vested interests, genre, style and tone, presentation and appearance' (Wellington, 2000, p. 116).

4.6.2 Participant Observation Design and Application

Observations can be used to describe and 'understand the culture of a group and peoples' behaviour within the context of that culture' (Bryman, 2008, p. 403). This however very much depends on the methodological framework employed, and the extent to which behaviour is recorded. Although, observation can offer a more ecologically valid approach to describing and examining social practices compared to a questionnaire or experiment, it does not discountenance the enormous complexity of human behaviour and the impossibility of making a complete record of all one's impression of what has occurred within a lesson for instance. In addition to these challenges, is the subjectivity of the researcher whom, whilst collecting data, is also actively involved in making sense of impressions and interpreting the meaning of observed behaviour and events (Jones and Somekh, 2005).

Consequently, what is recorded as observations may be seen as a 'product of choices' (Jones and Somekh, 2005, p. 138) about what to observe and what to record made either during the observation in reaction to impressions or in advance, supposing to impose a form of order on the data. Nevertheless, it reveals to some extent how the observer conceptualises the world and his/her place within it. As stated earlier in my justification of the case study approach, from an ethnographic perspective, the process of observation required a highly participatory process; one where I went on to observe in an open-ended way, and noting as many details as possible but also guided by some overarching categories. Consequently, my approach to the observations was unstructured, naturalistic and served to provide insight into classroom culture and the relationships within these classrooms. In such cases an observation schedule was not appropriate; rather I kept detailed field notes which I refer to in my analysis.

Participant observation as a means of gathering data involves perceiving reality from the point of an 'insider' and has the 'potential to yield more valid or authentic data' (Cohen *et al.*, 2011, p. 456). Also, it allowed for a close portrayal of the case study (Yin, 2009). The two key operative words in the title of this section – 'participant' and 'observation' are extensively discussed in the field of ethnography; they are not to be seen as independent practices in a classroom but as practices that effective teachers employ in varying degrees (Jones and Somekh, 2005; Noyes, 2004). It then makes sense to illustrate these practises on a spectrum ranging from complete observer to

complete participant. Within reason, it may be argued that the increased levels of participation do not make the ethnographer less an observer, for effective classroom participation is associated with good observation. Moreover, what is seen stems from how much the researcher observes or directly participates, and there is also the resultant advantage of different views from these different vantage points (Noyes, 2004).

The first phase of lesson observations (20 in school A and 16 in school B) were carried out from October 2013 - June 2014 in both schools; two mornings or afternoons per week in each school, initially observing four different mathematics classes (it later became three due to group changes in Cedar Park School). In the first few weeks of my time in the schools, I did not interact with any student but observed and made notes. This also gave me time to know students' names, the class routines and to become a familiar figure within the classroom. The lesson observations carried on into the new academic session (the students were now in Year 11) till early December 2014. The longitudinal nature of the research approach allowed me to observe the students with different teachers and also their development as they approached their GCSEs.

The purpose of the observation was to capture the activity in the mathematics lesson as a natural unit of organization (Shane, 2002), providing a holistic view of the teaching and learning environment. This involved observing the quality of teacher-pupils and pupil-pupil relationships; the teaching approaches and methods used; the level of student engagement and what it was like being in that class for all mathematics lessons. Field notes were recorded for each lesson. These field notes covered a description of the activities observed in the classroom and where practical, transcription of the different dialogues within the lesson. My field notes were developed into commentaries of what went on in those lessons. This went a long way to help my understanding and reflections on what messages were emanating from the field and in turn allowed me to compare these with relevant research studies.

Even though observation as a research method may be widely used and perhaps easily undertaken, it still did not make it a straight forward task for me –a novice researcher (Delamont, 2002) who was still struggling to overcome initial fieldwork hurdles. But understanding observation as taking on the role of a *traveller* (Clough and Nutbrown, 2012) curious about the culture or ways of the particular study's

setting made it less daunting. Clough and Nutbrown's (2012) definition of observation as 'looking' is particularly illuminating especially when one is wondering *why and how do I go about observing?*

looking- looking critically, looking openly, looking sometimes knowing what we are looking for, looking for evidence, looking to be persuaded, looking for information (p.54)

Following what they have termed as 'radical looking' (p.52), I came to understand that it was my responsibility to establish alternative ways of seeing what I saw or knew as 'familiar' particularly because I was entering a setting I was some worth at home with. My sentiment was equally expressed in Goodchild's (2002, p. 46/47) concerns:

... the main concern has been to establish that I, as an experienced mathematics teacher steeped in my own belief and value system, should be able to produce a trustworthy account of activity in a mathematics classroom.

Nevertheless, as a research method, participant observation has its limitations. It is time consuming, leaving little time to make field notes or ask questions. This issue was tackled by adopting the role of a teaching assistant, initially focusing my attention on observing pupils' classroom behaviour alongside the teacher's instructional practices. As I had planned to spend an extensive amount of time in these schools, it made it possible to easily switch between the roles of observer and participant over time. However, there is also the issue of potential bias (Yin, 2009), also described as going 'native' that arises out of the researcher's prolonged stay in the field such that one's relationship with the research participants begins to affect the ability to be objective. To this end, I was reminded to maintain reflexivity throughout the research process, as Noyes suggests:

Through such reflexivity I acknowledge my own contribution to, and influence in, the data and seek to problematise the ordinary, taken for granted aspects of it. This involves a conscious process of systematically uncovering the unthought meaning-making of my own habitus and to critique that influence. (Noyes, 2004, p. 116)

In other words, as a researcher, I am a significant variable (Bassey et al., 1995, p. 12) in the research and as such must be open and accessible about the influences on the research process (Burton, 2002) which may arise by seeing through unique lens of my own socio-cultural constructed values (based on gender, ethnicity or social class).

In the same vein, it is necessary to point out the threatening nature of observation compared to interviews. Notably, all forms of observations involve entering other peoples' space and making meanings from the experience of participating in their activities rather than through the filter of their accounts about their activities (Jones and Somekh, 2005). This raises the issue of the well-known mismatch between both research participants' and researcher's construction of meaning from their individual experience of what has been observed.

4.6.3 Questionnaire Design, Pilot and Application

The survey instrument employed for this study had been used in other projects and therefore meant that issues of validity and reliability of the instrument had been tested (Noyes, 2012; Swan, 2006). However, I had to make sure it was fit for purpose. Hence a few revisions were made to a few questions and the structure and format made more user-friendly and there after the same was piloted with a representative range of respondents and revised where necessary.

The questionnaire (self-completed) captured the perspectives of pupils in Year 10 across both schools with regards to their learning experiences in mathematics. It covered 'broad' areas such; teacher quality; level of engagement; classroom culture, nature of support needed by pupils, teacher practices amongst other areas which also align with the study's research questions (see appendix 3). The term 'broad' simply implies that it is unlikely that a questionnaire will reveal the depth of pupils' views and experiences in any of their rich detail.

All together 363 questionnaires were given out in both schools (208 in PL, and 144 returned = 69%; 155 in CP and 104 returned = 67%). The questionnaires were administered by tutors in Pearl Lake to pupils in tutor groups (mixed groups) instead of mathematics groups/classes. This would have been the preferred option as it would allow for comparison across different attainment groups but the head of department felt that would eat into lesson time and also considering timetabling issues might be

cumbersome. To ensure uniformity in the administration, I provided the teachers with print outs of clear instructions on what was expected for the completion of the questionnaires. Nevertheless, I am not in the position to say if these teachers followed my instructions or if the quality of the pupils' responses were in anyway compromised. In the same vein, the missing questionnaires could be attributed to absent pupils or late arrivals considering these were administered during tutor time (8:30am – 9:00am).

I administered the questionnaires myself in Cedar Park according to mathematics groups and collected same for all pupils present. Out of the 248 pupils (144 from PLS and 104 from CPS), seven were deleted because of non-response of greater proportion of the survey questions. Therefore, the total number of pupils was 241. From the pupils' responses on maths group, they were classified as belonging to high attainment group or low attainment except for those who did not respond to the question. Of the 241 respondents, 173 were high or middle attaining pupils while 40 were low attaining. Of the 173 pupils, 105 (60.7%) were from PLS while 68 (39.3%) were from CPS. For the low attaining group, 21 representing 52.5% were from PLS while 19 pupils (47.5%) were from CPS. Twenty-eight pupils, 13 from PLS and 15 from CPS were non-responders.

Table 1: Distribution of Respondents according to Sampled Schools and Maths Attainment Group

	School		Total	
	PLS	CPS		
Maths Attainment Group	HAMG	105 60.7%	68 39.3%	173 100.0%
	LAMG	21 52.5%	19 47.5%	40 100.0%
	Missing	13 46.4%	15 53.6%	28 100.0%
	Total	139 57.7%	102 42.3%	241 100.0%

4.6.4 Interview Design and Application

Asking questions and getting answers is a much harder task than it may seem at first. The spoken or written word has always a residue of ambiguity, no matter how carefully we report or code the answers. Yet interviewing is one of the most common and powerful ways in which we try to understand our fellow human beings. (Fontana and Frey, 2000, p. 665)

Interviews allow a researcher to examine and prompt things that are not readily observable such as the interviewee's thoughts, values, prejudices, perceptions, feelings and perspectives (Wellington, 2000), which all reflect the individual students' habitus . This in itself is not so much an easy task as Fontana and Frey (2000) imply in the quote above. As my research design required that I spend much time in the classroom as a participant observer, it afforded the opportunities to carry out initial conversations with pupils about the immediate lesson or task at hand.

Conversations as articulated above may also be classed as interviews based on Powney and Watts' (1987) argument that these conversations may be seen as interviews if they are initiated by the researcher for purposes of obtaining research relevant information predetermined by the research objectives' framework. These were all recorded as field notes. Armed with the insights garnered from my (participant) observing pupils in the classroom, I constructed a semi-structured interview protocol (this was meant to be a guide) with questions clustered around the main themes I wanted to investigate (see next page).

Student Interview Key Questions and Probes

Everybody needs Neighbours

Exploring the value of Place

- Nature of neighbourhood, Peers, Network, Role models

Q1. Whereabouts do you live? (show on a map)

Q2. What's it like where you live? Are there any other school mates around?

Q3. Do most adults go to work? What do you do for fun in the area?

Q4. Are you allowed to stay out late?

Q5. Would you move out of the area when you get older?

Exploring self perception/ learner identity

- Personal history with maths (including parents, siblings)
- Enjoyment/trepidation
- Maths lessons different/expectations
- Level of challenge

Q1. Can you describe your learning experience in maths starting from primary school? (Parents/siblings experience, lessons any different? Teacher treatment? Easy or difficult?)

Q2. Can you describe a recent lesson you enjoyed? Why do you think you enjoyed it?

Q3. If you could change maths lessons, what would you change?

'Don't want to be in here with this lot!'

Exploring grouping, Pedagogy, self-identity

- Satisfaction (exam level, grade)
- Group dynamics
- Behaviour
- Teacher expectations
- Use of Resources/TA/learning support
- Level of challenge
- Pace
- Self-concept

Q1. How do you feel about being in this group? What do your parents think?

Q2. Which groups are your closest friends in?

Q3. What do you think about putting students into sets/groups?

Q4. Why do you think you are in this group? If you could choose today, which group would you choose to go into and why?

What if I don't want a C grade? (Are you being served?)

- Maths link to future
- Importance of maths
- Level of commitment/motivating factor

Q1. What are you planning to do after Yr 11?

Q2. What grade in maths do you need for that?

Q2. Do you think being good in maths will help you do particular things after school? What do you think maths is good for?

Initially, I interviewed sixteen pupils across both schools. All the interviews were carried out face to face and audio recorded using a digital audio recorder. The interviews lasted for 15-20 minutes and were conducted during the regular mathematics lesson periods. In CPS, the interview sessions were carried out in a very comfortable room offered by staff. I was not offered any room in PLS and I understand that in schools this can often be a luxury. Consequently, the interview sessions were held in the corridors outside the mathematics classrooms. I had no control over the noise from students moving back and forth from lessons or teachers walking past. I sometimes felt I was under scrutiny and had to keep turning back or following the student's eyes to see who was lurking around. I did not feel it was very convenient but had to make the best of it.

I am aware of the controversies around the role of a researcher (a sponge; a prober; a listener; a counselor; a recorder – see Wellington, (2000) and the balance of the two way exchange (who should play the leading role – interviewer or interviewee?). I was convinced that when it came to the interview, my task was to give these young people an opportunity to make their perspectives known. To achieve this, I needed to be flexible, adopting different roles for different purposes, hoping to develop rapport with the interviewees.

The challenge I had to overcome here was getting the students to trust me; I had to reassure students that whatever was discussed was going to be held in strict confidence. Similarly, I made sure I did not come across as a critical or judgemental parent figure that was quick to draw conclusions without hearing the young people out. It meant showing empathy where the student showed a need for it. I would like to describe this as showing my 'humanness' in the course of the interview, striking a fine balance between what Wellington (2000, p. 77) citing Smith (1972) describes as task involvement (involvement with the questions and answers related to the business at hand) and social involvement (involvement with the interviewee at a personal level). But as expected, one cannot be rigid in these matters because on several occasions, some of my participants could not help but show their anger, frustrations, fears and even pain; these emotions were real to them and could not be easily glossed over by following some formula.

Another hurdle was the issue of power dynamics that cropped up in interviewing young people even though interviews as discussed above is meant to be a platform for

young people to make their perspectives known. To attend to this, I followed Eder and Fingerson's (2003) suggestion to create a natural context for the interviews avoiding situations akin to classroom lessons based on 'known-answer questions' (p.36). Consequently, I started the interviews by firstly welcoming the students. I also made it clear that I was genuinely interested in them and whatever else they had to tell me about their experiences and then simply asked: 'where do you live and what do you do for fun? This served as a launch pad for the rest of the interview.

After transcribing the interviews into word documents using the Express Scribe Transcription software, I observed on the one hand regretfully, that there were certain questions I should have asked and themes I could have explored further. This may be attributed to the fact that the interviews lasted for just 15-20 minutes and the fact that these pupils were young and having a long drawn out interview would have been tiring for them.

On the other hand, this shortcoming also presented me with an opportunity to find out, albeit, from a few of these pupils how they were feeling at that moment with their examinations closer up than they were a few months back. I decided a second round of interviews was needed. I chose three pupils from each school (six transcripts that had interesting themes I wanted to explore). However, it was a difficult period (May, 2015 – see timescale on p.102)) as most Year 11 pupils were either on study leave or were deeply involved in revision classes in preparations for their examinations. I selected three pupils from both schools but eventually interviewed only five pupils (3 from CPS and 2 from PLS) instead of six as previously planned. Next, I discuss briefly the implications of interviewing teenagers drawn from the literature.

Interviewing Teenagers

I: So you had mentioned that you're all vegetarian in the house?

Sharon: Yeah.

I: And then you said you tried to be a vegan?

Sharon: Yeah.

I: But that didn't work?

Sharon: No.

(Bassett et al., 2008, p. 123)

As a parent of three teenagers, I had thought interviewing young people would not be an issue during my research. I had mentioned earlier about the challenge to adapt the roles I took on while interviewing the students, all in an attempt to develop rapport with them. In PLS, I found the students were more articulate compared to students from CPS. In some cases, like the quote above, all I could get were monosyllabic responses. Bassett et al., (2008) in their paper titled 'Tough Teens' share the difficulties they experienced whilst interviewing teenagers. These included the silencing effect the recording equipment had on adolescents. In addition, the issue of power dynamics between interviewer and interviewees as well as the 'formal' atmosphere that invariably permeated the interview setting:

In an attempt to make participants feel safe and enable them to speak freely about their eating patterns, our guidelines suggested letting people know that what they said would remain confidential and that the interviewer was not there to judge them. This seemed to work with adult participants. Yet ... introducing the concepts of judgment and confidentiality among EBC teens inadvertently formalized the interview setting and established her, the interviewer, as more powerful and authoritarian, perhaps even parental. (Bassett et al., 2008, p. 122)

Even though I had spent some time in these schools and was known to the students, it was not always easy to overcome the issues raised in the quote above. It was one hurdle to gain access to interview students but it was another to get what Shah (2004) described as 'gaining social access'; that is getting on with respondents knowing the effect this might have on the quality of responses got from participants. So, I had to sometimes play it by the ear in the conversations with teenagers until I got the required information; particularly because young people very often decide to what extent they dis/engage with any process. Some researchers put it down to developing rapport with the young people such that they come to trust you, whilst others suggest that shared cultural understanding (Shah, 2004) helped bridge any gaps between the interviewer and the participant.

The ability to turn a stilted interview into a conversation rested on cultural understandings shared by both interviewer and participant. Cultural subtleties play a large part in interviewer-participant interaction; knowing what is likely to be a topic of interest to a particular adolescent population and being able to probe further is essential to a successful interview. Although such familiarity can lead to omissions, such as a failure to explore vague statements and generalities ... (Bassett et al., 2008, p. 126)

Interviewing from the terms of cultural understanding meant I probably would have fallen short in some regards given that teenage culture could be radically different from adults' (often referred to as 'old school'). But I drew some insights from my experience as a mother of teenagers who understood that even when you did not understand teenagers' peculiarities, you should be sensitive not to embarrass or shame them but to communicate respect, interest, empathy and support (Coupey, 1997). The other issue worth considering was analysing the data collected from interviews with these young people. Shah's (2004) discussion on making meanings from data collected from interviews within intercultural contexts echoes some challenges: Meaning is not simply elicited by apt questioning, nor merely transported through respondent replies; it is actively and communicatively assembled in the interview encounter' (Holstein and Gubrium, 1995, p. 115). This stresses the importance of establishing rapport, empathy and understanding between interviewer and interviewee. Establishing rapport however depends on one's relationship with the participants and the researcher's position in the field – insider or outsider. All these have implications for the quality of data collected and the analysis of data.

Table 2: Timescale and summary of data set

Data set	PLS	CPS	Total
Analysis of Documents	May-Sept 2013 n=5	May-Sept 2013 n=5	n=10
Lesson observation transcripts	1 st Phase Oct 2013-May 2014 2 nd Phase Sept -Dec 2014 n=20	1 st Phase Oct 2013-May 2014 2 nd Phase Sept -Dec 2014 n=18	n= 47
Survey analysis	July 2014 n=144	July 2014 n=104	n=248
Interview transcripts	Dec 2014- May 2015 n= 12	Dec 2014-May 2015 n= 8	n=20

4.6.5 The Ethical Dimension

In the course of carrying out any research, it is pertinent that it is done with a lot of sensitivity to avoid harm to others, or any form of distress and to respect others' rights to freedom and privacy (Coolican, 2000). According to Miles and Huberman (1994), dealing with ethical issues effectively involves 'heightened awareness and negotiation...rather than the application of rules' (p. 297).

Equally, Cohen *et al.* (2007, p. 51) point out the ethical dilemmas that occur in seeking a balance between a researcher's pursuit of truth and the threats the research may pose to participants. This 'cost/benefit ratio' is depicted as a conflict between two rights: the right to conduct research in order to gain knowledge versus the rights of participants to self-determination, privacy and dignity' (Frankfort Nachmias and Nachmias, 1992 cited in Cohen *et al.*, 2007, p. 63). Thus, this demands that the

individual researcher approach their projects with greater awareness and fuller understanding of the ethical dilemmas and the moral issues involved in the research process (Cohen et al., 2007).

Hence, my research design was influenced by the British Educational Research Association Revised Ethical Guidelines for Educational Research (BERA, 2004). Subsequently, ethical approval from the School of Education was confirmed before conducting any form of data collection for this study. This approval also involved undertaking a Disclosure and Barring (DBS) check since I was going to work closely with young people.

Whilst all forms of research involve ethical concerns, in this study as indicated earlier, the use of publicly available data presented some ethical challenges. The study is focused on schools within specific areas of a city. To understand the social-cultural influences on mathematics learning entails looking into schools and neighbourhoods. The use of publicly available data meant it might be easy to trace participants and schools. This negates the BERA guidelines with regards to anonymity. Anonymity involves obscuring the names of participants or research sites and leaving out any information that may cause participants or research sites to be identified (Walford, 2005).

Tilley and Woodthorpe (2011) highlight the difficulties that can arise from applying anonymity to historical and geographical context alongside the pressure to disseminate research findings. According to them, this 'ethical and methodological tight spot' which often requires obscuring the identity of settings and individuals needs to be critiqued on the basis that firstly, it questions the level of visibility and engagement, which are critical in qualitative research; secondly, it allows for researchers to opt for convenient research sites and thirdly, it overlooks the essence of providing contextual information when reporting the research. Nevertheless, Tilley and Woodthorpe still leave researchers with the responsibility of charting their own individual path through this tight spot. However, I decided to use pseudonyms for the schools and all participants involved to avoid any undue stress to all those involved.

To address other ethical concerns, all participants in the research were provided with information sheets/consent forms which outlined the research aims, duration of study, their right to privacy and confidentiality of the information and their right to withdraw

at any point without prejudice or fear of consequence. Also, participants were assured of the secure storage of data and any copies of data generated.

4.7 Data Handling and Analysis

Employing Bourdieu's theoretical perspective to guide data analysis, involves recording the dynamic interaction between individuals and the settings in which they find themselves and situating these within a larger historical, economic, political, and symbolic context (Mills and Gale, 2007). Even so, it is interesting to note that Bourdieu often started with a practical context – an image even, on occasion a social entity, this was used to conduct his enquiries. In other words, what was crucial was,

a particular phenomenon, or research question, at the point of initiation in Bourdieu's work – not a theoretical motive... from practice to theory... to come up with a set of propositions for the research which were "logically required as a ground for its findings". (Grenfell, 2014, p. 214/215)

In addition, Bourdieu points out the need to be cautious with the use of language, because as researchers, it is possible to impose personal definitions upon the research process rather than understanding it in its own terms. Although it is not possible to completely eradicate this effect. It is, however, possible to maintain a constant consciousness of it and curtail its influence. Consequently, in an attempt to construct an explanation, the language used to explain and conceptualise it must be accounted for at every stage. In other words, for any concept to be useful, it has to be expressed in terms of their operations between the field and the individual habituses located there. Thus,

Using terms such as habitus, field and capital can sensitize one to these processes after the research event, as it were. However, they might also be adopted from its outset. In either case, the attempt is to go beyond the sort of strict representations of social theories which have a strong predictive force but risk reifying dynamic processes; what Bourdieu sees as going from a 'model of reality' to the 'reality of the model'. (Grenfell and James, 1998, p. 158)

In relation to this, Reay's (2004) urges researchers not to superimpose research analyses with Bourdieu's concepts, including habitus, rather than making the concepts work in the context of the data and the research settings. Consequently, Table 4 shows how the key constructs outlined earlier has been used to read the data.

Construct	Operationalisation
Habitus	The identification of habitus is problematic (Reay, 1995) because of the indeterminacy of this concept. However, I have focused on non-cognitive personal dispositions of pupils demonstrated through their perspectives on their experiences in LAMG (i.e. responses to the process of learning mathematics) and on the relevance of mathematics; academic self- perception; perceived parental support/values and student ambition/aspirations
Capital	Capital is best understood in economic, cultural and social terms. The identification of capital was tied to certain measures that reflect SES (also a component of habitus), such as pupils' place of residence; the nature of after-school/leisure activities pupils participated in and the nature of their social networks.
Field	Mathematics education with its unique practices, ascribe value and status to particular dispositions and learning, resulting in a differential evaluation of these practices within the field. In response, the field imposes 'an objective structuring upon pupils and teachers through curriculum, pedagogy and the organisation of learners' (Jorgensen et al., 2014a, p. 225). These form significant elements to examine within these classrooms.

The analysis of the data was on-going throughout the data collection process. The data was sorted into categories and assigned codes chosen from the literature, which were relevant to the purposes and research questions of this study. According to Shane (2002, p. 131), this is the process of converting documentation into data, which allows one to become 'intimately' familiar with the data. Subsequently, I present further discussions on the analysis of the different data sets.

Analysis of Documents

I merged information from various databases used for the analysis in this study. A descriptive analysis of the DfE database for schools in the area was undertaken to characterize various schools and their level of attainment. More information was obtained from the Neighbourhood Statistic Service of the Office of National Statistics. These include thematic analyses that profile the region (Newby, 2010) which helped to give context to the issues this study addressed. In addition, historical facts about the area were obtained from the relevant literature; also, Ofsted inspection reports of the schools were examined to gather more relevant background detail. I also used data collected on my initial visit to each school to develop a picture of the school, department and its culture. This strand of the research is presented in Chapter 5

Analysis of Lesson Observations/Fieldnotes

I started out trying to convert my fieldnotes to word processed texts at the end of each day but failed to keep up in the face of the realities of doing research as a multifaceted entity. But technology, by reason of smartphones came to my rescue (a pragmatic decision). I used my phone's camera to take pictures of my fieldnotes and transferred these unto my computer as photo files. These files were then uploaded to NVivo. This made it easy for me to read the notes again and again, noting my thoughts and points of interest. This was the process of turning documentation into data which gave the opportunity of getting familiar with my data. This involved reading the materials from 'a holistic perspective and dissected, categorized, marked, and reassembled according to categories (Shane, 2002, p. 131). The benefit of this process was the ability to seek out associations and insights from the raw data and thereafter cluster these thoughts into broader themes, such as learner attitudes and teaching approaches and methods, for example.

Analysis of Questionnaires

The main goals in survey analysis are the creation of illuminating accounts, persuasive narratives and plausible explanations, grounded in the survey findings, concerning the social structures, groups, and processes under investigation. (Aldridge and Levine, 2001, p. 135)

After the questionnaires were administered and collated, I entered the data into excel spread sheets initially and spent some time cleaning the data before transferring into SPSS. Further work was done on the data in SPSS, to clean the data and to check for any irregularities. The data was subsequently analysed within SPSS using frequencies, descriptive statistics, cross tabulations and where necessary inferential statistics such as chi-square and t-test were used. In addition, as mentioned previously, this instrument also incorporated ideas developed by Swan (2006) which identified mathematical activities prevalent in most lessons as either teacher (T) or pupils centred (S); (Cronbach alpha 0.73).

Table 3: Teacher centred and student centred practices adapted from(Swan, 2006)

Teacher Centred	Student Centred
<ul style="list-style-type: none"> • Transmission oriented • Teacher directs the work • Predigests and organises material • Whole class teaching in a fixed way • Practice for fluency rather than discussion for meaning • minimal room for creativity • transimission of definitions and methods to be practices 	<ul style="list-style-type: none"> • Constructivist stance • Students' needs direct teaching • Focus on individuals not homogenous group • Selective and flexible coverage of contents • Students allowed to make decision, compare different approaches and create their own methods
<ul style="list-style-type: none"> • Contents covered in minimum time 	

Swan's (2006) two year empirical study (within an FE and sixth form context) involved the design and use of longer- term diagnostic teaching programme, in GCSE retake classes. He observed that transmission oriented practices were widespread and that students had a tendency to assume passive attitudes towards learning characterised by the following actions; listening, copying down, working alone and trying to follow given steps.

Similarly, Noyes (2012) also used these same items to examine related pedagogic questions to ascertain the extent to which pupils' experiences differed between schools and classrooms with a focus on the relationship between pupils centred teaching and the enjoyment of learning mathematics (Cronbach alpha 0.81).

Pupils were asked to rate the mathematics activities that occurred in their lessons on a Likert scale of: almost always, most of the time, about half the time, occasionally and almost never (see next page).

Table 4: Pupils' self-reported mathematics activities instrument items

Item No.	Pupils- or teacher centred	Item
1	T	Tells us which questions to do
2	T	Expects us to follow the textbook or worksheet closely
3	T	Shows us which method to use, the asks us to use it
4	T	Tries to prevent us from making mistakes by explaining things carefully first
5	T	Expects us to work mostly on our own, asking a neighbour from time to time
6	T	Asks us to work through practice exercises
7	S	Expects us to learn through discussing our ideas
8	S	Encourages us to discuss mistakes
9	T	Shows us just one way of doing each question
10	S	Shows us how different maths topics link together
11	S	Asks us to compare different methods for doing questions
12	S	Jumps between topics as the need arises
13	S	Asks us to work in pairs or small groups
14	S	Lets us invent and use our own methods
15	S	Lets us choose which questions we do

Possible responses: 1 - Almost always; 2 - most of the time; 3 - About half the time; 4 - occasionally; 5 - almost never

The reliability of scale components of the questionnaire was established using Cronbach's alpha measure of internal consistency. The alpha coefficients obtained were as follows:

Teacher Quality (5 items)	-	0.831
Pupils Engagement (6 items)	-	0.754
Classroom Culture (12 items)	-	0.902
Teacher-Centred Pedagogy (8 items)	-	0.891
Pupils-Centred Pedagogy (7 items)	-	0.914
Home Learning (5 items)	-	0.867
Parental Support (3 items)	-	0.883

The reliability coefficients show that each of the 7 scales has sufficient internal consistency and therefore good enough for use as a scale reliability scale for data collection for this study.

The data collected using this instrument were ordinal variables which Field (2009, p. 8/9) describes as categorical data that is ordered. Although this is the case, a number of scholars have presented some justification for treating Likert-type responses as an interval scale (Carifio and Perla, 2007; Norman, 2010; Sullivan and Artino, 2013). Based on this and the acceptable level of internal consistency among items in each of the 7 scales, the items were summed up to get composite scores on the variables for each respondent. Thereafter, each of the composite scores was converted to the level of the response weight (1-4 or 1-5 as the case may be) by dividing each of the composite scores with the number of items in each scale so as to achieve ease of cross-variable comparison.

The results presented show pupils' perspectives on their experience of the teaching and learning of mathematics. The pupils in low attaining groups (LAMG) are contrasted with pupils in high attaining groups (HAMG) both within and across both schools (in all cases, school 1 = PLS; school 2= CPS). The aim is to show the

mathematics teaching and learning culture across the whole year group in order to validate the reports from my case sample and to show the variations of experience for groups in the same school.

Analysis of Interviews

According to Newby (2010), the process of qualitative analysis involves the act of shaping data into a form where it can be interpreted and perhaps in some way contribute to our understanding of the research issue. The interview data was transcribed into a text format. Since these interviews were designed to draw out pupils' perspectives on their learning in mathematics, I decided a data driven thematic analysis was appropriate at this level without necessarily giving attention to the 'use or understanding of communicative intent or actuality or the consequences of both' (Newby, 2010, p. 499).

To carry out the analysis of the interview data, I initially attempted to do all the data processing by hand but it became overwhelmingly difficult to manage all the field notes and interview data. I decided to use computer assisted qualitative data analysis software (NVivo) to aid the management of the data. I particularly found it helpful to use this software as a container for the project. It equally provided easy and fast access to my data; allowed me to code, annotate my data and helped to display my data using diagrams. My initial coding of the interview data identified themes of interest, after which the themes that were connected or related were categorized and then interpreted in the context of the theoretical framework outlined previously. Hence, the process of analysis went through several stages.

Nevertheless, researchers analysing qualitative data gathered through interviews are faced with a quality decision concern which Silverman (2010) describes as the 'anecdotal use of data extracts (like spectacular quotes from participants) out of context'. To attend to this, I follow Silverman's illustration which required that I position 'perspectives in their broader contexts...explicitly acknowledging the trajectories preceding them' (p.274). In addition, using the coding facility in NVivo helped me keep an overview of my data, allowing me to evaluate the significant issues that I had unconsciously earmarked against the backdrop of the coding reports of the frequency of these particular issues. Even so, one may still be faced with the

possibility of inconsistencies or inaccuracies in the coding process, bringing issues of reliability (I will discuss these shortly) to the fore.

Throughout the fieldwork I had several discussions with the teachers (Mr Gregory, Miss. Freeman, and Mrs Brown) in addition to the pupils. These conversations were necessary to explore the teachers' perspectives on the pupils. These teacher interviews were sometimes pre-planned and at other times were spontaneous discussions around events that occurred in the lessons. A case in point occurred on one occasion, in a lesson on rotation, one of the pupils shouted out in class: 'Why do I have to do this? It has nothing to do with what I want to be in future'. This statement whilst only voiced by one individual could well be a sentiment shared by most of the pupils in this group. This revealed the disenchantment and apathy seen in mathematics classrooms. They could not see the relevance mathematics held for their future; this matter was extremely pertinent for my investigation.

4.7.1 Reliability and Validity

The mixed method approach adopted in this research was as previously discussed appropriate; considering different aspects of the study lent themselves to different modes of data collection and analysis. Furthermore, these approaches to gathering evidence were intended to ensure that data could be authenticated against other sources.

Issues of quality judgements in research are complex in the mixed method approach: on the one hand, you have the quantitative approach where the criterion of reliability, validity, generalizability and replicability hold sway. On the other hand, the qualitative approach advocates criterion based on credibility, dependability, confirmability and transferability (Lincoln and Guba, 1985).

O'Cathain (2010) is helpful in suggesting three different approaches to tackle the above dilemma. Firstly, using a generic tool to assess the quality of mixed method research but this approach is not specific enough to allow variable applicability across research designs. Secondly, assessing the individual methods used, but this raises the question of what criteria to apply to each methodological approach or method. Thirdly adopting a bespoke approach; developed by O'Cathain's attempt in proposing a quality framework for mixed method research. She builds on Tashakkori and Teddlie's

(2010) concept of inference quality which emphasises methodological rigour and interpretive rigour and puts forward eight domains of quality as a yardstick for assessing mixed method research. These domains include quality in planning, design, data, and interpretation, transferability of inferences, reporting, synthesizability and utility of findings. In practical terms, this involves making sure my study stands up to the demands of:

- a.) Establishing a rationale for the study by drawing on a conceptual framework;
 - b.) Ensuring the research design is appropriate for tackling the research questions;
 - c.) Minimizing bias by considering the strengths and weaknesses of methods used;
 - d.) Making interpretations that are credible;
 - e.) Transferability of inferences made to other contexts and settings;
 - f.) Justifying the research design given the findings;
 - g.) Making findings useful to various stakeholder
- (O’Cathain, 2010)

The quality demands articulated above have been dealt with in the process of describing the approach and design of the research (a-d). Nevertheless, other quality demands (e-g) boarder on retrospective evaluation of the study upon completion.

4.7.2 Limitations of the study

Some of the limitations of the study have been described earlier in the discussions of the various research methods adopted. In addition, the effect of not administering the questionnaires based on mathematics groups but using tutor groups meant I could not categorise pupils based on attainment groups as some pupils did not know or remember their groups’ name.

The merging of the mathematics groups in CPS meant I initially lost one of the case study classes and as such there was no basis for comparison across the two parallel classes I started with initially. I however gained them back in the next session. Furthermore, the expulsion of two of the pupils in my case study class in CPS meant I could not follow up some queries and have had to make some critical decisions in these cases.

4.8 The 'pain of fieldwork'; Reflections from the field

... a fieldworker hoping to come out of the field without personal alterations is naive. No account of field-work is complete without an evaluation of one's position in the field, remarks about method of observation, informants, power relations between self and subject, implications of one's actions in the field and so on. (Lecocq, 2002, p. 281)

The phrase 'the pain of fieldwork' according to Lecocq (2002, p. 273) is neither a complaint nor does it indicate disgust at the thought of fieldwork. But it embodies all the suppressed mixed emotions one experiences during fieldwork. As much as I do not want to dwell on my personal field experiences so that I am not passed off as too self-involved or worse still incompetent; Lecocq's assertion above points out that omitting this vital aspect renders my fieldwork report incomplete. Furthermore, and essentially, leaving out these seemingly insignificant aspects fail to account for its impact on the research process:

We would like to believe that this emotional state is one of euphoria, but in reality, it includes negative experiences and feelings. These feelings should be accounted for not just personally, but also professionally. (Lecocq, 2002, p. 273)

The point that I want to get across is that the personal emotional experience and state of mind during fieldwork have an impact on the way fieldworkers, in being their own instruments, practice their research.

Researchers are not invisible, neutral entities; rather they are part of the interactions they seek to study and influence those interactions. (Fontana and Frey, 2000, p. 663)

The researcher has the responsibility to 'come clean' about predispositions and feelings, to declare their values, nevertheless even this is not adequate because researchers rarely acknowledge their 'taken-for-granted's', values must be unearthed, clarified and questioned (Mills and Gale, 2007, p. 441). This proposition illustrates Bourdieu's (1993) insistence on reflexivity; the requirement to turn the instrument of

social science back upon the researcher aimed at controlling the distortions that could be introduced in the construction of the research participants (Wacquant, 2008).

This study including the methodological approach employed presented a long desired opportunity to examine the challenges pupils in LAMG have to negotiate in mathematics lessons. This has been from a different position; not as a teacher or parent but as a researcher. This position also presents its own set of struggles. I have at various stages of the study had to step back and challenge my biases, both from a cultural perspective and also from a particular social position. I am fully aware of the effects these dispositions exert on my role as a researcher. I have reflected on how the research process has impacted on my attitudes to the field; the events I have chosen to study and the explanations I provide for them. Based on my interest in exploring the mathematical learning experiences of pupils in low attaining groups, I found myself trying to get into their heads, wanting to know what they wanted for themselves, and how they arrived at the options they chose and tried to imagine what they wanted for their future and how they negotiated the paths to that future given their experience of school mathematics.

I found myself wanting to be a crusader, a defender for the young people who I would describe as marginalized in the sense that they were already disqualified even before the race had begun. My dilemma was a case of carrying on with the research even though I was resentful of a system that did not give everyone a fair chance and of the teachers who enforced the standards indiscriminately. Sometimes I felt it was a lost cause and I wondered if I was wasting my time as a researcher. So on some days I swayed between the place of meritocracy (attainment and achievement mattered) today and the next day, the place of egalitarianism (equality for all). My only anchor was my firm belief that every individual deserved a fair chance irrespective of class, gender or race. This made it easy to see my research participants as individuals negotiating the demands and expectations of the educational system, torn between the choices of compliance or defiance – a difficult place to linger as the pressure of the competition for GCSE grades mounted (and I illustrate these issues in my discussion of findings).

These personal conflicts may be justified given Becker's (1967) argument that neutrality is imaginary.

For it to exist, one would have to assume, as some apparently do, that it is indeed possible to do research that is uncontaminated by personal and political sympathies. I propose to argue that it is not possible and, therefore that the question is not whether we should take sides, since we inevitably will, but rather whose side are we on? (Becker, 1967, p. 239)

This throws more light on the *pain of fieldwork* (Lecocq, 2002) which in some sense symbolises all the suppressed mixed emotions experienced during fieldwork.

4.8.1 The Social Intruder

Different cultures enable different ways of thinking and different ways of interpreting objects and events, shared by the members of that cultural group. Rapport building for researchers in cross-cultural interaction requires an understanding and manipulation of the socio-cultural norms to adjust action accordingly without being offensive. All forms of research have an intrusive element which is dependent on making an entry at particular point, often leaving traces of (more/less) after effects. Nevertheless, whether the research process is a welcome or unwelcome venture is a point of discussion; this 'unwelcome' and 'uninvited' element of research for the researched is sharpened in cross-cultural contexts (Shah, 2004). Even though I would like to see myself as a fluent English speaker, it still did not give me license to be defined as a native. So in one sense one could see my study as research within a cross cultural context. A foreign black African female researcher in a 'civilized' western world would certainly have implications for the research process and outcome.

In examining cross-cultural communications and understanding, Barna (1998, p. 337) recognises six stumbling blocks:

- preconceptions and stereotypes;
- tendency to evaluate;
- high anxiety;
- assumption of similarities;
- language difference; and
- non-verbal misinterpretations

In my case, there were no similarities or language difference but it was often very tempting to have preconceptions and label stereotypes based on my subjective and cultural position. Also, the element of anxiety was often present for both the research participants and me. Shah expresses this point below:

In intercultural interaction, both the participants might experience stress and anxiety at the prospect of dealing with the 'unknown'. Without the normal props of one's own culture, there is unpredictability, helplessness, a threat to self-esteem, and a general feeling of 'walking on ice' - all of which are stress producing, and hamper understanding. (Shah, 2004, p. 564)

The general feeling of 'walking on ice' was a tricky patch I had to negotiate, making me question my position as an 'insider' or 'outsider' even after spending all that time in these schools. I cannot make any assumptions whether the case might have been different if I was British or male. But it draws attention to the choices the insider/outsider has to navigate in questioning;

- how much the respondents may not tell, making assumptions about the researcher's knowledge as an insider;
- how much the researcher may fail to ask, believing it to be too obvious or too insignificant, and the implications of nearness- 'blunting the criticality';
- how much the respondents may not choose to share with a person who poses the possibility of being judgmental due to a shared knowledge of value systems, and which they may unburden with a complete stranger who might sympathize or would disappear with the information (Shah, 2004, p. 568/9)

The impact of the insider/outsider debate on research process and outcome may remain unresolved and therefore requires that as a researcher I critically engage with the different perspectives with the aim of generating quality data and interpretation of data.

4.9 Summary

This chapter has discussed the theoretical and methodological perspectives that shaped the research design. Starting with the adoption of a critical theory paradigm that defined a mandate to expose domination and marginalisation experienced through structures and frameworks within mathematics education. Consequently, the significance of the context within which these experiences are generated of necessity requires a methodology that allows for a close and in-depth account of pupils' experiences using a mixed-method research approach.

The case study approach presented the opportunity to look at the interrelationships between the learning of mathematics within different classes in different schools, the contextual issues at stake given the nested nature of the study, and other factors that feature in the process. I have also explained the classes selected with reasons and due consideration given to the implications of the sampling size and process. Although the sample classes are not representative, the methodology used allows for generalisation from the particular class contexts encountered within the study.

The methods of data collection were discussed, including the strengths and weaknesses of each method and the data analysis process applied to data collected through these methods. The limitations of the study showed how changes within the schools impacted on the research process and the findings that ensued. In addition, the implications of being a foreign researcher in the UK was discussed and also the need to be vulnerable and open about how the research process has impacted on the researcher.

In the next chapter, I present the contextual background of the study by discussing the demographic characteristics of the school, the teachers and the student participants.

5. CONTEXTS

This chapter presents the contextual background for interpreting pupils' experiences within mathematics classrooms in these schools including the demographic characteristics of the schools and brief profiles of the teachers and the pupils involved in the study.

5.1 Introduction

Pearl Lake and Cedar Park schools are located in two geographically proximate but demographically contrasting neighbourhoods in the same city, approximately three-quarters mile apart.

Table 5: Characteristics of schools

School	School type	% FSM	%5 or more A*-C grades including English and Maths (2014)	Expected level of progress ¹
PLS	City, ethnically diverse	14%	68%	73%
CPS	City, largely white British	49%	40%	42%

Below is a breakdown of the performance of both schools at KS4 comparing GCSE results over a number of years.

Table 6: Key stage 4 year on year comparison

Percentage achieving 5+ A*-C GCSEs (or equivalent) including English and maths GCSEs	2011	2012	2013	2014	2015
Pearl Lake school	63%	71%	74%	68%	73%
Cedar Park school	44%	35%	32%	40%	34%

¹ Expected progress is the minimum expectation of progress pupils should make during a key stage, regardless of their starting point (DFE 2015). This measure has however been recently phased out and replaced with the Phase 8 progress based on a calculation of pupils' performance across 8 qualifications, called Attainment 8 (DFE, 2017).

A close scrutiny reveal the variation between schools and perhaps by implication the considerable differences in the mathematical experience and attitudes of these pupils. Even so, the two schools though situated in very different contexts both socially and economically are located within the same area.

5.2 Pearl Lake School (PLS)

Pearl Lake School is a mixed, 11-16- years olds', school with approximately 1000 pupils on roll. It is situated in a quiet and affluent area of a major city. The school has a rich cultural blend of pupils, with roughly 40% from a broad range of different ethnic heritages. Hence the proportion of pupils with English as a second language is high. The proportion of pupils on free school meals is average whilst the proportion of pupils with special educational needs is well below the national average. This school is usually placed at the top of the league table as measured on GCSE passes of secondary schools in the local education authority and is equally oversubscribed.

The houses around the area are all detached, with well-kept lawns and manicured hedges. The vehicles parked in the drive ways tell the status of the occupants to a large extent. The school has mostly old buildings with some parts newly renovated, giving it a revamped but dignified presence on its street.

Entering into the school as a complete stranger, there is that sense of orderliness and purpose in every spoken word or taken stride. Posters are hung neatly on walls; pupils' work neatly displayed and going past the library and classrooms, the silence is almost palpable.

The school staff are friendly but with an air of officious stance. The staff room is modern with brightly coloured smart sofas and an area cordoned off as work stations with computers and printers. There is the self-service kitchen in the other corner. During lunch time, most staff are gathered in subject groups to have their lunch and enjoy the famous staffroom chat. Interestingly, each department also has a subject hub. In the mathematics Hub, there is a printer, a notice board with names of pupils needing intervention and those who have met targets. Teachers' tools and tips are boldly displayed for all to use; 'our birthdays' chart with all teachers' names on it, a fridge and a communal assortment of snacks at the centre of the workspace.

At the time of this study, most staff members were all mathematics specialists between 30 and 45 years old and had been teaching for less than 12 years. The head of mathematics proudly told me they had a reputation for gaining over 90% pass rate (A*-C) in GCSE.

The school's Ofsted report describes pupils' "exceptional positive attitude to learning" and conduct around the school as "commendable". Also, the quality of teaching was judged as "excellent".

Teachers interest, motivate and engage pupils extremely well and have high expectations of them as learners. The pace of learning in lessons is brisk and supports pupils in making rapid and sustained progress. Staff are rigorous in ensuring pupils' examination work meets high standards. Pupils have a clear understanding of what they need to do in order to reach higher levels (unreferenced Ofsted report)

The progress and attainment of all pupils was also reported above national average. Pupil absence rate and exclusions were below national average.

In PLS, the mathematics scheme was broken down into blocks of several units. At the end of three or four units, an assessment was carried out. This assessment process was always very formal and was carried out under strict examination conditions. Before every unit test there was a revision lesson, with sample questions on various topics in the unit. After the tests, detailed corrections are carried out; in addition pupils have assessment analysis sheets that record gaps in achievement. Students' progress and set placement were tied to end of unit tests, assignments and teachers' judgements.

Pupils are allocated into a variety of attainment groups ranging from mixed attainment groups, single sex groups (for high attainers) and foundation groups.

Mr Gregory was in his mid- thirties and had been teaching for some years in the school. His appearance, accent and manner suggested his middle class status and no doubt influenced what he would expect from his 'ideal' pupils(Jorgensen et al., 2014b; Rist, 1970)regardless of the standards imposed by the school context. He was regarded as a very conscientious teacher by his colleagues and had recently been appointed head of the mathematics faculty. He was always smartly dressed in shirt

and tie, on formal trousers and was always punctual to his lessons. Although Mr Gregory appeared to have a good rapport with his pupils, he seemed to have this strict no-nonsense persona most times. However, through comments made to me, I got the impression most of the pupils liked Mr Gregory, who also claimed he liked this class. According to him, the reason he had been given this class was because he had had some experience working with low attaining pupils in his previous post and so had a good grasp of how to handle disaffected pupils. He was of the opinion that, although the pupils in this group were not willing to give much, he had discovered how they learned and he was going to utilise that to get the best out of them.

Mr Gregory's high aspiration and confidence were key factors in his approach with the pupils. For example, in my discussion with Mr Gregory after a class assessment, he mentioned that a few pupils got Ds, most Es and one F grade. He maintained that although it was easy to expect the worst given their performance, he liked to be *aspirational* and was prepared to nudge his pupils to give their best. In describing the assessment targets, he said concerning the pupils' progress; "*I am working towards D for December, aim higher in March, all geared towards finals. I think a few of them will get a C*". Mr Gregory gave the impression that his pupils' success was important to him as he made effort to ensure all relevant topics were covered prior to the final examination.

Miss Freeman was a newly qualified teacher (NQT) on a temporary contract and had only been in the school for a few months. She was young and may have been just a few years older than the pupils. Miss Freeman seemed to enjoy teaching mathematical concepts. She was very keen to share the history of most mathematical concept with the pupils and showed them how it applied in real life. On one occasion, in a lesson on Pythagoras' Theorem, she shared the history of Pythagoras' and how he arrived at his conclusions. For the application of Pythagoras, she went on to share an interesting fact with the class about television, laptops, Ipads screen sizes; She explained that manufacturers knew that the diagonal length of the screen was more impressive than the actual length of the screen. It was this size they advertised and used to convince buyers. On another occasion, she explained the mathematics behind D-Day bombings as the class was being taught Loci and Regions and this got everyone's attention.

Miss Freeman was an enthusiastic teacher who knew her subject and related well with the students on a personal level. But as a newly qualified teacher, she was still

settling into the profession. She needed support with managing students' conflicting demands of wanting to have lessons they described as *fun and interactive* within the constraints of preparing for their GCSE and her personal quest to explore innovative ways of engaging students in mathematics lessons.

5.3 Cedar Park School (CPS)

This is a smaller than the average-sized secondary school. It is a mixed, 11-18- years' old², school with approximately 800 pupils on roll. The large majority of pupils come from white British backgrounds whilst other pupils come from a number of minority ethnic groups. The proportion of disabled pupils and those who have special educational needs is much higher than the national average. A much larger-than-average proportion of the pupils are eligible for the pupil premium, which provides additional funding in this school for pupils who are looked after by the local authority or known to be eligible for free school meals. The proportion of pupils regularly absent is high and exclusions are equally high compared to national averages.

CPS is situated in a community which is seen to have wide streets, houses set back from the road, and properties which, although mainly semi-detached, often have four bedrooms and as much space as many detached homes elsewhere in the city. The area was mostly created when slum housing in the city centre began to be cleared during the mid-20th century. Most properties in the area were built after World War II. The area consists of family houses and a large number of bungalows (due to the high percentage of older citizens), some built on the sites of prefabricated homes that were meant to have been destroyed long after the war, but are still been used today. Although this area is close to the city, it does not enjoy the full range of facilities as would be expected. Walking around the community revealed a lack of recreational facilities for children and young people. This may mean that young people are not occupied and therefore are left to their own devices. Similarly, a general lack of investment in the area meant there were no jobs on offer as stated by a Year eleven pupil I spoke with and therefore there was limited opportunity for exchanging ideas with the wider world or even to challenge young people to aspire.

²The upper age limit here is significant when compared with PLS (11-16) (Reay et al., 2001)

The head of mathematics had over 20 years teaching experience, there was also an advanced skill teacher (AST) brought in to help improve the attainment levels here. The rest of the staff were young people under 30 years of age (mostly NQT).

This school has gone through series of transitions by way of change in school leadership and has being recently judged as "requiring improvement" as many other schools in the area. According to their latest Ofsted reports, the teaching and learning were judged "inadequate" and the school was deemed to require improvement on many fronts. So there was a new leadership in place, a good number of old members of staff had left, new structures were in place, new timetables, mentor groups changed from vertical (years 7-11) to horizontal (individual form groups)clusters amongst other things. Given this context, it meant there was a lot of scrutiny for teachers with termly Ofsted, which could have been some worth unsettling for the pupils.

The Ofsted report states that:

Pupils' rates of progress in mathematics are also improving, but too few are making the rapid progress necessary to reach higher grades. Low-attaining pupils' progress is limited by poor basic numeracy skills. Teachers do not always insist on high standards of presentation. This is especially true in mathematics and science, where untidy and sometimes unfinished work has gone unchallenged. (unreferenced Ofsted report)

The report goes on to state that the school needed to ensure pupils made fast enough progress by preparing pupils well for examinations though regular, realistic practice and revision so they could achieve the grades they should in mathematics, ensuring that pupils' basic skills are mastered from Year 7. In addition, the report highlights the need for teachers to always articulate the highest expectations for what students should achieve in lessons, including the amount and quality of their work including providing a variety of tasks that reflect appropriate challenge for students of different abilities and generate high levels of enthusiasm for learning.

Students' progress (or lack of it) was monitored based on the unit test results, end of year tests and teachers' judgments. These assessments were mostly used to monitor

pupils' performance and to determine which attainment group students would be assigned to. Assessment in mathematics was very informal. After each unit of lessons, a unit test was given within the lesson period. This was a very short test focused on the most recent mathematical topic covered. The reason given for this was that a longer test would be more demanding for these students but it was also easy for the teachers to assess and grade students. A unit test after each topic meant the students did not have to cover much content. One could argue that this idea of making it simplified or easier for these students was not giving them a true picture of what external examinations demanded and it probably failed to stretch the students. Assessment feedback and grades were written on students' scripts, an A5 sized booklet. These summaries suggested areas students needed to work on in that particular topic.

CPS operated a banding system, where pupils are allocated into bands A-C, which is further subdivided into different sets (e.g., C1, C2, C3). Consequently, there were some classes that had very small numbers of pupils.

Mrs Brown had only been in this school (in a leadership position) for a few months but had been teaching for well over twenty years. She came at a point when the school was going through various transitions following a negative Ofsted report. So, she came in to the picture with the demand to improve pupils' performance placed on her shoulders from the start.

Mrs Brown was soft spoken and non-confrontational and often used soft power in the face of misdemeanours, giving pupils choices, hoping they will make the right decision. She explained that she believed that if pupils thought they could make a decision, then they would not feel they were backed into a corner. I could readily see a motherly disposition come across in her interaction with her pupils. Mrs Brown believed so much in showing the pupils respect and told them she expected the same from them. She was very patient with the pupils and was quick to give treats when the pupils met their targets. She reasoned with pupils on several issues and would often model the expected standards of language or behaviour for the pupils who had a foul mouth or not well behaved.

Mrs Brown had a negative view about attainment grouping and was very much in support of having aspirational targets for her pupils despite their attainment levels. In

her gentle manner, she attempted to change the notion of attainment group and its implied hierarchy with the pupils. On one occasion, she categorically told the pupils that they did not have top or bottom sets, all they had were groups. She later explained that even though the pupils knew there was a hierarchy in the grouping pattern, she was not going to reinforce that stance because she understood the injustice it connoted. In her opinion, attainment grouping in mathematics brought about pupils having a negative view of themselves and less confidence in mathematics. She stressed that learning mathematics was about being confident and secure and pointed out what she felt was one disadvantage for pupils in low attaining groups as seen in the excerpt below.

The downside for the pupils in low groups is that they don't get to see examples of good work unlike in History where they have mixed attainment...it's a case of step up and not step down. (Mrs Brown, CPS)

In essence Mrs Brown favoured some form of grouping. Specifically, one where there would be no huge difference but one that allowed groups that worked faster to be together. This suggested to me that Mrs Brown's idea of grouping was based on the speed at which pupils worked and not necessarily their attainment. In other words, there was no room for any pupils to hold up other pupils' learning and so everyone moved at their own pace.

Although this sounded considerate and fair, I still questioned what this would look like in practical terms. I had observed Mrs Brown teach both a higher and a lower set and noticed that the level of challenge and her expectation for the pupils varied with the sets. I am not apportioning any blame here because despite Mrs Brown's ideology about groups, she is not able to resist a process that is enshrined in the system.

Mr Raymond was a young male teacher who trained to be a teacher in the school and had been teaching in the school for about seven years. He came across as an easy-going gentleman with a good sense of humour. He was quite familiar with these students as he had known them from Year 7 and got on well with them. He more or less treated them as if they were contemporaries. He made the students understand they had rights but also had to show some responsibility. However, Mr Raymond stated that he tends to push the pupils along as he felt they could do more.

5.4 Research participants - pupils

The groups in CPS had fewer pupils compared to PLS where there were twice as many students in each group. This influenced the number of pupils selected in each school.

The following synopses are included in this thesis because they introduce the students who participated in this research; they provide background and context to their experiences of learning and teaching in LAMGs. I have included their stories within this thesis and not as an appendix because these pupils and their experiences have played a major role in the production of this thesis, but also so the reader can get a strong sense of the people this research is about.

Table 3.3 Research participants, teachers and their groups

School	Teacher	Group	Pupils
CPS	Mrs Brown	10B	Jess Len ³ Jake*
	Mr Raymond	11R	Amy Phil John
PLS	Mr Gregory	10G	Bob Nick Sharon Aisha Charlotte Brenda
	Miss Freeman	10F	Zac Jamie Jackie Catherine Awais Shasha

³ * Pupils data not available due to permanent exclusion from school

Jess (CPS) was a courteous young girl (greeted teachers and myself with a smile) who lived with her grandmother and her three siblings in a 3-bed house. She had a troubled past with her biological parents who were now separated and were not allowed anywhere near her or her siblings (this is an example of the difficult lives some pupils manage alongside schooling demands). She feels bad that her friends have dads or in her words, 'someone to call dad'.

She wanted to do well in school and in mathematics (even though she had struggled in mathematics in primary school). She made notes in class, asked questions and was often bold enough to call the class back on track when there was a slip into off task activities. She was nervous now GCSE was around the corner because she did not really get mathematics. She was starting an apprenticeship in hair dressing and loved that she could get paid whilst also learning.

Amy (CPS) lived with both her parents. Her mum was a cleaner while her dad was her sister's carer. Amy admits that mathematics has always been hard for her. She had been moved down from 'A' band to 'C' band. She claimed she used to mess about '...because I didn't understand what he was saying... I just like lose focus a lot ...I just don't understand it so I switch off'. She could not describe one lesson she had enjoyed. Amy is certain she wants to go to Music school. She was sure she needed a qualification in English but not necessarily in mathematics.

John (CPS) lived with both his parents. His mum worked as a cleaner in a children's play centre and his dad worked in a car garage and was also a full-time care-giver for his autistic sister. John loved spending time with his family and loved listening to music. He had struggled with mathematics all through primary school but the situation got better in secondary school. According to him, he was now a much-focused pupil. For instance, when asked what needed to change in mathematics class - he reasoned that 'teachers should be stricter with the children so they know their place and that they have to listen'. Also, John was of the view that he could go far in life to get the job that he wanted if he carried on putting his head down like he was doing.

He was hoping to go to either work in a hotel or take up street dancing. However, he later got an offer to study hospitality in the local sixth form. In addition, he was also

starting part-time work at a supermarket. John maintains that if he did not pass mathematics and English, he will do it again. In John's words; 'I want to build my CV so I can go forward to get bigger jobs in higher places. I want to get a C so I can get a job.'

Phil (CPS) lived with his parents. His mum was an Estate agent whilst dad worked in the maintenance unit at the local university. Phil reports that mathematics has been hard because he did not really get it. He attributed his difficulty to a faulty foundation in primary school where he believed mathematics was not taught well. However, all that changed in Year 9 when he realised that in 2 years he would be in Year 11 and 'like you've got to get your grades and think you need to start getting better at maths because it's one of the main grades you need other than English or Science'. Phil had been in 'A' band before and dropped down to B and then C. He claimed this was because he used to mess around in English in the previous year and got bad grades so they moved him down. Phil was planning to go on to study Engineering at the university.

Jamie (PLS) lives with his parents. Mum used to be a manager at a care home but had to stop to care for his grandmother who had now passed away. His father used to be a plumber in the army. He was the younger of two; his sister now lives and works in London. He hopes to join her shortly as he felt there were no viable opportunities locally. For leisure, Jamie played cricket and football. Jamie loved mental mathematics in primary school because it was quick. Year 10 was his worst year so far because he felt the group was wrong. He missed his previous Year group and teacher who knew how to get him to focus and remain on task and avoid day dreaming. Jamie was not really happy in this group and he missed his friends too.

Jamie wants to go to college to study Sports, business and marketing. He knew he needed 5 A-C but was not sure he needed mathematics. He preferred college because he wanted something practical, with coursework. He claimed he knew people who had dropped out of Sixth form after a year because it was too hard. He did not want to do the same because if he dropped out after a year, it will be a waste of his time.

Shasha (PLS) is one of five children. Her father is a cab driver, whilst her mother is a full-time housewife. Her older siblings were either working or managed their own businesses. At the start of secondary school, she never found mathematics

challenging, it just came, if she listened, she understood but felt it was just a bit more complicated now. Shasha pointed out that previously, she did not focus in class because she just never thought it mattered. But now she does the worksheets and all that is given to her because she now knows it matters as the teachers push them and say it matters. But Shasha claims this was not the case in Year 10, especially in mathematics. According to Shasha, Miss Freeman never sat down and said to them, 'this is important'. She never did any of that so it didn't real seem important. Shasha has no clue what she wants to do next but is certain she wants to go to college and then university.

Zac (PLS) lived with his grandparents. His mum had passed away and his dad lived in another city. So he only got to see him occasionally. Zac likes to ride to school alone, on his bike, as he liked to get to school early. He also loved playing football. He has never really liked mathematics. But he states, 'you just have to do it, so I do it'. He did not like tests or any work that meant he had to sit for long as he described himself as an active person. Zach did not get on well with his Year 10 teacher because he felt she could not handle the class. However, Zac loved interactive lessons where there was engaging games incorporated into lessons. Zac did not feel he was in the right attainment group and this made him quite upset. He wanted to study Sports and travel. He knew he needed at least a C in English and he was certain he was going to get that anyway. He claimed he did not even need science. In relation to mathematics, he opines 'but obviously every job you need maths ... so I think I need maths'.

Jackie (PLS) shuttles between her parents' homes as they had only recently been separated. She attends dance and drama classes. Jackie had been moved down a set because she had gone on holiday for a while and had fallen behind. She was not happy with her attainment group because she claims the teacher was not the best and as a result, the whole class had dropped and were under achieving. She also receives extra tuition outside school and claims she has friends in Sixth form who can help her catch up on lost grounds. Jackie wants to go to university to get her qualifications like her older brother.

Sharon (PLS) lives with her mother who is a qualified nurse. She has two younger sisters, who she claims perform much better than her in mathematics. She occasionally visits her father who is an engineer.

According to Sharon, at some point in Year 9, *'I didn't care about school, I just woke up and went to school, did the barest minimum for my homework...really didn't care. I didn't feel motivated...it was a phase I was going through. Mum gave a serious talk...teachers constantly tell you if you want a good job you have to do well in GCSE'*.

For Sharon, mathematics has always been a big barrier and she has never quite understood it; a situation that terrifies her as her GCSEs approach. 'Maths...I've got mixed emotions...I feel like I will get the 'C' but what happens if I get in and can't ask any questions about something I don't understand?' Sharon worries that her results will determine whether she goes to university or not. Sharon plans to do nursing or midwifery at the university. She is very aware of the entry requirements for this course and wants to do her best to succeed.

Nick (PLS) lives with his mother who runs her own business. He volunteers in a care home (after doing his work experience there) and enjoys it as it helps him with his Health and Social coursework. Nick describes mathematics as complicated and regretfully expresses that he does not get it even when he tries. Nick has been moved down a set because according to him 'I have missed bits...last year I was higher and then because I missed school because of my operations, it's just been quite stressful to get back learning it all'. Nick wants to be a nurse and understands that he needs to pass mathematics to achieve this. So, he states, 'even though I hate maths I've got to get my head round it'.

Charlotte (PLS) is the youngest of three children and wants to be a primary school teacher. She lives with both parents who are both self-employed. She has always found mathematics difficult and in Year 9, she missed a lot of learning because she had to go to hospital regularly because of a medical condition. As a result, she is a little bit lower than she should be. Consequently, she has had to come in the mornings to do some practice. In relation to her attainment group, she reports that it annoys her sometimes when she gets her test back, 'It's annoying because like I want to get a C and I was predicted an E, I am sick of being in the lower, I wanna be in higher set'. Charlotte also complained about the pace of the lessons and the content covered, saying she wanted it 'a bit slowed down and make sure we are not learning so much in one day and make sure we taught it like at least a week or two to make sure everyone has got it instead of going out of the classroom still like confused'. She was adamant she wanted to do well in mathematics for her to achieve her goal as

suggested when she stated, 'That's why I like to come in the mornings now but if I could do any more days, I would because I really just need to get that C otherwise I wouldn't be able to do anything'.

Aisha (PLS) lives with both her parents. Her mother works with health visitors and social workers and her father owns his own business. She has never really liked mathematics. She confirms that she enjoys mathematics when taught the 'old fashioned way' (e.g. flow charts). She enjoys mathematics when it is easy but also loves to have a challenge. She maintains that mathematics taught in school has to be relevant in reality and insists that some of what she is taught is not necessary (i.e. Algebra). Aisha is not sure what she wants to be in future but she wants to go to college.

Awais (PLS) has an older sister who is an accountant and two other younger sisters. He lives with his mother who expects him to work hard in order to get moved up in his attainment group. Awais is a diligent pupil who was always focused in lessons and completed tasks given. He explains that his learning in mathematics was impacted by a period when he did not have a 'proper' teacher but had a string of substitute teachers. He enjoys it when mathematics lessons are not disrupted as much because he gets a bit frustrated because the teacher keeps having to stop. He is not very happy in his mathematics group because he feels he was working below his 'ability' and also, there were a few pupils in the group who often messed around and disrupted the lessons. In relation to the mathematics taught in school, Awais says, 'Certain topics I would say would help but like algebra you may need that in certain career but If you don't want to go into that, then maths doesn't real help at all'. He plans to study engineering at university.

Bob (PLS) is one of six children and lives with both of his parents. He describes his mother as 'smart', she works with the disabled. He informs me that his father never went to school. He did not really like or enjoy mathematics but he liked mental mathematics. For Bob, it was important for him to like the teacher; otherwise he would not do the work. This was significant because Bob had just been moved down a set, a situation that made him feel 'stupid'. He was very displeased about the move as he was not told why, but he liked his new teacher and they got along well. Bob had not given a lot of thought to what he wanted to do next but he wanted a 'C' in

mathematics so he could go to college and not have to retake the examination. He was certain mathematics is needed for every job.

Catherine (PLS) has a younger brother and sister and lives with her mother who is an accountant. She plays tennis every Monday. She believes pupils should be challenged earlier rather than later because the pressure is a lot more in Year 11 and then puts people off especially when they realise they have the GCSEs before them. Catherine tends to be a perfectionist as seen in the way she describes her work in mathematics, 'I find if I don't understand, I just give up which is not the best thing to do. If I can't do something, it is the same thing when I draw... I just rip it up straight away. I just give up if something goes wrong'. She finds doing negative numbers in mathematics easy and says, 'It being easy is making me not give up which is good'. Catherine loves to be in the same attainment group with her friends (who happen to be in higher groups) because she believes friends help you learn and not distract you as is commonly claimed. She hopes to study philosophy, physics and mathematics at college.

Brenda (PLS) lives outside the catchment area of her school and so has to get the bus to school. Her mother is a housekeeper whilst her father does odd jobs. Brenda feels mathematics can sometimes be hard depending on the topics. Her problem stems from the fact that she gets taught different ways of doing a particular topic and then does not know which to follow and as a result she gets easily muddled up. Brenda does well in lessons and often finishes before everyone else. She claims she knows what she is expected to do but tends to forget these under test conditions. She wants to go to college and later work with disabled children or go into hair dressing.

5.5 Summary

This chapter has laid out the scene for the remainder of this thesis. It has introduced the two schools, PLS and CPS, and their respective mathematics departments, highlighting the differences between them in terms of their geo-demographics, GCSE performance league tables, Ofsted reports and particular circumstances.

PLS is an over-subscribed academy with roughly 40% from a broad range of different ethnic heritages. It is situated in an affluent area of the city and is highly rated on the

performance league table. In contrast, CPS has majority of pupils from white British backgrounds whilst other pupils come from a number of minority ethnic groups. It is largely situated in a working-class area and ranks low on the GCSE performance league table. Both schools operate different attainment grouping structures.

The synopsis of each pupil offers an insight into their background which is pivotal to this research and their experiences provide the backdrop to the analysis in the next two chapters. These chapters will illustrate the similarities and differences that emerge between the two schools and how these and other factors shape students' experiences of the teaching and learning of mathematics in LAMGs.

The following analysis traces three perspectives particularly, to allow for comparison: across the Year group in the form of surveys; pupils' experiences in LAMG in the form of lesson observations and interviews.

6. FINDINGS

Students' experiences of the teaching and learning of mathematics within classrooms in schools invariably involves two distinct dimensions; firstly, what students bring with them in their virtual school bags (Thomson, 2002) and secondly what mathematics does or gives to students. Hence, within the next two chapters, several aspects surface as crucial elements to consider in relation to pupils' experience of the teaching and learning in LAMGs and the specific research questions. This will involve both the quantitative and qualitative elements of the study.

In this chapter, descriptive analysis of the quantitative aspect of the research study is presented alongside emerging themes from the survey results. In Chapter 7, I present within-case analysis in the form of class portraits to explore variations in pupils' learning experiences in mathematics education and significant factors that influenced these experiences. This is followed by a cross-case analysis of the themes that have emerged from the full width of the study, which is presented in Chapter 8. Subsequently, in Chapter 9, the findings are discussed in the light of literature and the research questions.

6.1 Introduction

In this section, I present findings from the quantitative aspect of the study which includes a descriptive analysis of the survey that captures pupils' perspectives about their experiences of the teaching and learning of mathematics in LAMGs across both schools. In the next section, I provide a brief summary of broad themes emerging from the analysis of the survey.

6.2 Questionnaire Results

6.2.1 Pupils' Perception of Teacher Quality

Pupils' perceptions about the quality of the teaching they experienced in mathematics across the two schools was captured using a survey. Pupils' responses were on a four-point scale (strongly agree, agree, disagree and strongly disagree), indicating the perceived quality of the mathematics teacher. The results (shown in Table 7- next page) from the study show that of the five dimensions of teacher quality examined, "My teacher knows the subject well" and "my teacher helps if I don't understand something" rank top respectively for pupils in HAMG in both schools as well as for those in LAMG in PLS and CPS. These two items appear to be the most demonstrated qualities according to pupils' perceptions. On the other hand, "My teacher gets me interested" ranks lowest across all attainment groups and across both schools. This appears to be the least quality demonstrated by teachers as perceived by the pupils. This suggests that this is an important issue in mathematics teaching and learning within and across the two schools.

Table 7: Pupils Perception of Mathematics Teacher Quality by their Attainment Group and School

Teacher Quality Items		PLS		CPS		Total	
		N	Mean	N	Mean	N	Mean
HAMG	My Teacher knows subject well	104	3.76	68	3.43	172	3.63
	My Teacher explains well	104	3.27	67	2.93	171	3.13
	My Teacher gets me interested	103	2.95	68	2.50	171	2.77
	My teacher helps if I don't understand something	104	3.36	68	3.16	172	3.28
	My teacher gives feedback on how I am doing	103	3.02	68	3.10	171	3.05
LAMG	My Teacher knows subject well	21	3.38	19	3.58	40	3.47
	My Teacher explains well	21	3.14	19	3.00	40	3.07
	My Teacher gets me interested	21	2.90	18	2.78	39	2.85
	My teacher helps if I don't understand something	21	3.38	18	3.44	39	3.41
	My teacher gives feedback on how I am doing	21	3.05	19	3.00	40	3.03

HAMG = High Attainment Group; LAMG = Low Attainment Group

At the school level analysis, $t(206) = 2.48$, $p = 0.14$ showed that perception of teacher quality in PLS was significantly better than that of CPS (PLS = 16.29; CPS = 15.27).

Table 8: Mean and Standard Deviation Scores of Teacher Quality based on pupils' attainment group and school

	PLS			CPS			Total		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
High Attainment Group	16.38	103	2.74	15.09	67	2.98	15.87	170	2.90
Low Attainment Group	15.86	21	3.15	16.00	17	3.26	15.92	38	3.16
Total	16.29	124	2.81	15.27	84	3.04	15.88	208*	2.94

*n <241 due to missing data

An independent samples t-test comparison of perception of teacher quality based on pupil attainment group $t(209) = -.09, p = .924$ showed no significant difference (HAMG = 15.87, LAMG = 15.92). This element would not be attributed to socioeconomic backgrounds only and needs some explanations. Arguably, the sample size could have influenced the means obtained in this case but the issue here is that across both attainment and school levels, the element of disinterest is widespread.

6.2.2 Pupil Engagement

Based on Table 9, the top characteristic of the pupils' mathematics lessons for pupils in HAMGs in both schools was 'my maths lessons *have no connection to anything*'. The perceptions of HAMG in PLS also showed their maths lessons were interesting; however, there was a big contrast in terms of 'My maths lessons are interesting' which ranked very low among HAMG in CPS.

This same pattern was found among LAMG in both schools as shown by the top position of "maths lessons have no connection to anything" as rated by LAMG in both schools and the difference in perception of "my maths lessons are interesting". This suggests that making mathematics lesson meaningful and interesting is an issue for both high and low attaining pupils.

Across both schools and all attainment groups, my maths lessons *have no connection to anything* stands out as one element that pupils used to characterise their learning experience.

Table 9: Pupils Perception of Mathematics Engagement by Attainment Group and School

		PLS			CPS			Total		
		N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
HAMG	My maths lessons have no connection to anything	101	2.93	1st	67	2.84	1st	168	2.89	1st
	My maths lessons have some real-world connections	102	2.88	2nd	66	2.65	2nd	168	2.79	2nd
	My maths lessons are interesting	104	2.93	1st	65	2.4	5th	169	2.73	3rd
	My maths lessons have too much content (stuff) to learn	101	2.56	3rd	67	2.43	3rd	168	2.51	4th
	My maths lessons are fairly easy	101	2.47	4th	68	2.41	4th	169	2.44	5th
	My maths lessons are sometimes too difficult	103	2.42	5th	66	2.36	6th	169	2.4	6th
LAMG	My maths lesson have no connection to anything	19	2.84	1st	17	2.88	1st	36	2.86	1st
	My maths lessons have some real-world connections	19	2.84	1st	18	2.78	2nd	37	2.81	2nd
	My maths lessons are interesting	19	2.68	2nd	19	2.42	4th	38	2.55	3rd
	My maths lessons are fairly easy	19	2.53	4th	19	2.58	3rd	38	2.55	3rd
	My maths lessons have too much content (stuff) to learn	18	2.28	5th	16	2.19	5th	34	2.24	4th
	My maths lessons are sometimes too difficult	19	2.21	6th	19	2.11	6th	38	2.16	5th

HAMG =High Attainment Group; LAMG = Low Attainment Group

Table 10: Mean Scores of Pupil Engagement in Mathematics based on pupils' attainment group and school

	PLS			CPS			Total		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
HAMG	16.18	94	2.37	15.09	64	2.44	15.74	158	2.45
LAMG	15.39	18	1.61	15.07	15	2.49	15.24	33	2.03
Total	16.05	112	2.28	15.09	79	2.43	15.65	191*	2.39

*n <241 due to missing data.

The data in Table 10 shows the possible values which vary between 6 and 24, mean pupil engagement score for pupils in HAMG was 15.74 while that of LAMG was 15.24. The high attainment group had slight higher score within the two schools. From the school level analysis, mean pupil engagement score was 16.05 for PLS and 15.09 for CPS. These show high mean differences for high attainment group and PLS respectively. However, while a t-test analysis comparison of pupils' engagement based on maths attainment did not show any significant difference between the two groups, the comparison based on school revealed that pupils from PLS was significantly more engaged in mathematics lessons than those in CPS.

Table 11: Percentage Responses by Pupils' on How Well they Doing in Maths, English and Science

School		Maths	English	Science
		N (%)	N (%)	N (%)
PLS	Poorly	4 (2.9)	-	1 (.7)
	Not too well	22 (15.8)	9 (6.5)	17 (12.2)
	Well	82 (59)	68 (48.9)	84 (60.4)
	Very Well	28 (20.1)	59 (42.4)	34 (24.5)
	Missing	3 (2.2)	3 (2.2)	3 (2.2)
	Total	139(100)	139(100)	139(100)
CPS	Poorly	8(7.8)	2(2)	10(9.8)
	Not too well	27(26.5)	21(20.6)	30(29.4)
	Well	51(50)	62(60.8)	48(47.1)
	Very Well	13(12.7)	14(13.7)	11(10.8)
	Missing	3(2.9)	3(2.9)	2(2.9)
	Total	102(100)	102(100)	102(100)

Data in Table 11 shows the percentage responses of pupils on how well they feel they are doing in mathematics, English and Science. For Mathematics, in PLS, 18.7% of the pupils were of the view that they were doing either "poorly" or "not doing too well", while 34.3% belong to this category in CPS. In English, no pupil reported doing poorly in English and only 6.5% reported not doing too well in PLS, whilst 22.6% of the pupils in CPS reported either doing "Poorly" or "not too well". On how well they

are doing in Science, 12.9% reported doing "poorly" or "not too well" in PLS, in contrast, in CPS, it was 39.2%. These show that the greater proportion of the pupils reported not doing well in mathematics (and science) were from CPS. This personal report data arguably, indicates something about self-perception and not actually attainment. However, self-perception is a key element in performance.

6.2.3 What will help you do better in Maths?

What follows is a presentation of pupils' views of what will help them do better in mathematics which reflected what pupils described as preparation for life outside school. The results suggest that it was important to pupils that they had more time to ask questions. This particular element was critical to understanding concepts taught and confirmed pupils' reports (from interviews) of lessons being rushed and covering a lot of content. The result in Table 12 show mean responses of high and low attaining groups on what they feel will help them do better in maths. Using mean value of 2.50 ($4+3+2+1=10/4$) as acceptance cut-off point, the high attaining group in PLS are of the view that six out of the seven listed possible strategies will help them to do better. In the order of extent agreement, the three most endorsed strategies include; less content (stuff) to cover (Mean = 2.83), more practical applications (Mean = 2.81) and clearer reasons for doing some topics (Mean = 2.79). However, they disagreed that more opportunities to ask questions will help them do better in Maths.

Table 12: Responses by pupils on 'What will help you do better in Maths?'

	PLS			CPS			TOTAL			
	Number	Mean	Rank	Number	Mean	Rank	Number	Mean	Rank	
HAMG	Clearer reasons for doing some topics	105	2.79	3rd	68	3.12	2nd	173	2.92	1st
	More practical applications	105	2.81	2nd	68	2.96	3rd	173	2.87	2nd
	More individual attention	105	2.7	5th	68	3.07	1st	173	2.84	3rd
	Less content (stuff) to cover	105	2.83	1st	68	2.79	5th	173	2.82	4th
	More feedback from teachers	105	2.71	4th	68	2.81	4th	173	2.75	5th
	More discussion of assessment tasks	105	2.51	6th	68	2.78	6th	173	2.62	6th
	More opportunities to ask questions	105	2.45	7th	68	2.63	7th	173	2.52	7th

LAMG	Clearer reasons for doing some topics	21	1.9	5th	19	2.74	1st	40	2.3	1st
	More feedback from teachers	21	2.1	1st	19	2.53	2nd	40	2.3	1st
	More opportunities to ask questions	21	2	3rd	19	2.42	3rd	40	2.2	2nd
	More individual attention	21	1.95	4th	19	2.37	4th	40	2.15	3rd
	Less content (stuff) to cover	21	2.05	2nd	19	2.21	7th	40	2.13	4th
	More practical applications	21	1.95	4th	19	2.32	5th	40	2.13	4th
	More discussion of assessment tasks	21	2	3rd	19	2.16	6th	40	2.08	5th

Rankings 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree = 4

High attaining group in CPS were of the view that all the listed possible strategies will help improve their learning in mathematics. For them, clearer reasons for doing some topics (Mean = 2.92), more practical applications (Mean = 2.87) and more individual attention (Mean = 2.84) are the three most favoured strategies that will help them do better in maths. In contrast, the low attainment groups in the two schools did not have a clear consensus on the listed possible strategies that will help them do well in Maths. However, they have a common agreement that they would benefit from 'more feedback from teachers'.

6.2.4 Pupils' Response to teaching and learning

The responses in Table 13 show the rank order of pupils' perceptions of their mathematics teachers' pedagogical practices based on their mean scores. The top three pedagogical practices of mathematics teachers as perceived by the pupils in HAMG in both schools were teacher-centred pedagogies. This was also the same for pupils in LAMG in both schools, the top three pedagogical practices were all teacher-centred practices (The teacher shows us which method to use, then asks us to use it and Asks us to work through practice exercises and Tells us which questions to do). However, for the low attaining group in PLS, one pupil-centred pedagogical practice, namely; expects us to learn through discussing ideas was highly ranked (interestingly this particular variable did not tally with what was observed, which could indicate an internalisation of a discourse the pupils have been presented with).

Table 13: Pupils' Perception of Mathematics teaching and learning by Attainment Group and School

		PLS			CPS			TOTAL		
		N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
		HAMG	(T) Shows us which method to use, then asks us to use it.	102	4.13	1st	67	3.88	2nd	169
(T) Asks us to work through practice exercises	103		3.93	2nd	68	3.87	3rd	171	3.91	2nd
(T) Tells us which questions to do	93		3.62	3rd	67	3.9	1st	160	3.74	3rd
(T) Tries to prevent us from making mistakes by explaining things carefully first	100		3.5	4th	67	3.43	6th	167	3.47	4th
(T) Expects us to follow the textbook or worksheet closely	97		3.45	6th	66	3.5	6th	163	3.47	4th
(T) Shows us just one way of doing each question	93		3.33	7th	68	3.59	4th	161	3.44	5th
(T) Expects us to work mostly on our own, asking a neighbour from time to time	102		3.28	8th	68	3.56	5th	170	3.39	6th
(S) Encourages us to make and discuss mistakes	94		3.16	9th	68	3.43	6th	162	3.27	7th
(S) Expects us to learn through discussing our ideas	95		3.03	10th	66	3.17	8th	161	3.09	8th
(S) Shows us how different maths topics link together	14		3.14	11th	16	3.31	6th	30	3.23	9th
(S) Allows us choose which questions we do.	101		3.01	11th	66	3.08	10th	167	3.04	10th
(T) Jumps between topics as the need arises	92		2.65	15th	66	3.21	7th	158	2.89	11th
(S) Asks us to compare different methods for doing questions	101		2.89	14th	68	2.76	11th	169	2.84	12th
(S) Asks us to work in pairs or small groups	94		2.9	13th	67	2.7	12th	161	2.82	13th
(S) Allows us create and use our own methods	95		2.53	5th	67	2.34	13th	162	2.45	14th
LAMG	(T) Shows us which method to use, then asks us to use it	13	3.92	1st	16	4.06	1st	29	4	1st
	(T) Asks us to work through practice exercises	14	3.64	2nd	16	4.06	1st	30	3.87	2nd
	(T) Tells us which questions to do	13	3.46	6th	16	4.06	1st	29	3.79	3rd
	(S) Encourages us to make and discuss mistakes	14	3.36	8th	16	3.81	2nd	30	3.6	4th
	(T) Expects us to learn through discussing our ideas	14	3.57	3rd	15	3.33	5th	29	3.45	5th
	(T) Tries to prevent us from making mistakes by explaining things carefully first	14	3.29	9th	16	3.5	4th	30	3.4	6th
	(S) Asks us to compare different methods for doing questions	13	3.38	7th	16	3.31	6th	29	3.34	7th
	(T) Shows us just one way of doing each question	14	3.21	10th	16	3.31	6th	30	3.27	8th
	(S) Asks us to work in pairs or small groups	14	3.5	5th	16	3.06	9th	30	3.27	8th
	(T) Expects us to follow the textbook or worksheet closely	14	2.93	13th	16	3.5	4th	30	3.23	9th
	(S) Allows us choose which questions we do	14	3.36	8th	14	3.07	8th	28	3.21	10th
	(T) Jumps between topics as the need arises	13	3.08	12th	16	3.19	7th	29	3.14	11th
	(S) Allows us create and use our own methods	13	3.15	11th	16	3	9th	29	3.07	12th

The first column in the table indicates whether these items are more student (S) or teacher (T)-centred. Ratings 1 = almost never, 2 = occasionally, 3 = half the time, 4 = most of the time, 5 = almost always.

Generally, this result shows a greater occurrence of teacher-centred (T) practices across all groups as evidenced in other studies. This to an extent could explain the lack of interest and engagement of students in mathematics classrooms where students are not given any form of autonomy with respect to their learning.

Table 14: Mean and Standard Deviation Scores of Mathematics Teaching based on Pupils' attainment group and School

		PLS			CPS			Total		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
Teacher-Centred Pedagogy	Higher Attainment Group	27.87	90	4.61	29.06	63	4.66	28.36	153	4.65
	Low Attainment Group	26.55	11	6.56	29.38	16	5.16	28.22	27	5.83
	Total	27.72	101	4.83	29.13	79	4.73	28.34	180*	4.83
Pupil-Centred Pedagogy	Higher Attainment Group	20.60	93	5.28	20.37	62	6.24	20.51	155	5.66
	Low Attainment Group	23.62	13	5.88	22.08	13	7.69	22.85	26	6.75
	Total	20.97	106	5.42	20.67	75	6.49	20.85	181*	5.87

*n < 241 due to missing data

It is interesting to note that the low attaining groups recorded a higher overall mean for pupil-centred pedagogy since this did not align with what was observed or reported in interviews with pupils.

Similarly, the boxplot (Figure 6) shows pupils' perception of the level of pupil-centred pedagogical practices they experienced based on attainment group.

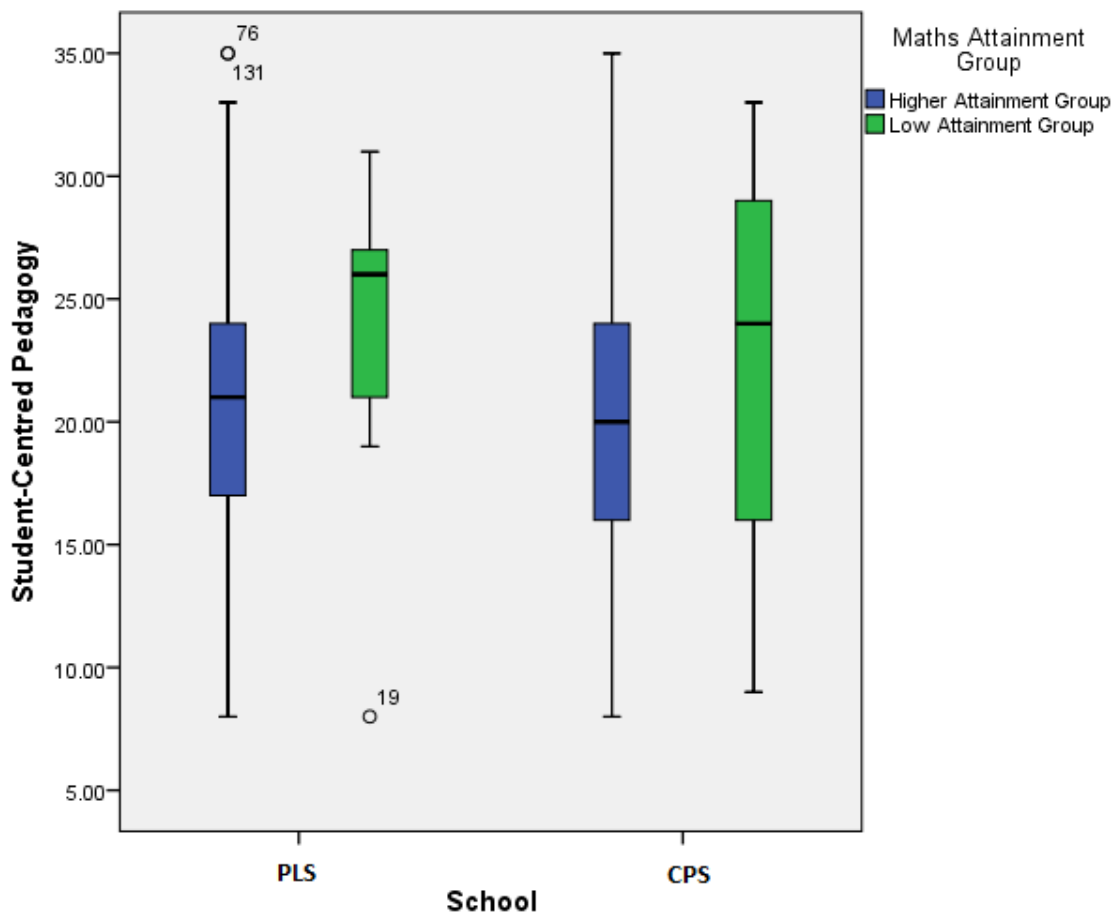


Figure 6: Boxplot showing composite mean pupil-centred pedagogy based on school and attainment group

The boxplots suggest that there is not much difference between the schools. There may be barely any issues for the HAMGs which report low levels of student-centred practice; these pupils are able to get on with the work. However, there appears to be more pupils at the lower end in the case of LAMGs, this situation supports the need to look at LAMGs where pupils often get a restricted diet of mathematical content. Even though these schools are close together, it makes no difference to the pupils in LAMG, particularly in PLS, where pupils appear to fare better by virtue of being in this school.

6.2.5 Pupils' perceptions of parental support

School level results show that pupils in PLS reported greater parental support than those in CPS. Although these results do not show the specifics of what parental support comprises, it is undoubtedly connected to the parental values and the socioeconomic resources (capital) at their disposal.

Table 15: Pupils' perceptions of parental support based on Maths attainment group and school

	PLS			CPS			Total		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
HAMG	8.36	85	1.56	8.13	68	1.95	8.26	153	1.74
LAMG	9.00	10	1.05	7.25	16	1.73	7.92	26	1.72
Total	8.43	95	1.52	7.96	84	1.94	8.21	179	1.74

On a scale of 3 to 12, pupils' perception of their parents' support was 8.26 for HAMG and 7.92 for LAMG. This suggests that high attaining pupils enjoyed greater support from their parents compared to pupils in LAMG. However, it is interesting to note that the difference is so small and insignificant.

6.3 Similarities and Differences between the schools

The school-level results have demonstrated a number of trends. 'My teacher gets me interested' ranked lowest across both schools. This is closely linked to 'Clearer reasons for doing some topics' noted to be a significant step that would help pupils. These two variables feed into each other and along with the view that 'My maths lessons have no connection to anything' could indicate that pupils did not perceive the **relevance** of what they were doing in mathematics.

Similarly, three main characteristics that describe the teaching styles in both schools are, my teacher:

- Shows us which method to use, then asks us to use it;
- Asks us to work through practice exercises;
- Tells us which questions to do

These three variables do not involve pupils making any form of contribution to their learning and could therefore explain their disinterest to some extent. The results substantiate the negative responses (Boaler *et al.*, 2000b; Nardi and Steward, 2003) given by pupils which indicated a lack of variety and the boredom experienced in mathematics lessons.

At attainment-level, the results have shown that, pupils in LAMGs across both schools are both agreed that,

- My maths lessons are sometimes too difficult;
- My maths lessons have too much content (stuff) to learn (this element also applied across both schools)

These descriptions have severe consequences for pupils' attitude and eventual outcomes depending on how they decide to respond to these demands.

Furthermore, in response to 'what will help you do better?' they maintain that 'More feedback from teachers' and More opportunities to ask questions (but time is a constraint) will make a difference, which may indicate engagement at some level. Also, the variable *more practical application* which ranked highly could also suggest the influence of pupils' social backgrounds (Dowling, 2002).

In contrast, pupils in PLS (HAMG and LAMG) reported that their 'maths lessons are interesting' the reverse was the case for pupils in CPS. In addition, pupils in CPS according to the results felt they were not doing well in mathematics. An explanation may be deduced when the mean of this variable is compared with the mean of the pedagogical practices experienced within the different schools. This could imply that it matters which class or set you are in (Noyes, 2012; Opdenakker et al., 2002; William and Bartholomew, 2004).

Finally, the small difference recorded based on the parental support enjoyed by pupils between and within schools and attainment groups could suggest the presence of other influences on pupils' experiences but does not clearly portray the difficult lives of individual pupils.

The next chapter present the four case study classes and highlight the distinct nature of pupils' experiences within these classes. This includes examining the nature of tasks pupils were asked to do and how they responded to the various demands placed on them. Teachers' dispositions and pedagogical styles have been portrayed, as well as pupils' perspectives about their experience.

7. CLASS PORTRAITS

Classrooms are complex places with varied dimensions (Doyle, 2006; Good et al., 1987) and can be understood from multiple perspectives, with varied interpretations and even conclusions about what was observed. These are often coloured by the observer's past experiences, biases and prejudices and so requires a reflexive stance. In this chapter, I present the qualitative aspect of my findings in the form of four class reports - 10R and 10F (both in PLS) and 10T and 10R (both in CPS). These reports presented in the form of portraits are used to demonstrate the concepts within Bourdieu's model and how it was applied in the context of students in LAMG. Therefore, in presenting these case reports I am concerned to show

- The nature of mathematics as a social field which connects it to political and economic systems.
- How pupils' experiences are products of the undetected structuring fields derived from the combination of their particular attainment group context, the schools and their social backgrounds.
- The resulting dispositions and perspectives of pupils

The class portraits include classroom observational data and pupils' narratives drawn from interview extracts. These portraits are meant to reflect how the strategies of the habitus seen in classroom disposition to learning mathematics are related to those originating from outside the immediate classroom context as well as the structuring influence of the field of mathematics education and their mathematics group.

7.1 Introduction

The class portraits include classroom observational data and students' views drawn from interview extracts. Some of the extracts are lengthy in order to retain the flow of connected ideas. Different aspects of students' and teachers' narrative accounts have been highlighted and have therefore, required that in some instances the extracts are fragmented where relevant.

Each class portrait is sub-divided into three parts.

- Part 1 - Brief descriptions of the classroom interactions
- Part 2 - Pupils' reflections on their experiences within LAMGs
- Part 3 - A review of the case

Subsequently, I present snapshots of these pupils' experience of learning mathematics within their respective classes.

7.2 10G mathematics group (PLS)

This was a GCSE foundation tier Year 10 class. There were sixteen pupils (7 boys and 9 girls) with varied ethnicity in this class; Black British, others with black background; white British; mixed background, white and Asian; Pakistani. The majority of these pupils had English as their first language.

Mr Gregory their teacher welcomed his pupils at the door. He was quick to enquire about any pupils who were not present for his lesson. His class filed into the classroom and sat down to work without much conversations or time wasting.

Entering into Mr Gregory's classroom, his table was in front, right next to the white board and pupils' chairs were arranged in groups around tables, with the result that some pupils had their back to the board or needed to turn to the side to view the board. Whilst there was a seating plan in place, I observed the pupils did not hesitate to check each other's work when they needed clarification and generally the pupils appeared to get along well. There was that quiet sense of purpose that signalled that pupils understood what was expected from them in this class.

Most times students got a copy of the lesson starter as they got ushered into class, allowing a smooth start to the lesson as shown in the excerpt from my field notes below.

The bell has just gone, pupils lined up in front of their classrooms; this is a mathematics foundation exam class. The teacher greets them at the door, ready with starter to hand out. Students settle down quickly to do the starter activity. The teacher gives prompts to help students get the task at hand after which a whole class review is done. The lesson objective is explained and the curriculum level of the topic is given. Students are advised to take notes into reference books. So, each student had a plastic wallet of books for maths lessons; a reference book, a notebook and possibly homework book. The teacher illustrates the lesson objective with selected examples and the students are set a task to complete. The teacher goes around supporting where necessary.

This was the basic routine in every lesson; you line up, come in and get down to work. This suggested that the students had been trained to follow the rules (they knew the routine) and understood the consequences of doing otherwise. The starter activity distributed at the door could be seen as a strategy for managing effective transitions and signalled for students the acceptable work ethic operational in Mr. Gregory's classroom. There was a huge sense of order and clear expectations laid out for the students.

Most of the lessons followed the 'three-part lesson' structure customarily seen in schools in the UK. After the starter, the lessons continued with a presentation on the interactive white board, showing students sample questions and the methods, they were going to use during individual work even when they were sat in pairs or groups. On few occasions, I heard pupils comparing their answers quietly. Mr Gregory had Power Point slides prepared for every lesson. He asked a lot of questions in an attempt to engage pupils. Most times these questions were closed and procedural and it was mostly the same pupils that proffered answers to questions. The pupils in Mr Gregory's class were always prepared to do the task assigned to them after the whole class presentation of lesson objectives and worked examples showing methods and procedures. The tasks were paper-based and such that required the pupils to apply

the methods they had learnt from the whole class session. According to Mr Gregory he did not like using textbooks except when the text showed pupils the GCSE levels so that they knew what was required to make progress and what made this question more challenging than the other. He would always come to lessons with his own prepared worksheets with lesson objectives, levels indicated and adequate space for annotations which was mostly pupils copying down what the teacher had just said or what the teacher said to note was important.

The students each had two note books for mathematics- a reference book for personal notes or pasting teachers' notes and worked examples and another for class and homework (this was a departmental tradition). The use of reference books indicated that students were given some degree of autonomy and on several occasions, I saw students looking through their reference books for reminders when they needed to remember a method or clue for solving a problem. Students were seen taking notes and practicing concepts they had been taught. Extra mathematics support classes were available at the beginning of the school day, during breaks and at the end of the school day. The quality and standard of work produced were remarkable considering their attainment level. The students took notes, highlighted key points and even wrote reminders for themselves.

Here is an example of something I saw many times in Mr Gregory's class, the teacher scaffolding the work carefully to reinforce key features.

$$3(w-2)=9$$

Mr Gregory: What do we do first?

Ben: Expand

Mr Gregory: Now we use the flow chart

$$3w-6=9$$

$$+6=9+6$$

$$3w=15, W=5$$

Mr Gregory: How can I check that 5 is correct?

Sally: Put 5 back

Mr Gregory: Sometimes you get it wrong out of lack of memory and not understanding.

Mr Gregory talks about this issue of 'memory' at other times, he explained that the pupils tend to be capable of doing this process but tend to forget even though they may have done it many times. Consequently, he is very careful to reinforce these processes repeatedly to try and get that really embedded. Whilst this issue of remembering things is noted to be an issue for low attaining pupils, it does allow us to begin to ask the question; what is the pedagogy for helping people remember things who cannot remember things easily?

It was also interesting to observe from the extract above the collaborative nature and the sense of togetherness in the learning process through the use of language particularly when Mr Gregory asks, 'What do we do first'; 'Now we use the flow chart', 'How can I check...' However, this collaborative language does not offer the skills and qualities associated with collaborative tasks in which pupils are involved in discussions and solving problems creatively which may help alleviate the problem of 'memory' Mr Gregory talks about when he described the pupils.

Closely related to the issue of memory, Mr Gregory seemed to be particular about illustrating explicitly the order and structure for laying out solutions to questions.

$$5x + 3y - 2x + 4y$$

Mr Gregory: Circle or highlight the like terms like I taught you

$$3x + 7y$$

Mr Gregory: Don't miss the sign out or you will lose a mark.

For these pupils losing a mark could make a difference if they were on the C/D borderline, although one might ask what was crucial here, losing a mark or understanding why you should not leave out the sign. However, these rules pupils are forced to remember diminishes the opportunity to think about the mathematical relationships, giving pupils knowledge without considering or showing them ways of knowing (Boaler, 1997b). It was evident Mr Gregory had a clearly established way of doing things and seemed to understand how to organise and teach pupils.

In many instances, I noticed that lesson activities were structured to engage pupils and this was also indicated in the responses on the survey and the interviews.

SN: What has it been like learning maths?

Aisha: I never really liked maths. I struggled with some topics I just wasn't good at. But now I think. In Yr 7 I hated it. Yr. 8 I got to like it...

SN: What about Yr 9?

Aisha: It was just kind of a drag...I found it a bit boring and but sometimes it was ok. Yr 10, I did enjoy it because it wasn't how it used to be in Yr9 when we just sat in our seats and did our work. Mr Gregory made us move about.

An example of a lesson where pupils got to move about as mentioned in the quote above was a lesson on presenting data with a focus on the topic 'Stem and Leaf'. Mr Gregory explained the mathematical concept of the stem representing the tens and the leaves representing the units. He then put up several numbers on the board and got the pupils to line up and take turns to put the numbers correctly in the Stem and Leaf chart before going back to the end of the line again until all the numbers had

been placed in the chart. At the beginning the pupils seemed interested but that interest waned quickly. Whilst this activity might have had a kinaesthetic flavour to it, there is still a need to step back and evaluate whether it involved any deep mathematical reasoning.

There were no open-ended tasks or projects that required the pupils to extend their ideas by posing and solving problems or using their initiative; with the exception of one specific lesson that occurred during the data handling unit. Before this particular lesson, the pupils had just finished a unit on solving equations and had done the unit assessment. Mr Gregory ended the lesson by saying:

Next Thursday, we go onto Data Handling; targeting grade C. We might skip the simple stuff and move on to interpreting. We will have the test after half term as it is a small unit. (Year 10, foundation class, Mr Gregory)

The arrangement of disconnected topic area suggested above could give pupils the impression that there was no connection between topic areas as lessons were structured to align with the mathematics syllabus. In contrast the development of mathematical understanding follows from connection making in mathematics (Hiebert and Carpenter, 1992).

Within the Data Handling lesson, the pupils were given a sample questionnaire. They were asked to discuss the features of a good questionnaire and to decide what makes a good questionnaire. Mr Gregory decided he wanted to put this concept into context so that the pupils got it right:

Imagine this, you are a creative young star in the mobile network business and you want to advertise a new phone network tariff. Design a questionnaire that will enable you to understand the public's use of mobile phones, their functions and tariffs. (Year 10, foundation class, Mr Gregory)

This activity was practical and employed a real-life context but the teacher had to keep prodding the pupils to think and come up with appropriate questions suggesting the pupils were probably not used to this kind of demand placed on them in

mathematics lessons. This might also have been a good opportunity to explore various aspects of mathematics and therefore point out the connections between topic areas.

The quick paced lessons experienced in this class meant a time constraint (Nolan, 2012) was an issue, even though this was a class that needed ample opportunities to explore and consolidate skills and concepts. Similarly, the use of closed questions and tasks pupils were given did not involve any form of discussion or higher order thinking.

Bob: Are we going to start that now? We only have a few minutes.

Mr Gregory: Yes, we have a couple of minutes.

The pupils start to discuss the task and then get a warning:

*Mr Gregory: Anytime we're not on task, I will stop my phone's timer.
Start thinking about the question you want to ask.*

Bob: Is it in silence?

Mr Gregory: Not necessarily but must be focused.

The other constraint here was the fact that this was a supposed to take the form of group work with discussions going on and pupils sharing ideas but under a controlled environment. Bob points out the contradiction in this case. But these are young people who want to articulate their thoughts and ideas or ask questions but have had to suppress these positive traits in order to adhere to the classroom mode of operation.

In most lessons, pupils were given examination tips and shown how to get full marks. For example, in a lesson on angle facts, after the pupils were shown how to identify alternate and corresponding angles, the teacher reminded pupils that they had to give reasons for their answers if they wanted to get their full marks. The scenarios above depict the tension prevalent in the teaching and learning of mathematics in schools. The pragmatic case is that teachers have to prepare their pupils for examinations and therefore have to ensure they teach these examination success criteria and also have to ensure the pupils acquire the level of mathematical proficiency expected at their level. Sometimes it meant putting pressure on the students.

There was a huge focus on examination and tests preparation and Mr Gregory gave the impression that his students' success was important to him as illustrated from my field notes (see next page).

It is 11:40 am on a Monday morning; the pupils had just finished their Paper 1 mathematics mock test and were now a queue ready to come into the classroom.

Aisha: How was your morning sir?

Mr Gregory: Good and yours?

Aisha: Fine sir...you know why...

Mr Gregory: I've looked at the paper 1 and I'm trying...

Sharon: Test again, I cannot deal...

Mr Gregory: stop now or lose your lunch!

Mr Gregory: I am trying to help you. I have had a look at what was not on paper 1 and I'm trying to guess what will come up in paper 2. (Discussion continues on what to expect on the mocks the next day. Pupils are working on revision paper and discussing quietly. The teacher walks round, discussing and prompting pupils). At 11:20 am, the teacher stops the class, gives out green pens and asks pupils to note key points to remember. He encourages them to flick through these that night or first thing the next day in preparation for the mock examination. Mr Gregory puts different topics on the board and starts to write key facts beside each one:

Area – space inside cm^2, m^2

Perimeter – around the outside cm, m

Area of triangle- $b \times h/2$ cm^2, m^2

Fractions – simplifying

Fraction – amount

Angles – Y

Angles -

Equations

Probability

Mean from frequency

Freq/polygon (the lesson carries 10mins after the bell goes for Dinner time and the pupils remain seated, no one venturing to leave.)

It may not be out of place for one to conclude that Mr Gregory genuinely wanted his students to do well; equally it should not be out of place for Sharon to vent out her frustrations. For Sharon, it was more examination style questions to practise, more rules to remember, the pressure seemed intense and as expected the pupils have individual ways of handling it. The tension here lies in the fact that Mr Gregory is under obligation to prepare his pupils for their assessment. However, the message in this context suggested that the pupils have had to sit many tests within a specific period.

The ethos in Mr Gregory's classroom signalled a commitment to high expectations. The pupils in this class were mostly seen to be on task with little or no discussions. The teacher hardly had to deal with any form of disruption or interruption to the learning process. When he spoke, the pupils were quiet; there was never any verbal challenge to his authority. On one occasion, he simply mentioned a pupil's name, put his finger to his lips and the whole class went silent. These pupils were compliant, ready to do whatever they were told to do. However, pupils became uneasy in the class when their teacher resorted to the use of constant threat of consequences or repercussions – 'missed breaks'; 'stop the clock and continue afterwards' and detentions, these always got the required response. The following are examples of how Mr Gregory maintained quiet control and order in his class:

Prompt for latecomers: *"They've finished, you are on catch up!"*

Response to low level disruption: *"You are taking my attention away from the rest of the class."*

Response to a pupil who was not applying himself: *"Don't copy, do different questions."*

Response to any noise: *"Feel free to talk for a few minutes and I'll sit and wait (class goes quiet) or "Anytime we're not on task, I will stop my timer."*

These responses illustrate Mr Gregory's expectations for his pupils. But some of these pupils could find it difficult to meet these expectations either because of their

dispositions or because they had a different concept of what they wanted from schooling.

7.3 Pupils' Reflection

7.3.1 Parental Involvement

The pupils in PLS seemed to enjoy a degree of parental support shown through their attitude to learning and their responses;

SN: What does your mum think about you being in this group?

Aisha: She knows I struggle, maths and science are my weakest, she is not really bothered if I do foundation or higher, she just wants me to get a good grade so I can pass. Well she is bothered about doing foundation obviously, she is pushing me to get a C, constantly pushing me and always telling me I need to revise, I've got to do this or that by the end of the day. She doesn't mind which group I'm in, she's not disappointed in me because she knows I've been trying hard.

SN: And that's important. What about dad?

Aisha: My dad is the worst when it comes to lectures. He used to live in Pakistan and in those times, you had to pay for school and his family couldn't afford to pay for him every day so he would only go sometimes.(Aisha, PLS; 10G)

Similarly, with Nick,

SN: Does mum like maths?

Nick: No, but grandad does, so am back and forth his house but he does go away on holiday quite a lot.

SN: You mentioned you want to be a nurse, what grade do you need in maths for that?

Nick: C...even though I hate maths I've got to get my head round it

SN: Why do you hate it?

Nick; Because it's so confusing. It's so hard and I just don't get it...I want to get but I just can't. (Nick, PLS:10G)

The willingness to persist even in the face of the challenges experienced in mathematics stands out here, as well as the value attributed to mathematics and education expressed by parents or significant others.

7.3.2 The relevance of mathematics

For the pupils in this class, there ought to be more to learning mathematics than what was presented in lessons and often that was implied in the all too familiar question pupils asked; why do we have to do this?

SN: If you could change maths lessons, what would you change?

Aisha: I would teach things we actually need, like the flow charts, we don't necessarily need, like algebra, in life it's not actually gonna come in everyday job. I think the lessons have to link back to what is actually going to happen in life. My teacher does that sometime but not with everything because he can't but I think it is irrelevant to learn things you don't actually need. My sister has to pay tax now and she was like, they never taught us any of this stuff in school. Whereas I'd wanna learn that so then I can be prepared for it because that's what school is all about, isn' it? (Aisha,PLS: 10G)

This suggests that there may be gaps between what Aisha feels is needed to prepare her for life and what mathematics educators think is significant. The issue of meaningfulness and connections pupils want from mathematics is also illustrated in Nick's case.

SN: Can you describe to me a recent lesson you enjoyed and why you think you enjoyed it?

Nick: I find pie charts interesting, I can do pie charts...like percentages I enjoy doing that but just when it comes to algebra

SN: What is it about algebra?

Nick: I just, I kind of get it but then I find it hard to do it. But like say I do a couple of practice and go to it, I will get it but it just takes time...

SN: So you like data handling, why do you think you enjoy it?

Nick: I don't really know...no I think it's because you know when like you go to the hospital, you get to see all the heart beats and stuff and graphs (Nick, PLS:10G)

Nick understood graphs and charts because he could relate with these concepts. It was not just procedural facts but it was practical and he could readily see the use of this particular concept in the care home where he volunteered. Even the words he used to describe his learning 'interesting'; 'I can do'; 'I like' and 'I enjoy' illustrate that Nick was an active learner and not a passive recipient of methods and formulas that did not make sense to him which then could explain his difficulties with Algebra.

Commenting on the importance of mathematics, pupils indicated that they needed to succeed at mathematics in order to access good opportunities in employment or further education.

SN: What do you want do when you leave school?

Aisha: I want to hopefully get my GCSEs and go to college.

SN: What grade do you need in maths for that?

Aisha: C,

SN: Do you think maths is important?

Aisha: I actually think it's one of the most important because some of it links back to relevant things in life and you'd need a C for any decent job. And I'm thinking about the long run... I can't get far in life if I don't have my GCSEs.

Aisha's first point is that mathematics is important because some of it involves a real-life context which shows the practical use of mathematics. Her second point echoes

the concern of most pupils: *A 'C' grade in mathematics is equivalent to a good job/life.*

In Sharon's case, a pass in mathematics will determine if she ends up going to university or not.

SN: So would you say maths is important?

Sharon: Yes very important

SN: Why?

D: It gets you more places and it opens more doors and most college courses and universities obviously want you to have maths and I think if they want you to have maths and I want to go to university then I need to do all I can to pass in that subject.

However, in a later interview Sharon had this to say,

Sharon: I like working with money...the reason why I don't understand most of maths is that I just don't see where it relates with my future career... I mean in future how does area, perimeter and bearings relate to my career...in generally I don't think some of it is helpful. So, I think that's why I don't understand some of the subject.

SN: But as a midwife, won't you need to work with maths?

Sharon: Obviously that's different, that's measurements not bearings...

What is clear from the various responses is that mathematics may be difficult but relevant for their future (*Hernandez-Martinez et al., 2008*). But also, that they recognize that and may have given some thought to it.

7.3.3 Dealing with set restrictions

Bob was very cross he had been brought down to a lower set even when he was certain he did better than a few other students in his previous set.

SN: You got moved down, how did you feel about that?

Bob: Stupid because I did better than 4 people on the test and it was on the test results and I got moved down. I think it was wrong.

SN: Did you find out why?

Bob: I was never told. (Bob, PLS: 10G)

In Aisha's case, her group provided her a safety net, a source of comfort where her struggles were not easily seen. This perception easily tallied with the low expectations students were prone to have because they did not have the confidence nor see themselves as capable.

SN: Are you happy in your group?

Aisha: I don't mind it.

SN: Do you know why you are in that group?

Aisha: Yeah, because of my lower ability in maths

SN: What do you think about putting students in groups?

Aisha: I think it's good because you are with people at the same ability as you and you don't feel... aw they are superior to me, they're better than me, like I am just sat here doing nothing. People you are in the same group with...you can kind of jive with them. So say you don't understand something, like me and Nick, I will ask him. He will know one part of it and I will know one part of it. Whereas a higher ability group or middle, majority of the work, we would only understand some. (Aisha, PLS: 10G)

How did Aisha arrive at her knowledge of the level of work done in a 'higher ability group'? The same views were re-echoed by Sharon;

SN: How did you feel about being put in that group?

Sharon: Not bad really... It didn't really bother me.

SN: Why not?

Sharon: Because at least I know everyone, we all have like the same ability and everything and then you don't have to feel like anyone is really smart, you don't have to feel like you are competing to get a good grade or whatever.

SN: How can you tell?

Sharon: Mock exams put in groups based on performance.

But on the other hand, the absence of academic role models and minimal peer support within the group is a serious concern which Sharon alluded to in a follow up interview,

It's scary because everyone gets the same number wrong...you don't find some people who get different numbers right or wrong...it's hard to ask how they solve the questions because you both got it wrong.

(Sharon, PLS: 10G)

Sharon's assertion suggested that she felt being in a LAMG presented a disadvantage in terms of limited peer support.

7.3.4 Case Review

In 10G, high standards of expectations pervaded every facet of lessons. Disruption or interruption of the learning process was unacceptable. The quick paced lessons experienced in this class meant time constraints could have been an issue Mr Gregory had to deal with despite the fact that this was one class that needed ample opportunities to practice skills and concepts. The level of autonomy given to student, in terms of having reference books and allowing these books to be taken home is significant but it could also have been in response to parental pressures and expectations. This illustrates how the influence of place and SES could dictate how teachers choose to respond to their students.

The level of compliance seen in this class reflects the harmony between students' disposition and that required to be successful in the mathematics classroom. The quality of their family backgrounds and network (social capital) was an added advantage that would have shaped students' attitude in mathematics lessons and their sense of responsibility. As a result, this social and cultural capital is an advantage that works in their favour, in terms of positioning them to succeed in

school. But their present position in a LAMG presents a reality where the students have to deal with the structuring influences arising from mathematics education. Students responded to these pressures in different ways. In 10G, it was a compliant attitude that masked the quiet disaffection towards mathematics.

On the other hand, their dispositions engendered in the students a perseverance that made them not give up the desire to progress into further education despite their lack of attainment in mathematics. This resilient disposition allows them to see beyond the immediate constraints experienced in a LAMG and positions them to want to do well.

On the relevance of mathematics, the influence of their backgrounds is reflected in not just their attitude to learning but in their career choices where they show that they understand the exchange value of mathematics and the implications it has for their future.

7.4 10F mathematics group (PLS)

This was a Year 10 mixed attainment class, all set to do either the higher or foundation level GCSE mathematics depending on their achievement in the mock examinations. There were 14 pupils in this class (7 girls and 7 boys). These pupils came from a range of backgrounds and ethnicities (Indian, Pakistanis, Caribbean, White British and a few mixed heritage pupils). The dynamics in this class were such that everyone had their clique of friends or people they got on well with and even though there appeared to be a seating plan in place; they always seemed to carry on with their conversations across the classroom. In Miss Freeman's room, the chairs were arranged around tables (shaped like horse shoes), facing the whiteboard which was right next to the teacher's table.

Miss Freeman prepared her lesson slides to accommodate the varying levels of attainment in her class. This was shown through the lesson objectives with GCSE levels indicated. However, I did not observe any element of differentiation as the pupils were seen to do the same tasks and activities at the same time. The work pupils were asked to do was very structured, leaving no room for discussions or any form of individual explorations as illustrated in this example from my field notes below.

Miss F: 5, 4, 3, 2, 1...In your reference books, you need the title, date ... (she stops to remind a student he had had no equipments in three lessons in a row). She goes on to introduce the topic for the day (Rotation) using a prepared interactive PowerPoint slide. It showed the movement from one point to the other indicating direction, angle and the type of transformation that was happening. Zac then notices the date (sounding excited and thrilled like he had won something) talking over the teacher he goes on to share what he had heard on the news about the date sequence (11.12.13). He informed the class that these date sequence will not occur for the UK for another 90 years. The teacher quickly comments on this but wants to carry on with the lesson but Zac wanted to continue this line of conversation.

Another student shuts him down saying: 'You are blanking her out'. The students listen and copy notes from the board quietly. Zac carries on talking and the teacher cautions him.

This episode could suggest that the teacher's priority was to cover her lesson objective for that day and there was no time for digressions.

The lessons followed the 'three-part lesson' structure customarily seen in schools in the UK. First the starter, after which the lessons continued with a presentation on the interactive white board, showing students sample questions and the methods, they were going to use during individual work. The students each had two notebooks for mathematics- a reference book for personal notes or pasting teachers' notes and worked examples and another for class and homework.

The lesson starters were mostly on slides put up on the interactive white board with GCSE levels indicated with colours (green, yellow and red). The students had to attempt these whilst they settled down. Miss Freeman then went on to deal with administrative matters such as taking attendance. This often resulted in prolonged starter activity with the start of lessons staggered and some students never completing the starter activity or getting much work done. Lesson objectives were dutifully (fitting in with the system's prescription) put up on the slide with GCSE levels indicated. In most lessons, there were task sheets given to allow pupils to practise the taught skills. This class did not use any textbooks.

Miss Freeman taught mathematical procedures using the whiteboard, after which pupils were to practise the procedures on their own following methods taught by the teacher. She evidently made an effort to ensure pupils understood the lessons by illustrating concepts with different examples. Even so, this repetition and rehearsal was such that some pupils appeared to become annoyed at the slow pace of lessons in Miss Freeman's class. I will illustrate this further by using Awais' reaction in a lesson on angles.

Miss Freeman:

$$x + 2y = 10$$

What pairs of x and y will make $x + 2y$ equal to 10?

Or $4x + 3y = 12$?

The pupils look intently, trying to work out a solution. Teacher explains a quicker way called 'Cover up method' – To make a straight line, we only need two points, find where the line meets each axis;

Y (0,5) $x + 2y = 10$,

X(10,0) it only meets the x axis when $y = 0$, $x + 0 = 10$, $x = 10$

It meets the Y axis when $X = 0$

$0 + 2y = 10$, $y = 5$

Cover up x or y to find the values- Any more confusion?

A pupil replies; Yes! All of it.

Miss Freeman tries to explain again...

Awais: oh my..., wake me up when the lesson starts (venting out his frustration).

This particular lesson was one of a double lesson right after lunch break. I observed that there were always a few pupils who wanted to carry on with their work but were often constrained from doing so because of low level disruption and this also impacted on the flow of the lesson.

According to pupils' views they did not learn much because they felt Miss Freeman could not control the class as illustrated in the following examples (from interviews conducted after pupils moved into Year 11).

SN: What has your experience of learning maths been like from primary school?

Shasha: I can't really remember primary school but when I came here, I enjoyed it...and then it got to year 10, and we got Miss Freeman..., she was a good teacher but could never control us. So it was like I just never really understood anything and now we have to go back from unit one to learn everything again. It kind of went downhill from year 10...

SN: What exactly do you mean?

Shasha: I can actually learn now unlike before, we used to get our books out but we never really learnt anything. We used to get on to the starter activity and that's it. She was never able to control us.... We used to take advantage of our previous teacher but not anymore. (Shasha, PLS: F)

Similarly with Jackie,

SN: What has it been like learning maths?

Jackie: It's been ok but I was alright in junior school. I was like really good and then was alright in y7, it was nice and y 8 and 9. Last year because the teacher wasn't like the best so like the whole class has dropped and under achieving really. Because I was predicted a B like about a year ago. I was in Mr. Dobb's group. I went on holiday and was moved down because I missed so much work

SN: what's your predicted grade now?

Jackie: Like a D or something.

SN: What caused that drop?

Jackie: I don't know... everyone says it was last year's teacher.

Most of the pupils had the same sentiments as Jackie. However, Jackie does not attribute her underachievement to the fact that she was away on vacation during term time, which as might be expected would have had some adverse effect on her learning.

SN: Did you get on with your teachers from year 7?

Zac: ummm not last year's teacher, no.

SN: Why not?

Zac: Because I didn't learn anything last year.

SN: Why do you say so?

Zac: I don't know, like... first, couldn't control the class so we didn't learn anything. Secondly, we didn't get anything she was saying cos she just wasn't teaching it right. Didn't incorporate any fun into it... not even ...that's not the problem, none of what she said made sense at all and they blamed it on us.

SN: What do you mean they blamed it on us?

Zac: Like it's our fault we are not learning and even though she is the one teaching us and we are not getting any of it and she just moves on like we do get it while we don't. (Zac, PLS, 10F)

The level of helplessness observed here is worthy of attention. Zac paints the picture of the difficulties he had in this group and also of his teacher moving on when pupils had difficulty grasping a concept. However, the need to apportion blame was a contested issue as shown in this extract from my fieldnotes. The issue here was who was going to be blamed for the pupils' poor performance in mathematics. Whilst some of the pupils felt it was Miss Freeman's fault, others felt the pupils themselves had to take some responsibility.

This was a lesson (after some form of Year 10 assessment) on drawing nets of 3-D shapes, the starter is on the board:

Pupil: Only one thing you taught us came out on that test.

Neena: I am not willing to do this if I don't know what I'm meant to know (I read this as this pupil was indirectly saying she was not prepared to move on to a new topic).

Cathy: Don't blame the teacher; you guys should have gone through your revision guide

Neena's frustration here lies in the difficulty she experienced in the examination because she had not been taught the concepts that came out on the assessment tests. The unfair aspect of this case is that she was going to be judged based on the outcome of this assessment.

This issue of inadequate curricular coverage could also be linked to the level of anxiety pupils experienced in examinations and tests. For example, Zac like many pupils had not quite understood the concepts he was taught and so he was not confident and secure in the knowledge he had acquired. In addition, pupils are not able to remember all the rules and methods they needed to know or had not grasped the concepts they had been taught but they had just copied down notes dutifully without proper understanding.

SN: Do you know why you are in this group?

Brenda: Because I struggle in maths...I know what I'm doing but when it comes to tests I always forget (Brenda -PLS: 10F)

SN: You don't like tests, why?

Zac: I don't know, It's just like I'd rather just learn it than doing the test...I don't know. I don't like tests. I've never liked tests.

SN: What do tests do to you?

Zac: Everything. Every time I start a test, everything just goes out of my brain...so I can't remember anything... (Zac, PLS:10 F)

On the other hand, there seemed to be issues that signalled all was not as it should be in this class.

Miss Freeman: Have you ever cut open a box? (She does not wait for an answer) When you do, you end up with the net of the box (there is still noise in the background)

Shasha: Can we just stop now, this is why we don't pass- the teacher says stop (ten minutes into the lesson, no one had done the starter activity).

Miss freeman: To be honest, this is why we aren't getting the grades.

Neena: I don't know what 'm doing, I'm just copying

In this class, threats were not often used and were often unsuccessful when used as seen in the case of pupils who got several warnings without any repercussions.

(The pupils are working on set task but also discussing about examination timetable and revision, not sure which subject to concentrate on. The teacher is seen walking around, helping and prompting pupils. Some pupils are yet to start and the teacher challenges them).

Jackie: I'm getting out my equipment.

Miss Freeman: You need to get in and get on; I can't have this time wasting every time. Taking 30 minutes to get out your equipment- I will give you one more minute.

Miss Freeman starts to illustrate an example:

$$Y = 5 - 3x$$

$$Y = mx + C$$

Where is the gradient?

(Some pupils are having a private conversation and start giggling thereby disrupting the lesson)

Awais: This is the fifth time... Madam send them out.

Miss Freeman would not send pupils out because she believed that will disrupt their learning and she tried to manage situations as much as she could possibly do.

Miss Freeman: I am tired of teaching this class. I spend my time preparing lessons and I come and get ignored, talked over and disrespected and feel like I've wasted my time (The class goes quiet).

Miss Freeman was very upset and her reaction got the pupils' attention. This could indicate some form of remorse and a level of responsibility on the part of the pupils. In another school, the pupils would not have cared less nor given the teacher the chance to talk without being interrupted.

Miss Freeman seemed to be having difficulties controlling the class. She did not come across to the pupils as an authority figure and the pupils seemed to take advantage of

her gentle and non-confrontational approach. The atmosphere in this classroom was relaxed and pupils were free to have non-subject related-conversations and occasionally, the teacher would contribute to these discussions. She related with the pupils as though they were equals. She was very polite to pupils and almost too nice.

SN: So if you could change maths lessons, what would you change?

Shasha: With Miss, if she was a y7 teacher, it would be okay because y7 doesn't matter but she was teaching a GCSE class and couldn't control... it just didn't work. With a new teacher, I would say be stricter and actually help us get our GCSEs.

These pupils had their own expectations, fuelled by their sense of entitlement and desire to excel at mathematics because they were aware of the value of a good grade in mathematics.

SN: Did you enjoy your lessons?

Awais: I enjoy it when it isn't disrupted as much but when it's disrupted I get a bit frustrated because the teacher keeps having to stop.

SN: How would you describe the pace?

Awais: it depends...sometimes it's a bit too slow...some pupil mess around and then don't know what to do and then slow everyone else down.

SN: You once said, with your head on the table 'wake me up when she finishes', why?

Awais: Oh yeah...

SN: What was going on in your head?

Awais: I felt that it was going a bit too slow... like you could go to sleep. (Awais, PLS- 10F)

After this particular lesson, Miss Freeman explained to me why the lesson pace was slow; she wanted pupils to arrive at their solutions by thinking through the process and not waiting for her to spoon feed them with the answers. Whilst this may have been Miss Freeman's intentions, it was not communicated in that sense to the class or indeed to Awais. There appeared to be some tension here. On another occasion a discussion ensued after pupils asked Miss Freeman if she had been on a popular television Quiz programme and who she went with. This was one way in which Miss Freeman related with her pupils. However, it did appear that this class was in need of some boundaries if any meaningful progress was to be made, I illustrate this issue with an extract from my fieldnotes.

At 2:10, worksheets are handed out. The pupils move to another room for the second period and continue working on worksheets. Awais finishes his work quickly with a little help from the teacher. He went on to revise for his Physics examination which was coming up the next day. The teacher offers to help with Physics problem if pupils had any issues explaining that she had done some Physics modules in A' levels and university. This offer to help pupils with their physics was a bit unusual considering this was supposed to be a mathematics lesson.

Whilst having mathematics for the last two periods of the day may have been some worth demanding for pupils, it should not give pupils the liberty to engage in non-subject related matters. The messages that seemed to come across from the teacher's actions were, "I do not have anything prepared for this period" and for the pupils, "You can do anything you like in Miss Freeman's mathematics class".

These two messages were not aligned with the overall school ethos and standards and it was not clear how things were going to proceed but it appeared the pupils were not

prepared to settle for less. Therefore, in some sense these pupils were different; they understood what was expected from them. Furthermore, the pupils did not feel Miss Freeman was suited for their group. This perception could have had an impact on how pupils described their group and their learning.

7.5 Pupils' Reflections

7.5.1 Pupils' Priority in Attainment groups

In this group, the pupils' main priority was getting their 'predicted' grades but it seemed that was going to elude them if they remained acquiescent.

SN: Do you know why you are in this group?

Awais: Not really

S: If you could move groups, which would you choose.

Awais: The one above mine because the people there are working at my attainment whereas the people in the group I'm in now are working at a lower ability than I am. (Awais, PLS:10F)

The element of disenchantment seen in this group may be one of the reasons students in low attaining groups lose focus and disengage from learning. It clearly was not a case of immaturity in Jamie's instance.

Jamie: I feel restricted...If I was in a group where everyone else wanted to work; I know it's hypocritical to say this because I know I distract myself. But if you were in a group like last year in Y9, where there were people I could bounce off the work, wanted to do work and were clever, then it got me higher on grades than now when it seems no one wants to do anything

SN: You mentioned that you didn't like your group...what exactly did you not like?

Jamie: it's not a place to focus.

SN: Are you happy in there?

Jamie: Since the start of Y10 when they put me in the group, I said I wasn't happy with it but they never changed it.

SN: Which groups are your friends in?

Jamie: Most of them are in the top set or the one above me.

SN: OK. Do you think that has anything to do with the way you are feeling?

Jamie: I think sometimes I think I want to be doing what they are doing, at their level...sometimes I don't know... but sometimes you just wish you were in a group above where people I know and sometimes walk around with, they are all getting the same grade like a B or C, whilst I am in there doing D, C...while I could be in their group doing what they are doing...it's so sad I think (Jamie was very upset and seemed like he was going to cry).

SN: So what do you think about putting students into groups?

Jamie: When you put people into groups, you need to think about the people you're putting in there. It's as well as academics but who is in the group? How are they going to learn? It's not all about the...schools shouldn't think it's all about getting the grades because it's just too much stress.(Jamie, PLS:10F)

Jamie's perception of restriction included not doing the correct level of work required to get him his grades; not being with his friends and not being in a place where he could focus. These were significant elements for Jamie and he made this clear when he suggested that grouping should not be all about getting the grades. Underneath these feelings of dissatisfaction is also a sense of inferiority indicated by the comparison Jamie makes between himself and his friends.

Zac's complaints were also quite similar to Jamie's.

SN: If you could change math lessons, what would you change?

Zac: ... the way it's taught

SN: What do you mean the way it's taught?

Zac: make it slower, and easier ...not easier but like doing the work that's right for us if you know what I mean.

SN: No I don't...

Zac: like the right level for us. I'm doing foundation work when I'm predicted a B...that shouldn't be right... Even when I asked other maths teachers about it, they said I shouldn't be doing foundation if I'm predicted a B.

SN: So how do you feel about being in that group then?

Zac: I don't mind being there because I know...feel like the work is fine and I can do it but I need more of a challenge so I can get my grades if you get what I mean. (Zac, PLS: 10F)

It is reasonable to dispute how realistic Zac's desire for the level of the mathematics work to be easy but at a higher level in the light of his determination to get his predicted grades. However, the point is that Zac and Jamie wanted more challenge but could not have that opportunity cannot be dismissed.

Most of the students in Miss Freeman's mixed attainment group had been told they would do the higher tier mathematics examination if they worked hard. There was less chance anyone was going to be moved up a set considering this was already getting close to their external examinations.

Jackie: I was annoyed when I got moved down but told if I worked hard I could move up again...but then she wasn't the best teacher so I didn't get the grades as I was getting Ds and Es.

SN: How does dad feel about that?

Jackie: Dad is really angry about it because he spent loads of money on getting me a tutor.

SN: What do you think about putting students in groups?

Jackie: I think it's good in some ways because it changes the teaching but kind of makes you feel like you can't do it as well

SN: I don't get that...

Jackie: Like it's good because obviously people have different abilities but I think you should still be told to aim for the higher and not like our group being taught foundation, still think you should be told to aim for higher. Still be taught the same things but not like the same pace (Jackie PLS:10F).

Jackie, Jamie and Zac's reactions show the emotional dimensions involved when students get moved down a set on one hand and on the other hand it demonstrates the value they have placed on getting their qualification in mathematics.

7.5.2 The relevance of mathematics.

SN: Is the maths you're learning now going to help you when you leave school?

Awais: Certain topics I would say would help but like algebra you may need that in certain career but if you don't want to go into that, then maths doesn't real help at all

SN: What's maths good for?

Awais: Maths is good for certain jobs like accounting. I spoke to my sister and she doesn't really do much, she only mainly uses like the main principles of maths not like algebra or the more complex things. It's mainly adding and subtracting and 'times-ing' and other basic principles. (Awais, PLS: 10F)

In essence, Awais like other pupils did not readily see the relevance of the mathematics they were doing in school. Consequently, this could influence pupils' choice in terms of effort or participating in lessons as shown in the excerpt from Miss Freeman's lesson below.

In a lesson on rotation, Miss Freeman reminds Zac that he had no equipment and this was the third time in a row. In addition, Zac was also falling behind with copying the notes on the whiteboard; he starts playing with his hat and then asks a question about the turn of the object. After a little while, he exclaims;

Zac: Why do I have to do this? It has nothing to do with what I want to be in the future!

Carl: If you can do these, the better job you'll get and the more money you'll get.

Zac's question is one every mathematics teacher has heard at some point, usually borne out of resentment and exasperation coupled with the fact that he strongly believed he did not belong in this group. His question also suggested that he had a strong sense of what he wanted for his future. Zac's question and Carl's response show the conflicting motives and perspectives that pupils have whilst learning school mathematics.

Zac, was planning to specialise in Sports and Tourism, which might explain his question of relevance in mathematics.

SN: I'd like to know what your experiences have been like in maths, say from primary school, did you like maths?

Zac: Not really. I've never really liked maths. But you just have to do it, so I do it.

SN: Why don't you like it?

Zac: I am more an active person than academic person...in really any lesson, I don't like sitting down, books and I don't like that.

SN: But you have to do it?

Zac: I have to do it so I act like I like it.

Zac's phrase 'You just have to do it' (a detached status) reflect pupils' negative perceptions of mathematics and quiet disaffection in mathematics classes (Nardi and Steward, 2003). Also, the fact that Zac felt he had to put up an act that suggested that he liked mathematics, points to pupils' identity struggles (Boaler, 2002; Cobb et al., 2009).

Zac like many others I encountered said he did not like mathematics for various reasons. His description of himself as more of an active than academic person suggest some notion of learning styles; a phenomena most schools advocate without really understanding what this entails or even cultivating the needed pedagogical orientation (Marks, 2011). So there is a gap that needs to address how to teach mathematics to pupils like Zac who find formal academic learning unappealing and difficult.

Pupils' description of the mathematics they encountered suggested that the demand placed on them was a requirement to practice decontextualized procedures and memorize formulas that held no meaning for them.

SN: Do you think maths is important?

Shasha: It is important for getting into college and not retaking but I don't think I would ever use maths like further on...like triangles and

stuff. I don't think I'm ever going to have to construct a triangle. They say you use algebra in the supermarket, I have never used algebra in the supermarket...and I never will. (Shasha, PLS: 10 F)

Shasha shows she understands the instrumental value of mathematics signified in her reference to getting into college but does not understand how useful mathematics will be in her everyday life.

7.5.3 Parental influence

The SES of pupils in this class was very obvious. Some pupils had parents who could afford to pay for extra tuition outside school and some others had various extra-curricular activities outside school which meant they enjoyed a range of enriching activities outside school like Catherine (whose mother is an accountant),

SN: What's it like where you live?

Catherine: It's nice and we've got really nice neighbours. Quiet except like when people have parties and stuff...I don't really like parties a lot.

SN: What do you do for fun then?

Catherine: I don't really do anything...my friend and I go for tennis on a Monday.

For some others, it was a strong sense of familial expectations that defined what was acceptable or not.

SN: How does your mum feel about your group?

Awais: She feels if I work harder I might be able to move up but if I just sit there not...like doing my best, nothing will change.

Awais showed a high level of responsibility in lessons; he seemed to want to prove to his teacher that he was not meant to be in this group.

For these pupils their experiences outside class equips them with the dispositions and discipline that prepares them for the demands they face in LAMGs.

7.5.4 Case Review

Miss Freeman's mathematics class presents a few paradoxes which makes the case have some distinct elements. The conflicts observed in this class could be interpreted as both teacher and pupils playing an active role in constructing the social context within this group.

Lessons in Miss Freeman's mixed ability class often showed how mathematical concepts were applied in the real world and the students loved it. But as a mixed ability class, I was surprised there were no differentiated tasks given to the students. The pace of lessons was an issue that complicated matters both for the teacher and the students. The students' dispositions and sense of entitlement suggest the strong influence of students' habitus. They were confident enough to challenge the quality of teaching they were receiving. This 'mixed ability' class was scheduled to sit the foundation tier examination. Some of the pupils could not understand this contradiction neither could they openly challenge the status quo. This was undoubtedly enough reason not to cooperate with the teacher.

Hence, mathematics was described as a 'chore'; 'it was not something you gained from'; 'You just have to do it' etc. So even though the pupils did not enjoy mathematics lessons, they had to settle down to do it because they understood the value of a qualification in mathematics.

The parental support, material provision and experiences pupils enjoyed meant they have developed dispositions and discipline, traits that positioned to do well in school; in spite of the disruption which would have negatively affected learning in LAMG.

7.6 10B mathematics group (CPS)

This was a GCSE foundation tier group. The number of pupils in this group often varied for different reasons, ranging from absenteeism, truancy, etc. I could never tell how many pupils were in this class. But according to the register they were supposed to be about ten pupils (mostly White British and one mixed heritage) but at every point in time we had about six pupils present. On a bad day, there were three pupils. The attendance in this class was irregular as some days the pupils were in 'Isolation' or absent. All the pupils in this class lived within the school's neighbourhood.

On entering Mrs Brown's classroom, her table was at an angle, diagonally opposite the door. In her classroom, there was a white board and an interactive whiteboard. The room hardly had any pupils' work on display. What was seen on the walls was a homework chart display, a poster that displayed different kinds of learners and what was required of each kind of learner. There were texts books piled on a table at the other side of the room and pupils had their note books in folders with their names on it stored in plastic boxes marked with their group name. This particular lesson was the second lesson of the day, just before the first break. At the start of lessons, the students would often stroll in, not as a whole class but in drips. Sometimes the late comers were accompanied by a senior member of staff.

There was a permanent teaching assistant assigned to this group. The teaching assistant was not very popular with some of the students because she was seen as a disciplinarian whilst others saw her as their 'mate' and they addressed her by her first name. The teaching assistant was there to reinforce concepts taught by the teacher and to make sure there was adequate support for pupils.

The lessons followed the 'three-part lesson' structure and always began with a starter activity on the whiteboard which only a few did depending on their mood. Some students would tend to do the work whilst others seemed to regard that time as opportunity to catch up on some gist or to start off a conversation with the teacher. The lesson starters were varied but mostly covered basic numeracy skills and on two different occasions I heard pupils exclaim:

'Why are you treating us like flipping Kindergarten?'

Mrs Brown would always start off her lessons by going over what she described as the minimum required standards for the lesson;

Starter done

Date

Title

Copy example

Try 5 questions

Pupils had to ensure they achieved all these steps to get a positive commendation on 'Sims' (whole school information system) or right away for those on 'report' (a report card mentors/tutors used to monitor behaviour through the school day) at the end of the lesson.

The lessons from my point of view were often not well thought out as Mrs Brown seemed to make up simple questions/examples for illustration on the spur of the moment. She would model lesson concepts through examples and then pupils were made to work from levelled textbooks with GCSE grades indicated. So one can assume that provided some form of differentiation by task. But the quantity and quality of work were not satisfactory by my own assessment (a point also raised in the Ofsted report). The tasks pupils had to do were drawn from de-contextualized textbooks that allowed them to practice concepts by answering similar type question. These questions were always closed questions. They were often presented with elementary concepts that did not equip the pupils with strategies to tackle novel questions in any form. Pupils reported that they wanted lessons to be more interactive, starting from the basics (by which, I believe they meant a graduated approach to learning and not necessarily elementary foundations). There were no class discussions or group work observed.

The lessons were often slow paced so everyone was carried along. Looking through some of the pupils' notebooks, I noticed there were no notes written in them. Worked examples were often not copied into note books and worked solutions to textbook questions were scantily written in one or two lines (pupils preferred to give only the answers and not show the steps to their solutions).

Overall, the mathematical content was not very demanding and the level of instruction was sometimes overly simplistic. Here is an example of a starter session;

Mrs. Brown: Label it (a circle)

Fay: How do you spell it?

Mrs. Brown: Cir-cum-ference. The middle one begins with 'r', it has six letters

Fay: hmmm mmmmm (Fay tries to spell radius)

Mrs Brown: (continues giving clues) Slice of the icing from the cake – Arc

In another lesson on shapes, the students were asked to draw a hexagon or a quadrilateral. Jess asked Mrs. Brown for help with drawing a Hexagon. Mrs. Brown offers help with the start, then Jess stops her saying she could do the rest now. After Mrs. Brown moves on, Jess makes the following comments;

Jess: Miss, chats too much, that's why we don't get all our work done.

SN: What do you mean?

Jess: She keeps demonstrating

SN: But isn't that good?

Jess: Yeah but I know what to do and I like to just get on with it. (Then above our conversation, comes the teacher's voice telling the class they had ten minutes to go and Jess wondered why, looking confused).

This observation by Jess was also seen in Len's case (CPS, 10B), a mixed heritage pupil who did not seem to get along with his teacher. He was well known to the senior leadership team because he was often reprimanded for wearing the wrong shoes to school. He looked very presentable in his school blazer but always had his trousers 'sagging' as he did not wear a belt. He initially comes across as anti-social as he always had his earphones plugged in and would always sit alone. But on one occasion

I got a chance to work with him and I discovered that was not the case. He needed help with working out some equations; he asked me questions freely and was very willing to listen and try out what I had just explained to him. Len was always quiet in class and would carry on with the work without interacting with his classmates. He appeared to know what he was doing but also appeared to be bored as he would very often sigh and show signs of being irritated as illustrated below.

In a starter session; the following questions were put up on the white board

$$x + 5 = 7$$

$$x - 5 = 7$$

$$5x = 35$$

After some time, the teacher starts to solve starter questions and tries to involve Len;

Len: Can I go to the toilet miss?

Mrs Brown: You need to listen to this

Len: I know it already though

Mrs Brown: Do we need to practice more of these or do we move

Len: Move on

On several occasions, the pupils were asked if they thought various examples used to illustrate mathematical concepts were at the right level for them as indicated below.

Mrs Brown: If you want to get on and practice, turn to p127. If you want the harder stuff, pay attention to this example (solving the equation on the board with little contribution from the pupils)

$$2a + 1 = 5$$

$$2a = 4$$

$$a = 4/2$$

Mrs Brown: which do you want? Harder or simpler? Do you want one more example?

Len: I know it already.....no can I just have the work?

Len's response may have sounded impetuous but his annoyance here was the fact that he was asked to do what he felt he already knew. This suggests the need to strike a balance in judging practices that hold pupils back and understanding when they have grasped the concept and when they need to move on to something new.

Also, the tentative approach of gauging pupils' perception of the complexity of the mathematical problems did not seem to create any form of reassurance in the pupils. What were they expected to answer? The default response would be to avoid any answer that will make them look like they had no clue.

Len moaned at the fact that they were being treated like they were in nursery and he blurted this sentiment out loudly in class on one occasion.

Mrs Brown: Turn to the back of your books and try these 3 questions

$$\frac{1}{2} + \frac{1}{2}$$

$$\frac{1}{2} + \frac{1}{4}$$

$$\frac{1}{2} + \frac{1}{3}$$

Len: Miss you are treating us like we are in nursery

This accusation was also confirmed by my observation; for example, the teacher set about illustrating a right angle by drawing pupils' attention to the corner of a cabinet and then asking them to show by wave of hands the different angles. The pupils bluntly refused to participate in this activity. Most of them showed disbelief by their facial expression whilst for some others they could not be bothered to participate in the activity. The pupils' reactions at various points suggested to me that they felt offended at the level of some mathematical concepts they were made to do. On several occasions I heard pupils moan, "We did this in primary school".

It was not very easy for me to visualize or accept that this particular class was a pre-GCSE class. I could not readily align what they were doing in lessons with the demands of a GCSE foundation examination paper. I kept wondering when they were going to go on to GCSE level work. It appeared that Mrs Brown was trying to accommodate the pupils' 'ability' by adopting a low level structured manner.

Assigning or doing homework was visibly absent in this class, an issue Mrs. Brown tried to tackle to no avail.

Mrs Brown: Tomorrow is homework day.

Jess: I don't do homework.

It is possible to think that Jess' response revealed the value she attached to home learning and indirectly her family's background. But Jess's home was not conducive for doing homework as she had to share the living space with several siblings. Furthermore, she believed her grandmother was not in a position to support her if and when she needed help.

On several occasions, I looked through the pupils work and the presentation and quantity of work they had done in the lesson and some had done little or no work for the duration of the lesson period. This action was so natural with the pupils that it was more likely this attitude could have become entrenched over the years such that the pupils may have come to think it was acceptable to give the barest minimum. In most lessons pupils showed little interest and this was amply reflected in the quality of work pupils produced.

For example, in the vignette overleaf, Jake's report targets alerts one to the challenges Jake presented as a pupil. He thought nothing of being excluded, showed no concern for any missed learning opportunities. Jake knew he could re-take mathematics in college if he eventually failed to get it this time around. One could speculate that he had decided to opt out after rationalising that he was never going to get the grades given his current attainment group. If Mrs Brown acknowledged that he was a clever pupil, what was he doing in that particular group?

At 9:50 am, Jake forces himself through the door after the teacher asked him to hold on till the previous class had left. He drops off his 'report' on the table. He goes on to sit behind a particular girl. Other pupils come in and collect their books. Mrs. Brown prompts pupils for the starter,

Mrs Brown: Starter – front or back (of the books); 2 numbers that multiply to make 12, add to make seven. What's the question?

Whilst the class is busy solving the question, Mrs. Brown looks through Jake's report and says;

I am sure we can manage one of them;

Work hard; Be kind; No exclusion

Mrs. Brown goes on to talk about the ratio of pupils to teachers and then asks pupils "What's the ratio of boys to girls?" I was not sure if this was still part of the starter questions. The lesson moved on to corrections of starter questions, gathering answers from pupils.

Factor pairs are put up on the board:

Which of these add together to make seven?

$$6 \times 24 \times 3 \quad 1 \times 2$$

One pupil gives the correct answer.

Mrs Brown: What does product mean? It actually means multiply (answering when she got no response)

Mrs Brown: What did we do on Friday? Jake you weren't here- where were you?

Jake: Excluded

Mrs Brown: You shouldn't be...you're a clever boy. You should be getting a 'C'...

Jake: ...I will do it in college

Mrs Brown: That will take longer

Jake: I've got over 100 exclusions

Teacher: That's not something to shout out.

I thought it was a contradiction for Mrs Brown to imply that Jake should be getting a C grade in mathematics when the work covered in this class may not position him to achieve that.

It's 9:50am, the second lesson of the day. Jake comes in to class with the wrong shoes and Mrs. Brown asked him to change it. The starter, focused on finding area and perimeter of shapes is on the board. At some point, Jake attempts to step out of the class, Mrs. Brown raises her voice to get his attention;

Jake: Don't shout on me

Mrs Brown: Sit down now, I want you to get a 'C'

Jake: What if I don't want a 'C'?

At this point Mrs. Brown ignores him.

Most times some of the pupils in CPS came in to class looking indifferent and it seemed like they were just going through the motions with no clear purpose in view. But, on another occasion, I was impressed to hear Jake, a very clever and outspoken pupil who loved football and was very knowledgeable about the different clubs, players and followed the premier league matches closely discussing so confidently with a male teacher. Jakes' knowledge, social skills and interest were obviously not accommodated in mathematics class(Jeffcoate, 1984), these knowledge and skills could not be converted into the required capital in the field (mathematics education) that could have earned him a position in a higher group. Given this background, I was not surprised to hear him respond the way he did.

What grade did Jake (a smallish boy with an oversized coat and bag slung over his back) want to get in mathematics? I did not get to ask him because by the next lesson he had been permanently excluded and taken to a pupil referral unit. But he struck me as a pupil who though clever, was street wise and anti- school (Hargreaves, 1967). The few times he was in class, he would have his ear phones on, a can drink to hand, slouched in his seat and chewing on his pen. Occasionally, he worked well and even attempted some questions no one in the class understood.

The pupils in Mrs Brown's class had varying levels of needs that manifested in different forms including their attitudes to learning and resisting all forms of authority. The atmosphere in this class was very relaxed; pupils had their earphones on listening to their music; sweets were shared and eaten in class and cans of fizzy drinks were never hidden away. Behaviour issues were a common occurrence in most lessons observed in CPS. There seemed to be that sense of silent acceptance and support from fellow pupils when any individual pupil decided to challenge order in lessons.

Following on from the discipline issues, Mrs Brown tended to hold non-subject related conversations with the pupils. It was evident that this was one way she related with her pupils, perhaps to show she was interested in them as individuals. The use of soft power observed in lessons suggested the pupils were given a choice to act appropriately as the following show.

Jake has his phone out during lessons; Mrs Brown turns around and asks;

Mrs Brown: what am I going to say?

Jake: Put away your phone

Jake pretends to put it away and Mrs Brown looks away. He knew what was expected of him but he would not do so. On another occasion, Jake was eating in class and was given a choice between putting away his food or standing outside the class, he chose the latter. Jake made a choice that could be argued reflected the value he placed on learning mathematics. Incidentally Jake and Len (mentioned previously) were both later expelled from school. These two boys seemed to be clever and showed potential, but these traits did not yield results in their learning experiences. These episodes reflect some of the issues that marked pupils' experience in LAMGs.

The default position always seemed to be the need to make pupils conform to required standards.

Caroline was caught 'skiving' mathematics lesson. She was brought into class by an SLT member.

Caroline: This room stinks, who has been sweating? (opening window and then goes on to open the door)

Helen: Caroline, come in, you're distracting me.

Mrs Brown: Come and get your book

Caroline: I'm not doing any work. Sir said just come in and sit

PLA: Think about your future...

Caroline: I don't care and it has nothing to do with you

Caroline has not made the link between mathematics lessons and the future she wants and so even in the face of a teacher's admonition there was no room for quiet contemplation. Watching the different pupils, raised questions about what influenced their priorities and whether they appreciated the consequences of their actions.

The next class portrait is brief because I did not observe many lessons in this class. However, I have merged both class portraits in CPS to give a flavour of mathematics teaching in this school.

7.6.1 11R mathematics group (CPS)

The students were now in Year 11 and were already getting ready for their GCSE examinations. The atmosphere in this class was very relaxed and most of the students carried on with their work. I got the impression they now understood the gravity of the forthcoming GCSEs. I would say it was now a mixed ability group (some students from Mrs Brown's Year 10 class and Mr Raymond's Year 10 class). A few students who had come from Mrs Brown's class still appeared to be struggling to focus during lessons and still needed support with some mathematics concept. The difference in this class was there was no teaching assistant and the students either had to wait for Mr Raymond or a few of them turned to their peers for support. Below is an excerpt from my field notes

At the beginning of the lesson two students walked in, and were told where to seat. One of the girls says,

'We are not doing a test are we? (test anxiety?)

Mr R says no but just laying books out so everyone knows where to seat.

Starter on the board – Review on ratios. Rest of class in now. Register is done, a few missing. The rest of the class were getting on with the work with a few discussions here and there. Mr R goes over corrections for starter and introduces lesson objective – PROPORTIONS

Slide (10 ticks) up with illustration and questions. Mr R uses example question to introduce topic... asking pupils for the answer;

A man earns \$ 40 for 8 hours, how much does he earn for 1 hour?

A student comments, 'Sir the answer is on the board'.

T does another example from slide - 51 miles in 3 hours...

Pupils told to carry on with work... a few understood it.

One student didn't get it, she asked her friend who wasn't sure she understood it. What level of work is this? (Could anxiety be lessened if exam type question were practised in lessons?) The class was generally getting on with the work amidst chatting and socializing...some were discussing the solutions to sums.

Then Mr R reminded them time was almost up and asked them to pack away.

John says 'Sir I was just getting into it'

Mr R says it's time to pack away.

It was evident that more work was being done in this class even though most of the tasks were drawn from 10 ticks (a digital mathematics resource bank) with not much attention given to lesson presentation; the pupils had to point out to the teacher that the answer was on the board. The ethos in this classroom was some worth different. The engagement of this group was social but also focused on mathematics. However, it appears they still lacked the dispositions that are validated within the structuring practices of school mathematics as seen in the extract below.

Class started off with a review of inequality signs $<$, $>$, etc.

Few pupils are working on task except Edna, who when I asked says I don't do starters.

Today's objective - Inequalities on a number line

'Sir are you feeling alright?' 'All books marked?'

A particular student was giving all the answers to the starter questions and ended up saying I've done this before.

Some student didn't want to go out of maths for a scheduled meeting with his career adviser as he said he preferred sitting in maths lesson than this meeting (interestingly Mr R assures him 'it will at least get you out of maths lesson')

Mr Raymond's response above could be seen as controversial, given that this pupil opted to stay in the lesson. What was this pupil meant to take away from his teacher's 'amusing' assessment of the pupil's dilemma? This scenario reflects the nature of teacher-pupil relationship in this class; also seen in the pupil's comment about 'all books marked' and asking the teacher if he was feeling alright.

7.7 Pupils' Reflections

7.7.1 Home support

SN: How do you feel about being in that group?

John: It's ok...If I have a problem I talk to my mum or the teacher. My dad is not really a fan of school. He fixes cars.

John could be in an awkward situation because his dad was not 'a fan of school' (this agrees with the survey findings that showed that there was higher level of educational qualifications in PLS compared to CPS). This could mean that John never got to discuss school work with his dad. Similarly, it is also possible Jess did not talk about school work because her 'Nan' was not in a position to help her.

SN: What do you think about the group you are in now?

Jess: It's alright but then it's not...because some people mess about and wonder why they don't get good grades.

SN: What does nan think?

Jess: She doesn't ask and I don't real communicate with her because she shouts...

Parents' ability to help their children by discussing their learning and providing additional learning opportunities was not a dominant feature in discussions with participants in CPS. How do these circumstances position these students to cope with the demands of learning mathematics in school?

7.7.2 The relevance of mathematics

The students from CPS understood the role of mathematics in everyday life. They did not dwell on the exchange value of a qualification in mathematics.

SN: Can you describe a recent lesson you enjoyed and why you think you enjoyed it?

John: It has to be algebra or converting grams and meters and stuff like that and I real enjoyed it because that's what you gonna mainly be using as you get older like measurement of carpets or so

SN: Why do you say so?

John: It was more life...type thing that you need.

Similarly with Jess,

SN: What do you want to do when you leave school?

Jess: Hairdressing...I already have a place.

SN: So would you say maths is important?

Jess: Yes you do need it in hairdressing because you need to measure how much liquid you put into someone's hair and the dye you're going

to put. Because if you mess someone's hair up, it's not really good (Jess already had college admission to do hair dressing).

In contrast, Amy

SN: What's maths good for

Amy: It's not real good for anything really if you think about it because half the stuff you learn you are not going use. You don't go into a shop and go 17 is greater than 1.50.

Pupils' perspectives of the relevance of mathematics in CPS could be limiting them, to a narrow possible practical application in a limited sense of not moving from their immediate experience.

7.7.3 Embracing Attainment groups

Students in CPS were happy in their groups if they had their 'mates' in the same group and if the teacher was 'chilled' (easy going). The students felt being in groups was for their own benefit since they were more likely to get adequate attention as suggested in the interview excerpts below;

SN: You mentioned you were in B band before, what happened?

Phil: I don't know, I have been in 'A' band before and dropped from A to B to C,

SN: So what happened?

Phil: It's my English cos I used to mess around in English last year and got bad grades so they moved me down. So I have got more English now than anything else at the moment.

It was not clear why Phil had been moved down,

SN: How do you feel about being in the group you are in now?

Phil: It's a good group because I've got my mate in there

SN: Do you think it's a good idea to put students in groups?

Phil: Yeah, it narrows it down to the people that are good in maths and know what they are doing from the people that are struggling and need extra help and stuff like that.

Phil's last comment was the general sentiment towards 'ability' groups in CPS. The students felt the teachers knew best and there was that sense of contentment within their group and passive acceptance of their challenges with learning mathematics. The focus for these students was obtaining adequate support. So they did not see ability groups as a reflection of their ability or a barrier but as a process created to benefit and support them.

SN: Are you happy in your group?

Amy: Yes my friends are in there and it's more relaxed

SN: What do you mean?

Amy: The teacher is more relaxed.

The teacher being relaxed meant in this case that, the students were given some level of liberty. During my second round of interviews, I discovered Phil had been moved into the B band because his grades had improved, but how would that move benefit him at this point if he has missed out on crucial milestones covered in a higher set (Macqueen, 2012)? Hence, what is observed in this case are structural problems built in, one that the school did not alleviate given the absence of extra support.

In addition, some students had never changed groups and so were not in a position to comment about other groups.

SN: How do you feel about being in that group?

John: It's ok...If I have a problem I talk to my mum or the teacher.

SN: If you had a chance to change groups which would you go into?

John: I have always been in C band, I have never been in any other band so I can't say.

SN: Would you consider changing groups? Why not B band?

John: I don't talk to people in that band plus the stress of moving.

John felt being in C band was for his benefit which to some extent is telling of the level John had resigned himself to and the structural inequality Bourdieu (1991) pointed out and in this case is experienced due to the absence of movements between groups once assigned to a LAMG.

SN: What do you think about putting students in groups?

John: It's hard at first because obviously some of the people you don't like, they put you with, which causes a bit of gossiping and chaos. But then they are doing it for your benefit aren't they?

John like many other students had come to accept their perceived challenge in mathematics which has made them resign and accept the restrictions imposed on their learning as a necessary intervention put into place for their own benefit. A level of divisiveness is also seen here when John suggests he does not talk with students in B band.

Most students in this band liked their group and would not consider moving up a group if given the choice.

7.7.4 Case Review

The lessons observed in CPS were taught in piecemeal elements and there were no explicit connections made between the topics that were taught. There was often no reference made to previous lessons as most lessons began with basic numeracy questions. The tasks students had to do were drawn from decontextualized textbooks that allowed them to practice concepts by answering similar type question in an auto pilot manner. These questions were closed questions. They were often presented with elementary concepts that did not equip the students with strategies to tackle novel questions in any form. Some of the pupils felt they were being treated like children and seemed like they knew what they were doing and wanted some challenge. However, for some others their attainment group was not seen as a barrier but was regarded as beneficial.

The influence of students' habitus is reflected in pupils' attitudes towards learning mathematics. Their attitudes were not always in harmony with those required to

succeed in the mathematics classrooms. For instance, when pupils refuse to do the starter activity, the non-subject related interactions/conversations indicate the absence of a work ethic and commitment to learning.

Also, in relation to their perspectives on the relevance of mathematics; pupils stayed with the use value of mathematics in everyday life and showed little recognition of the exchange value of mathematics; a position that also contributes to the educational inequality but in this case it is partially self-inflicted.

7.8 The main features of the case studies

This chapter has presented the four case studies which illustrate the distinct nature of pupils' experiences of learning within LAMGs emerging from the research and suggests some of the factors that framed their experiences and perspectives. These could be largely attributed to school level processes/expectations and the **micro-processes** within their particular group context. These include the **nature of tasks** students were asked to do and how they responded (passivity or agency) to the various demands placed on them which could have marginalised some pupils and privileged others. Teachers' dispositions and pedagogical styles have also been portrayed. In addition, students' **attitudes** towards learning in LAMG illustrate the influence of their families and immediate neighbourhoods. This was seen in the level of **subservience, resistance** or **acquiescence** seen in these classrooms. Also, prominent were pupils' perspectives on their experiences within LAMGs and the **relevance** of mathematics to them.

This chapter has shown how the strategies of the habitus seen in pupils' classroom disposition to learning mathematics are related to those external to the immediate classroom context, and in **collusion** with the structuring influence of the field of mathematics and their mathematics attainment group define pupils' performance and mathematics trajectory.

The major features of these case studies lay the foundation for further analysis of factors that were significant for interpreting pupil experience across the whole study. In the next chapter, these features become strong threads within a cross-case analysis which identify and link the main themes within the study.

8. ANALYSIS

In the preceding chapters, the quantitative analysis and class portraits brought to the fore salient features in the experiences of the pupils resulting in complex and multiple interacting elements at both school and attainment group levels. In this chapter, a cross-case analysis examines the shared features and correspondences in the presented accounts which suggest that there are systemic and social forces that combine to impact pupils' learning experience in LAMGs.

8.1 Introduction

In seeking to explore pupils' experiences of the teaching and learning of mathematics in LAMGs, I was interested to understand the impact of disadvantage on their learning experiences in LAMGs. I considered what difference being in a different class or a different school across disadvantaged and affluent neighbourhoods will mean for pupils' experiences. This meant looking at the various influences that impinged upon the teaching and learning of mathematics between schools and within LAMGs. The findings suggest that pupils' experiences in these groups are best understood as tempered by a combination of factors arising from school processes which begins to illustrate the differences between the two schools; the micro-processes within LAMGs and the influence of pupils' background on their learning experience.

8.2 School Level Processes

In this section, school level factors that distinguished the two schools and the attainment groups are discussed under two subsections; expectations and standards and lesson focus.

8.2.1 Expectations and standards

The level of expectations and standards in PLS had a huge impact on pupils' behaviour and performance both within and outside the classroom. This for example was seen in the way teachers were addressed, 'Sir or Madam'. The way pupils lined up outside the classroom and waited to be ushered into the classroom. In the lessons, the tradition where all pupils had a reference book to note down key points at the beginning of the lesson stood out. It was more surprising to see pupils referring back to these notes in subsequent lessons. Pupils were also held accountable for their note books. I had opportunity to look through different reference notebooks and I could see notes neatly made, different bits highlighted and references made to different portions. From a parent's perspective, the reference book could serve as a revision guide or even a record of what skills have been covered or needed reinforcing. However, the note taking also had its downside, a view expressed by Awais in an interview,

SN: If you could change maths lessons, what would you change?

A: Probably, the way you take your notes if they can be more detailed than what the teacher suggests or things like that because when you go back to revise, it's not always a matter of you just recognising it, sometimes you have to look in another revision guide to actually understand it.

SN: So what stops you from making detailed notes?

A: Not enough time because on each slide you have...teacher tells you to write it down but the next activity comes up pretty quickly so you maybe have only two or three minutes to write some notes and you have to get on with the next activity. (Awais, PLS: 10F)

Apart from the suggestion that the lessons were quick paced, what also comes across here is the requirement to be on task, focused and the discipline to actually take the notes.

In CPS, some pupils got away with giving so little and showed little and no interest in lessons, consequently, it was somewhat difficult to place any demand on them. A significant trait observed in CPS was pupils' response to homework. It was a taken for granted notion that pupils would not do the homework and this could have influenced the teacher's decision not to give homework. However, most pupils did not have school bags; some had small fashionable bags slung across their backs. Pupils' note books (most of these had doodling all over them) were kept back in school because teachers could not guarantee pupils could take responsibility for them. So pupils went home with nothing to remind them of work done in school. I never observed homework given to pupils or any returned and there was no mention of parents demanding explanations for this oversight. There may indeed be arguments in support of not giving homework. Yet the evidence I got was this was not a constructive strategic decision, but rather an institutional way of managing the situation whereby schools reduce expectations and pupils meet those low expectations.

In contrast, pupils in PLS had big bags, they went home with their note books and reference books so they could turn to these for support with homework. It was a serious offence not to do your homework in PLS going by the dread on pupils' faces when they defaulted. The dilemma here is, was it the teacher's level of expectation

driving pupils' attitude to homework or was it the other way around, or perhaps the parents' insistence.

An alternative interpretation of this attitude to homework is not a case of either this or the other, but what is apparent is a form of collusion. Looking at the mathematics classroom as a whole system, every participant has a role to play if the system is to function effectively. There is no imposition of a regime on any side and pupils are not unwitting victims but contribute to their own exclusion or progress depending on their response to the prevailing culture.

Another distinct element involved the behaviour management strategies (reactive, preventive) employed by teachers. This played a significant role in the pupil's learning experiences in relation to the extent it provided a positive or negative classroom environment (Rubie-Davies, 2007). The maintenance of a close watch and control was not easy to negotiate in some classes. Where the teacher was very strict, there was a form of docility seen in lessons followed by some unspoken tension and fear of sanctions as seen in 10G. This reified the power difference (Jackson, 1968; Woods, 1990) that existed in this class, alongside the consequences of not being compliant. On the other hand, the use of soft power as used by Mrs Brown, was also not effective when used with pupils or in Miss Freeman's case where pupils interpreted it as a lapse on the teacher's part and moaned the impact it had on their learning.

It appeared that Mrs. Brown was always faced with the choice of making a compromise between pursuing students' learning and condoning misdemeanors. When questioned about this, she was of the view that making the most of the opportunity of having the pupil in the class was her priority and as such she weighed her options carefully. She asserted that it was the school leadership's responsibility to enforce a stern behaviour policy that permeated through the whole school. The impact this situation had on teaching and learning was immeasurable as the absence of boundaries often meant pupils took advantage of their teachers' gentle disposition. Lessons were largely interrupted, causing distractions which then impacted on the flow of the lesson.

Nevertheless, compliance to school standards was relatively easier to solicit in PLS. Being a large multi ethnic school meant the school had pupils who had as part of their cultural experience the requirement to show deference to constituted authority as

failing to do this brought on serious repercussion which staff used to a more liberal culture may find too stringent (Lupton, 2006). Consequently, an environment conducive to learning was maintained as pupils knew what was expected of them and the school seemed to enjoy support from parents whose expectations also mirror that of the educational system and therefore understood the necessary requirement of behaviour policies and sanctions. In this case, the parents play their part by aligning themselves with the system for their own perceived benefit.

Furthermore, the pupils in PLS appeared to be intrinsically interested in the lessons as indicated on occasions where pupils told each other off for disrupting the lessons. Teachers also capitalised on the instrumental value of what they had to teach considering that their middle-class pupils showed or had a desire to succeed.

On the other hand, CPS had discipline measures that did not strongly register with the pupils who continued "sussing out" the teacher (Woods, 1990), pushing the boundaries irrespective of any consequence. This inevitably impacted on pupils' learning. Mrs Brown used rewards (treats) as an incentive to encourage pupils and I questioned its appropriateness for pupils at this level but the pupils seemed to love the thought of having some home baked cake in recognition for their good conduct.

Teachers in CPS were largely aware of their students' background and the additional behavioural issues and they tended to give students a lot of leeway and 'pallyed' with students. Having said that, I recognize that the students on many occasions proved difficult to manage and this to a large extent seemed to influence the classroom atmosphere in unpredictable ways. When students were not fully engaged, it often led to behavioural issues and general apathy in lessons as reported in Amy's case,

I used to mess about...because I didn't understand what he was saying. I just like lose focus a lot ...I just don't understand it so I switch off. (Amy, CPS)

It is possible Amy was giving herself a reason to opt out but it was also possible that she was not getting anything from the lesson in question which as she claims resulted in her 'messaging about' in class.

Another issue here might be that the teachers may be more lenient with their pupils for the best of reasons in order to motivate, however one effect it might have is to

enhance the lack of motivation by playing down the significance of the work and behaviour that is so evident in CPS.

8.2.2 Focus of lessons

PLS' expectations for excellent pupil outcome in external examinations was shown through the provision of the structure required to realize this. There were extra support sessions planned for students outside normal classroom hours and many students took advantage of these sessions. The students were quite familiar with examination requirements or the assessment requirement of the GCSE examinations. This was largely as a result of the attention given to these in lessons and during revision sessions. Some reasoned that it was easier to get a C on the Foundation paper than the Higher paper, a fact they were very knowledgeable about. They even knew the number of marks needed to get a C on each examination tier. After each unit test, assessment analysis sheets were handed out to students as feedback and corrections were done. The analysis sheets were used to identify students' learning needs by both the teacher and the student who had to file this analysis sheet for reference purposes. This structured process of assessment and feedback gave the students some form of awareness of their performance. They knew the areas they needed to work on and the corrections focused on any misconception they had. The results students got were not always positive, in such cases the students were seen to be unhappy about their scores but they would take time to go over the script, noting where they lost marks and also enquiring what they needed to do to get the full marks.

In contrast, in CPS, not many pupils read through test feedback/summaries, particularly if they had performed badly on the test. I wondered if this was the reason there was no correction of misconceptions/errors done after these assessments. These students were already preparing for their final examinations in secondary school but they were not familiar with examination requirements or the assessment requirement of the GCSE examinations they were going to sit in a little while. So what was the purpose of having students sit these tests? The purpose according to Bourdieu (1972) is not always one deliberately enacted by the participants e.g. school may not deliberately do it for a reason but the consequence is that it positions the pupils in a state of failure or reduced achievement so they believe it and act that way.

Similarly, there was no connection made between the work covered in class and the assessment requirements of the examination board. This is not advocating for a system of teaching to the test but one that allows the students to be knowledgeable about the examination they were going to sit and equipping them with the tips for revision which then puts them in charge of their own learning. But by withholding knowledge from the weaker student in CPS, in one sense, teachers are trying to protect the pupil, however, this does not give them access to understanding how the system works. Therefore, they are constraining the pupils by restricting and withholding that meta-knowledge from them. Another way of looking at this is that one set of pupils are taught the rules of the game whilst the other set is not and are therefore placed at a disadvantage.

8.3 Attainment Groups: imposing limits

Based on responses from interviews conducted, there seemed to be mixed views about the benefits of attainment groups such that these groups could have been described as a blessing (it allowed them to achieve their goals) or a curse (it was a barrier to their goals). But this seemed to be dependent on the school attended, pupils' gender and who else was in the group. I go on to show the implications of this by looking at the nature of tasks pupils were given; the instructional approach and the methods employed and the negative consequences that followed.

8.3.1 Nature of tasks

The opportunity to learn in these classes was closely connected to teacher's expectation for the students as mentioned previously. This was realised through the level of challenge (either through questioning or tasks done in lessons) the students were exposed to in mathematics lessons and the nature of the choices students were given in lessons. The low level of expectations was reflected in the nature of tasks assigned to students.

Most often the questions (from textbooks or worksheets) used across all the classrooms were closed and procedural, placing little demand on the application of knowledge gained or reasoning on the part of students. This also made students rely so much on the teacher for solutions to questions that proved challenging especially if

it involved some form of knowledge application, hence creating a dependency attitude in students and discouraging any form of independent thought from the students.

The level of work in Miss Freeman's and Mr Gregory's classes was a little more mathematically demanding than what obtained in CPS, there was a lot of emphasis on content indicated by the constant focus on knowledge and examination tips, there was no attempt to relate the content to students' interests or backgrounds neither were students' input encouraged. These points also featured in pupils' responses on the survey question, 'what would help you do better?' When pupils did not have a clear understanding of what they were being asked to do and why they were being asked to do them, it reflected in their responses in class and during assessment. Firstly, the level of anxiety associated with tests and issues of memory lapses could suggest that pupils did not have secure knowledge of concepts taught in lessons or that the pressure arising from a constant testing regime was taking a toll on them.

On the hand, Mrs Brown's pattern of always starting the lessons with simple numeracy questions which the students complained made them feel like they were in primary school was not taking account of the reality that the pupils needed to be prepared for high stakes examinations. On the contrary, it signalled that pupils could carry on with their conversations (a sense of 'this is definitely not for us'). This could explain why some students never did the starter activities. This then places constraints on what pupils learn or not learn and raised the question of the possibility that syllabus requirement was not met by the work covered (Thrupp, 1999). However, what is also evident is the student playing a part in their own exclusion. The school imposes a restricted pedagogy, the pupils recognize this yet their opposition is to withdraw, further entrenching their own exclusion.

One of the ways teachers might get pupils interested is by providing activities that will engage them. The pupils loathed the drudgery and triviality of the activities they were made to do in lessons which was indicated in their demands for more interactive and dynamic activities seen in the class portraits in chapter 6. The request for 'fun' activities in mathematics lessons was expressed by students across both schools and marked a significant element of willing engagement in mathematics lessons.

SN: If you were to change maths lessons, what would you change?

Jamie: Since maths is a hard subject that can be boring, try and make it more interactive. Make the lessons fun...it's not aww I have got double maths today unlike in my English lessons, I like all my lessons, you come into maths, it's like a chore. It's not something you want to gain from but something you have to do.
(Jamie, PLS: 10F)

Jamie was in essence responding to a subject he perceived denied him control, creativity and meaning (indicated by reference to his English class) and this informed his beliefs about mathematics. The message that come across is one that suggests that there is sense of coercion (Picker and Berry cited in De Corte *et al.*, 2008, p. 25).

8.3.2 Instructional approach and methods

The case studies and survey results show that there is a greater occurrence of teacher-centred practices across all groups. This to an extent may explain the lack of interest and engagement of pupils in mathematics classrooms. Pupils' responses suggested that the pace of lessons was holding them back. Awais (PLS: 10F) is an example of a pupil who seemed to know what he was doing and wanted to move on but, he felt the pace of the lesson was often too slow. However, it was clear to me that Miss Freeman's pedagogical inclination was geared towards establishing pupils' understanding and not just about teaching procedural facts. Coincidentally, these ideals were not aligned with the pupils' mode of learning established as a result of the prolonged exposure to the typical culture of teaching school mathematics.

The mathematics lessons lasted for fifty minutes. The lessons were often taught at a quick pace in Mr Gregory's class. This is closely linked to what I said earlier about the lessons being mostly about accomplishing the set objective of the day. There was never an occasion where the course of the lesson changed as a result of a student's question or a need to clarify students' misconceptions. This could be as a result of the need to cover as much as was demanded by the scheme of work. This additional time pressure meant that teachers had to ensure their lessons moved quickly and hence exuded that sense of urgency; a tendency that had the students assuming that speed was relevant in mathematics (Boaler, 1997b). Consequently, students had to work quickly with little chance of giving deep thought to the task at hand.

SN: If you had to change the way maths was taught, what would you change?

Charlotte: I would make it a bit slowed down and make sure we are not learning so much in one day and make sure we taught it like at least a week or two to make sure everyone has got it instead of going out of the classroom still like confused.

Nick: Not make it as complicated, have more time on it

The element of time spent on mathematics concepts was crucial for these students because it could mean they understand mathematics better and therefore enjoy it. But for some others this quick pace may also have meant they got left behind and had to play catch up or got lost whilst trying to make sense of the rushed concepts, an assertion Charlotte alludes to when she suggests that it was possible to come out of lessons still confused. What I want to draw out here is that many days of leaving the lesson still confused would amount to many missed opportunities to deepen students' understanding in mathematics and therefore begin to sow seeds of early disaffection towards the subject of mathematics.

8.3.3 Giving pupils no options

The students in CPS believed that the teachers knew best and there was that sense of contentment within their group and passive acceptance of their position. The focus for these students was obtaining adequate support. Most pupils in CPS liked their group and would not consider moving up a group if given the choice. Jess was however of a different view; She felt she was not supposed to be in this particular group.

Jess: I don't want to be in here with this lot... It's alright but then it's not...because some people mess about and wonder why they don't get good grades...

SN: Would you consider moving up a group?

Jess: I would because I would do higher but I don't know if my ability will let me do higher (Jess, CPS, B).

Jess felt the work was too easy for her and just wanted to move on but her perceived inability (mental block) as a result of her attainment group was a barrier. In

summary, the language of helplessness conveyed by Jess suggested the seeming lack of control and agency that obtained in this process.

The pupils believed they were in the ability groups because of the difficulties they experienced whilst learning mathematics. Similarly, Aisha attributes her failure in mathematics to a lack of ability. The feeling expressed by Aisha is not new given, there is a tendency for girls to mostly attribute their failure in mathematics to a lack of ability (Diener and Dweck, 1978). Furthermore, Aisha's use of the phrase 'superior to me' (see p.167) is telling of the stigmatization attached to being in a lower set or the prestige attached to learning abstract concepts in a higher group.

Jackie's reaction shows the emotional dimensions involved when students get moved down a set. But, this comes at a price. In PLS, most pupils wanted to move up a set so they could achieve their predicted grades but felt they were not in groups that would allow them reach this goal. In this case, their attainment group was not something that benefited them.

These scenarios portray the structural nature of the field imposing constraints (in this case a mixed attainment group), even when the process can be challenged by moving pupils between groups. This explains why schools do not move pupils because if a pupil is moved up as in the case of Phil, it places them in a worse position if they do not get extra support and sessions (the idea is that this should be built into the system). So even pupils who succeed on the line of this will fail because they find themselves in a double bind where they come to a set but they have not done half of the work and the pupil would have missed significant learning covered in the higher set.

Similarly, the structural nature of exclusion is also fostered by the very act of moving pupils down following the argument that it is more suited to their needs. However, they are going slower than the others and by implication, they will never catch up! This resonates with a Simpson's sketch where Bart says "Let me get this straight. We are behind the rest of the class so we are going to catch up by going more slowly than they are? Cookoo!" (<https://www.youtube.com/watch?v=XQcBI5SKJgU>). The implication is that even though it appears pupils are being given options, they are not options that serve them well ultimately.

8.4 The Impact of Pupils' Backgrounds

The contrasting responses to learning demonstrated by pupils according to Bourdieu's (1974) will be connected to their habitus, which he argues is forged in the family. Consequently, it is linked to where students come from or the influence of their individual backgrounds, in the sense that these have defined for them how to respond or what to think about school, mathematics and homework and how they were expected to interact in school. This is considered from three aspects: Attitudes in lessons; Influence of family and social networks and Pupils' response about their experiences and the relevance of mathematics to them.

8.4.1 Attitudes in lessons

Alongside the very strict school ethos and standards of expectations in PLS, most students came from middle class families. This would have played a significant role in defining for students the acceptable work ethic and the associated rewards of getting good qualifications. So, it was not difficult to find students who were on task and wanted to do well in mathematics. The pupils understood the importance of getting a C grade in mathematics and were keen to ask what level of work they were doing or what they needed to do to get a C grade in mathematics.

The focus of interactions in these classes was telling of the influence of students' social backgrounds. The students in PLS focused on mathematics related topics and understood how to operate in this context which for them served as a form of cultural capital (Bourdieu, 1977) that paid off within school. In contrast in CPS the focus was social, students were involved in non-mathematics related topics which was not challenged by the teacher. Although it appeared there were really no boundaries in place here (or the students chose to disregard them), it does show that these students did not have the traits or dispositions that would help them succeed in mathematics classrooms.

Behaviour issues were a common occurrence in most lessons observed in CPS. In addition, the low level of social control students experienced outside school was such that meant peer influence wielded greater power over individuals' actions (Wilson, 1987). Consequently, this formidable force (formed by the students) collides with the prevailing classroom structures and often resulted in chaos and disrupted learning.

Generally, in CPS, student often showed some form of reluctance when asked to do mathematical tasks they were not certain how to go about. The response to this pressure was often emotional outbursts that illustrated frustration at being asked to do things they could not do or readily see its usefulness. This put them in a place of helplessness and lack of control, and to mask these feelings of inadequacy, students were prone to disengage and opt out from the learning process by resorting to humour and theatrics or took up adaptive attitudes and behaviours that discouraged success (Ainsworth, 2002). Yet again, this part played by pupils contributes to their own exclusion. Their reaction to possible failure is effectively to remove them from the possibility of success.

In PLS, there were no visible emotional outbursts observed but that is not to say the students knew what to do at every point in time. It was clear these students knew and understood the code of conduct expected in lessons. They would put up their hands and wait to be attended to showing they understood and adhered to the same principles of waiting turns, that obtained at home and within this environment. In other words, they had dispositions that were in harmony with the interactions that occurred in their mathematics classroom. This also alerts us to the levels of social stress the students in CPS had to deal with; one that required them to conform to standards that did not necessarily align with their habitus or what they were familiar with outside of school.

Interestingly, when the students in PLS did not understand a mathematics problem, they would ask questions or opt to forego their breaks and come back for support sessions. This showed a sense of responsibility and commitment to a desired outcome. These dispositions are key qualities for success and reflected the influence of their backgrounds which again aligns with what was expected in their mathematics classroom which also indicates that they had a strategic "feel for the game" (Bourdieu, 1990, p. 9). Although these classes comprised students who were supposedly low attaining, they had some elements working in their favour. The school mix here was predominantly middle class, so they were in class with students who had the same dispositions and values (Thrupp, 1999). Hence it was understandable that students wanted to do well and indirectly spurred each other on.

8.4.2 Influence of family and social networks

The pupils in CPS described the area they came from as nice and quiet but they were not allowed to stay out late or preferred to stay in with family.

I don't go out with friends. I like to see my family quite a lot (John, CPS: 10B)

No. I don't stay out late...I stay in, I'd rather get my work done (Jess, CPS: 10B)

Interestingly, outside that area other people did not think this area had a good reputation.

However, the case was different for pupils from PLS with a greater multi-cultural mix. Most of the pupils lived within the immediate environs of the school. Out of the 12 pupils interviewed in PLS, only 2 pupils who lived outside the school's immediate neighbourhood described their areas as 'rough'. The rest described their place of residence as nice and quiet. They conveyed perceptions of safety when they indicated they were allowed to stay out late or that they had never had any trouble in the area. They reported that their neighbours were mostly professionals who led very busy lives.

Pupils' responses suggested that pupils from PLS had some level of parental input: in PLS, Aisha and Nick could readily talk about the help and support they received from their family, this was not the same with Jess and John in CPS. The parental support pupils in PLS got came across in the way pupils were challenged to give their best. Aisha's dad's involvement echoes the process of transforming one's habitus; Nick enjoyed inherited cultural capital from his grandfather which placed him at an advantage. It is possible to conclude that these pupils discussed school work with their parents. The parents equally showed some level of interest and involvement.

From the interview data and survey responses, it was evident some of the pupils in PLS had parents who were well positioned and most of them had siblings who were either in higher education or professionals in different fields. Hence, these pupils came into mathematics lessons with an established sense of what they wanted to achieve as learners.

Also, parental support in this case is undoubtedly connected to the parental values and the socioeconomic resources (capital) at their disposal. The notion of providing material resources was also a distinguishing factor here. Some pupils in PLS had extra tuition outside school because their families could afford to pay for these lessons and thought it was a worthwhile way of spending it.

Jackie: I was annoyed when I got moved down but told if I worked hard I could move up again...but then she wasn't the best teacher so I didn't get the grades as I was getting Ds and Es.

SN: How does dad feel about that?

Jackie: Dad is really angry about it because he spent loads of money on getting me a tutor.

Jackie (who also attends drama and dance classes) may have been fortunate her parents could afford extra tuition but that was a luxury not everyone could afford. Some others had various extra-curricular activities outside school which meant they enjoyed a range of enriching activities outside school. All these may have contributed to the 'feel good factor' pupils demonstrated in class. These opportunities would have influenced students' sense of achievement and attitudes to work in school. In this case, an example of structural inequality becomes apparent, albeit different from the self-imposed contribution by pupils.

In contrast, in CPS parents' ability to help their children by discussing their learning and providing additional learning opportunities was not a dominant feature in discussions with participants in CPS. These circumstances could position these pupils at a disadvantage that makes it difficult to cope with the demands of learning mathematics in school. For example, Jess did not talk about school work with her grandmother because her 'Nan' was not in a position to help her. Some other parents had job or domestic circumstances that put a strain on what they were able to reasonably provide. Whilst for some others, it would have been an outright struggle as suggested in John's assertion when he declared 'My dad is not really a fan of school'.

In addition, most of the pupils had no form of extra-curricular activities outside school. They were either at home watching television or were outside 'hanging out with their mates'. These features may mean they may not be exposed to

environments that provide the needed traits and attitudes to grapple with the demands of the mathematics classroom through no fault of theirs (Gates and Noyes, 2014; Jorgensen et al., 2014b).

8.4.3 The Relevance of mathematics

Pupils' perceptions of school mathematics may have been shaped in various ways by the influence of family, school and classrooms (Bourdieu, 1974). Across both schools, pupils were aware of the usefulness of mathematics but they maintained the view that their lessons were not practical enough and it did not prepare them for the real world. In addition, they were also not told why they had to do certain topics in mathematics; this was indicated in pupils' survey reports of the less experienced mathematical activities in their lessons.

Nevertheless, pupils in PLS seemed to lay more emphasis on the *exchange value* of mathematics. Mathematics was described as significant because it could determine whether they went on to higher education or not and ultimately the quality of life lived as suggested below,

Yes maths is very important. It gets you more places and it opens more doors (Sharon, PLS: 10G)

Awais: I want to get a good job so then I can live like a better life. If you get bad grades, you are not going to get a good job (Awais, PLS: 10F)

In CPS the students were more inclined to see the practical use of mathematics, John referred to this in terms of measuring and laying carpets and Jess in terms of mixing dyes in hairdressing. They did not dwell on the exchange value of a qualification in mathematics. An explanation for this could be that because they have struggled with learning mathematics, they did not feel they had the required qualifications for further education and perhaps also suffered a lack of exposure to career role models. The recognition of their limitation often reflected in their attitude to learning mathematics and the kinds of career they chose to pursue (Archer and Yamashita, 2003).

SN: What do you want to do when you leave school?

Jess: Hairdressing...I already have a place.

John: I am going into hotels and street dancing

In PLS, students' choice of career was more academic than vocational,

SN: What are you planning to do after Year 11

Charlotte: I want to go to college because I want to be a primary teacher.

SN: Do you think maths is important then

Charlotte: A lot - yes I do. That's why I like to come in the mornings now but if I could do any more days, I would because I really just need to get that C otherwise I wouldn't be able to do anything.

It is interesting to note that Charlotte seemed to have a clear notion of what she wanted to be in the future but it is equally a concern that she dreaded the impact her grade in mathematics could have on her future prospects. This was also true for Aisha;

SN: What do you want do when you leave school?

Aisha: I want to hopefully get my GCSEs and go to college.

SN: What grade do you need in maths for that?

Aisha: C,

SN: Do you think maths is important?

Aisha: You'd need a C for any decent job. And I'm thinking about the long run... I can't get far in life if I don't have my GCSEs.

The influence of pupils' social space (family, school and peers) on their experiences of learning mathematics shows that pupils do not come into the mathematics classrooms as empty vessels. They come with their own values, dispositions and even their own agenda. These qualities regulate their attitudes in lessons, the decision to engage or not to engage.

This influence is illustrated in Phil's case

SN: What do you want to do when you leave school?

Phil: Engineering

SN: What grade do you need in maths for that?

Phil: C or above, C minimum

By the second round of interviews, Phil had changed his mind and had decided he wanted to undertake an apprenticeship now, whereby he does one day in college and the rest in the garage. He explained he did not want to go to university since he had a choice of earning whilst studying. This change of career choice was puzzling because Phil was doing well in mathematics and was now predicted a C grade or above. What was not clear was if this was Phil's way of avoiding disappointment of not getting the required grades for entry into higher education or he had come to know and accept his place (Reay, 1998).

8.5 A critical overview of Pupils' Experience

The study's findings show that pupils' experience of the teaching and learning of mathematics in LAMG is influenced by a number of factors. I illustrate these factors in a model that depicts how different structures combine in hidden forms to marginalise and exclude pupils whilst also explaining the need to adopt a stance that embraces a mindset of *possibilities* instead of constraints.

The mathematics classroom culture seen across both schools was illustrated in the class portraits in Chapter 6 of this thesis. I have shown how, in LAMGs, the level of '**expectations**' described the impact of structural constraints conveyed through the school level processes and the nature of tasks (within their attainment group) students were given as well as the teaching styles adopted within these groups. The restricted coverage of the curriculum meant students were not adequately prepared to do well in assessments and as such were in a sense already being excluded and positioned for a certain future. Nevertheless, the pupils equally, play a part in their own exclusion by acquiescing or failing to challenge the prevailing culture in most mathematics classrooms or by refusing to do the work assigned.

Similarly, the allocation into attainment groups perceived as beneficial or not equitable, could not be challenged. Overall, the students in both schools have come to accept a learner identity synonymous with low performance level in mathematics based on teacher judgements that have assigned them to 'ability' groups that have distorted their perceptions of what they can or cannot do and in the process, they collude with the school system of exclusion.

Where pupils' backgrounds or '**orientations**' (depicted by attitudes, parental support and influence and perspectives) largely structured by the habitus, (this is illustrated using broken lines to indicate its indeterminacy) are adopted as constructs that are valued and aligned with the expectations of the field, possibilities arise and there is a 'repositioning' for pupils that would allow them to rise above barriers or limitations. When the reverse is the case and pupils' backgrounds are treated as constraints, it implies a sense of deficits on the part of pupils such that warrants imposing forms of 'symbolic and cultural mechanism that pathologises' (Lawler, 1999, p. 4) working class realities by projecting onto them identities that disregard the backgrounds they represent (Mills, 2008).

The influence of pupils' background seen through students' attitudes and perspectives, indicated what they felt will help them do better in mathematics and the value they placed on learning mathematics. The students' views suggested that the element of relevance was missing in the lessons presented across both schools which had serious implication for the levels of engagement seen in lessons. The mismatch between what students felt was relevant for life and what educators thought was essential was highlighted, with students suggesting they were not well prepared for life outside school. They wanted practical applications and clear reasons for doing some topics.

Also, the students' views of the relevance of mathematics differed across locations which may suggest that the local context and traditions would have played an underlying role here. The students' views about job opportunities and their desire to move out of the area reflected their contrasting backgrounds. However, part of the problem was in social class influences on attitudes and the way families and children were socialized to respond. However, the bold arrows in the model indicate that this process is not deterministic and responds to what pupils are exposed to continuously.

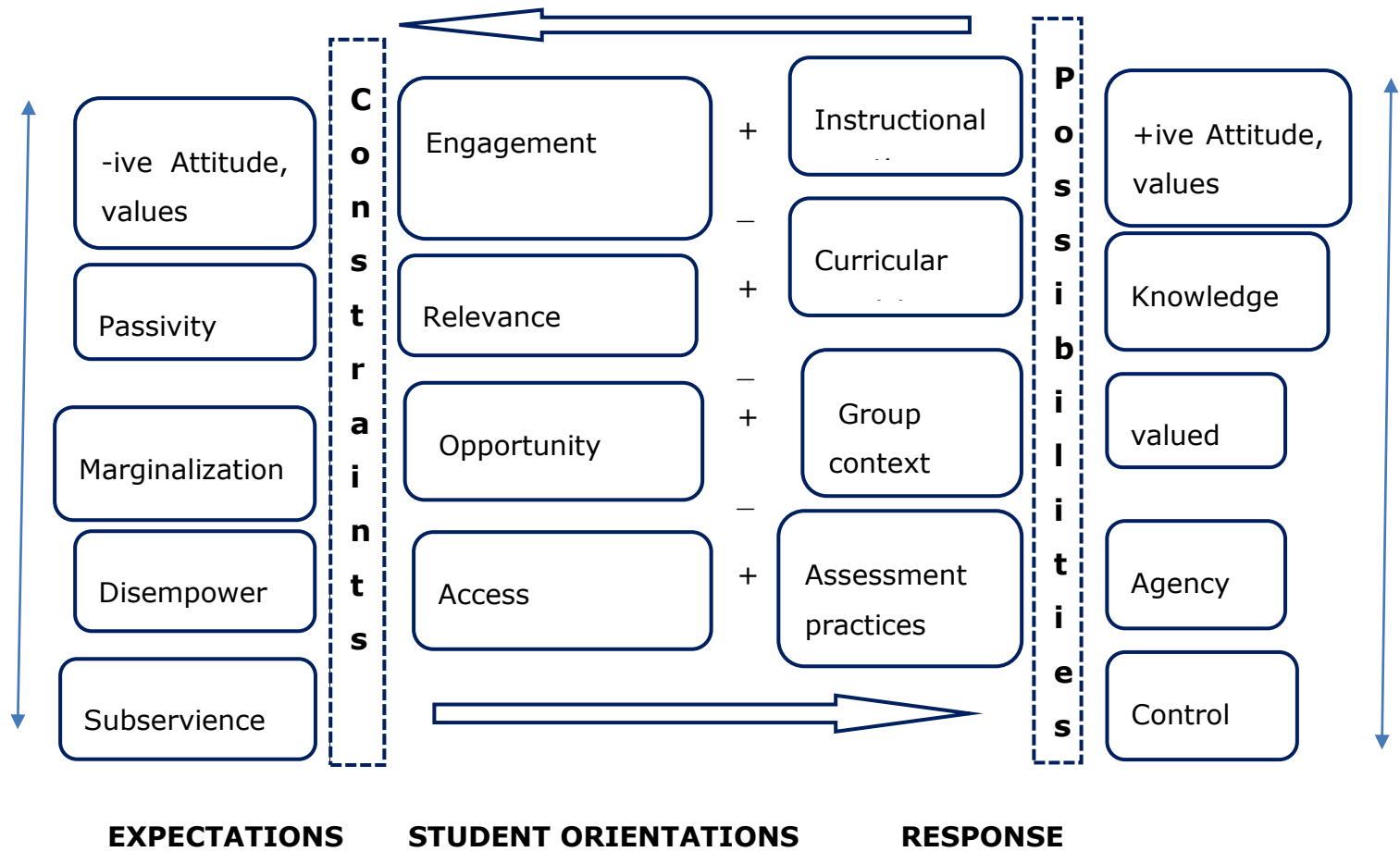


Figure 7: Factors associated with differential attainment

The mathematics education field, in combination with pupils' habitus and the quality of the capital they possess, to a large extent influence their potentials and trajectories, indicated by the plus and minus signs in the model. For instance, when pupils comply or resist, or show no value for school mathematics, I have demonstrated how pupils by virtue of their **responses**, play their part. Being aware that pupils will do one of three things: appear to be helpless; appear to be passive (a form of resistance) and appear to resign positions teachers and schools to develop strategies that appreciate the implications of the demands of schooling and the mechanisms pupils use even when pupils are unaware of them.

This chapter has laid out how students' social space impacted on their experiences of learning of mathematics within LAMG and the different ways the pupils responded to their experiences. In the next chapter, the study's findings resulting from the analysis are examined in the light of literature and the theoretical and conceptual frameworks employed in this study and the implication for practice is also discussed.

9. REINFORCING DISADVANTAGE

This chapter synthesizes and discusses the research findings in relation to the literature review, conceptual framework and the issues that were raised at the beginning of the study in terms of what may be understood from the experiences of pupils learning mathematics in LAMGs within schools in contrasting social contexts. Following the summary of findings, I return to the explanations given for differential attainment described in Chapter 2. The tendency is to treat pupils in different schools as if they are the same, which therefore, allows inadequate attention to be given to the social contexts of learning mathematics within schools. Specifically, attainment grouping is often considered to be a major factor in the development of elite and underclass groups in society. Perhaps most importantly, tracking (setting) is felt to work against egalitarian, democratic ideals by sorting pupils into categories from which escape is difficult or impossible (Salvin1990, p. 3).

Nevertheless, pupils also play an active role in this process through the value or importance given to mathematics as a result of their cultural and social backgrounds, embodied in the habitus of pupils and demonstrated through their dispositions and perspectives. Pupils' backgrounds in combination with these micro-processes work to determine pupils' mathematical outcomes. This helps to explain the differential attainment observed across disadvantaged and affluent places.

A summary of the findings resulting from the analysis is presented with a view to draw conclusions and to discuss the implications for current practice. The study's contribution and areas for further research are presented and the chapter closes with some personal reflections.

9.1 Uncovering Pupils' Experience

The analysis presented in the previous chapter allows for the understanding of the structuring within LAMGs on pupils' experience, across socially and culturally diverse groups. This analysis offers a sociological approach to understanding the foundations for pupils' differential attainment and the influences on their experience which differs from existing approaches based upon psychological models or school /teacher effectiveness.

The study was guided by the following research questions;

1. What similarities and differences are there in the mathematics learning cultures of the two schools these pupils attend, including curriculum, pedagogy, relationships, groupings, etc.?
2. How do the micro-processes within LAMG operate to reinforce initial divisions into classes?
3. How do the characteristics of pupils' background impact upon their learning, engagement and achievement in LAMG?
4. What are pupils' perspectives about their learning experiences and their views of the relevance of mathematics to their futures?

This study has presented both an exemplification and a manifestation of some sociological concepts (an explanation of these concepts was provided in Chapter 3) and have shown how they become evident within the logic of practice in an institutional setting. Therefore, my focus on four LAMGs and my argument that the construction of knowledge does not happen in a vacuum, by implication necessitates giving due consideration to the contextual background; and has allowed for the claims made in this thesis.

Some of the findings of my study bear some similarity with the study carried out by Jorgensen et al (2014) where they give a description of the subtle and coercive ways in which the practices of the field of mathematics education exclude learners depending on their cultural backgrounds and dispositions. Their study however, focused on investigating 'the patterns of language, forms of representation, as well as understandings of self and others' (p.229) within very distinct social and school positions. My study could be seen as an extension of theirs, as my study looks at similar groups of pupils in terms of school positions but varying social levels. My

analysis identifies the implications of the collusion that occurs between the school, pupils and their parents and how these impact on pupils' experiences and perspectives on the relevance of mathematics to them.

It is perhaps not surprising that the model here represents a fairly typical *class* stereotypical set of constructs across PLS and CPS. This can be loosely expressed in terms of self-control, perseverance and agency contrasted with immediacy, impulsiveness and subservience. On the contrary, it is encouraging that this is the case, which further establishes the validity or applicability of the analysis. If such class based responses and perspectives are instilled by the social conditioning experienced in early childhood (Lareau, 2000), then it follows that a model based on the dispositions and entrenched ideological frameworks in mathematics education would reflect those distinctions (Gates, 2000).

In summary, in my analysis I have

- (a) identified some micro-processes within LAMG that reinforce social difference;
- (b) demonstrated how this structuring processes stem from and is built upon the theoretical framework developed in Chapters 2–4;
- (c) presented some examples of the empirical manifestations of some theoretical and sociological concepts by demonstrating how pupils backgrounds impact their learning experience;
- (d) identified alternative conceptualizations that add to an understanding of *differential attainment*.

In general terms, this study has provided an account which illustrates the relationship between pupil's experiences and the social influences and origins of some aspects of pupils' (un) achievement. My account has been influenced by elements of social theory from Bourdieu rather than psychological accounts. There is a need to consider how to describe and account for the continued failure of pupils from low SES due to systemic influences. By drawing on a critical sociological framework, this approach brings to the fore theoretical issues behind the construction of differential attainment and of '*failure*' for certain pupils. In addition, it can offer some insight into some of the issues that result in pupils being marginalised and excluded.

9.1.1 How LAMGs work to reinforce social distinctions

This study's examination of pupils' differing mathematics learning experiences and trajectories demonstrates that the micro-processes within the attainment groups (of pupils in the case studies), in a myriad of small waysworks to determine their future attainment and in line with Boaler's prediction, 'will almost certainly dictate the opportunities they receive for the rest of their lives' (Boaler, 1997a, p. 594). The grouping context has an effect on the type of mathematical knowledge presented to pupils, the nature of expectations and the focus of lessons, a stance also supported in the literature (e.g. Hart et al., 2004)

Within the field of mathematics as a practice, teachers have come to accept setting practices as the preferred option due to the dominant ideology in mathematics education that mathematics is hierarchical in structure (Ruthven, 1987). Consequently, a hierarchy in the demands and complexity of the discipline would entail that students be organized around this hierarchy. Zevenbergen (2002) makes an interesting contribution about what obtains when this hierarchical notion is merged with the outcome based learning- 'the creation of an environment that reifies a learning hierarchy' (p.3). These structuring practices align with dominant beliefs about 'ability' and justify the implementation of practices that accommodate these beliefs. This study's findings concur with other studies that highlight the inadequate quality of experience for pupils in LAMGs;

For example, students placed in low ability classes tend to endure reductivist teaching characterised by 'repetition of drill and practice and the accumulation of fragmented bits of information with no apparent relevance to either real world problems or the kinds of thinking tasks productive adults perform' (Wehlange et al., 1992, pp. 85-86). This limits students' access to knowledge and therefore their power to determine the options in their lives. (McFadden, 1995, p. 297).

The issue of relevance is discussed later but what is critical in this case are the barriers (mental and structural) that stop pupils short of reaching their goals.

Furthermore, teachers who hold lower expectations for their classrooms as a whole are inclined to teach lessons with easier content, to devote less time to rigorous academic activities and accept less than perfect performance from their students (Cooper and Good cited in Good et al., 1987, p. 142) and hence, restrict pupils' opportunity to learn.

Stereotyped expectations contribute to differential achievement both directly and indirectly. First, the more restricted extent of teachers' pedagogic interactions with pupils of whom they have low expectations, and the inferior quality of these interactions, have a direct effect on these pupils' opportunities to learn. (Ruthven, 1987, p. 249)

This opportunity to learn becomes limited in lessons where the content of the lessons taught is shallow as seen in lessons observed in CPS, and therefore meant that the work covered did not meet syllabus requirement (Thrupp, 1999) or in PLS where their 'sets' was a restricting factor – an *artificial ceiling* (Francis et al., 2017, p. 5) that excluded them from higher level study and qualification paths (Dunne et al., 2007; Ireson et al., 2005). The consequence that follows is aptly described in the work of Boaler et al (2000), who have reported that pupils in low sets believed they were trapped within a vicious cycle because they had 1.) minimal chances to attain good results because they were not taught concepts that were assessed in the tests; 2) the absence of academic role models which meant they were in the same class with pupils with similar backgrounds and needs and this results in slower progression and continued underachievement in assessments. This consequently, continues to widen the gap between these pupils and the, mostly middle-class, pupils in HAMGs.

Zevenbergen (2002) has argued that pupils' mathematical habitus are largely shaped by the kind of experiences they have had whilst learning mathematics in set groups and ultimately shape their decisions about its value and place in the school curriculum.

This indicates a highly problematic relationship between their experiences of school mathematics (the field) and these become internalised (habitus) to ultimately frame their perceptions of the field. Zevenbergen (2002, p. 9)

All these elements constitute the gate keeping function of mathematics which Noyes (2007a) argues, will continue to be a stumbling block for pupils' future education and employment plans.

Equally, within LAMGs, pupils had mixed reactions to being placed in attainment groups. In CPS, it was assumed to be for their benefit. In essence they were being done a favour, therefore it was accepted as natural by all involved or what Bourdieu describes as *doxa* (Wacquant, 2008, p. 270). The notion of *doxa* is,

the set of core values and discourses of a social practice field that have come to be viewed as natural, normal, and inherently necessary, thus working to ensure that the arbitrary and contingent nature of these discourses are not questioned nor even recognized. (Nolan, 2012, p. 205)

According to Bourdieu, this illustrates how the dominated consent to their own domination (Bourdieu and Wacquant, 1992) and equates to symbolic violence which is effective through 'the complicity of those who do not want to know they are subject to it or even that they themselves exercise it' (Bourdieu, 1991, p. 164). This symbolic violence is 'particularly insidious due to the fact that it is exercised with the agent's full, though generally unaware, complicity' and explains why John, like other pupils come to accept their place in this group, and 'their treatment as inferior and lack of success as the way things are' (Nolan, 2012, p. 205).

In other words, they are complicit in this process of the symbolic violence acted on them and also legitimize the accepted order of things and their place within it. As Bourdieu explains:

By a series of selection procedures, the system separates the holders of inherited cultural capital from those who lack it. Differences of aptitude being inseparable from social differences according to inherited capital, the system thus tends to maintain pre-existing social differences. (Bourdieu, 1998b, p. 20).

The implication is that there are certain practices within mathematics education that do not promote the pupils' interest and do not also, necessarily reflect their mathematical attainment as Valero and Zevenbergen observe,

...through mathematics education practices, certain pupils are positioned as low achievers in mathematics. Such positioning does not depend in most cases on pupils' actual mathematical attainment, but on the interpretations made by teachers of pupils' participation in classroom interactions and in assessments routines. (Valero and Zevenbergen, 2004, p. 25)

Interestingly, Jackie pointed out a contradiction that questioned why as a mixed ability group they were all billed to do the Foundation tier examination. This brings to the fore how mathematics teachers can unwittingly do a disservice to students' achievement and aspirations (Archer *et al.*, 2010; Gates, 2001; Gillborn and Youdell, 2000). However, the participants in this situation can be seen as acting out roles they did not write themselves but those that are written for them by the larger social forces.

9.1.2 How pupils' backgrounds frame their experience

The schools and learning environments pupils find themselves have demands and expectations required of them, this positions them to fail where they do not meet up as a result of having a familial habitus that does not furnish pupils with the required cultural capital that are congruous with that of the school. On one hand, the capital available in for instance, Nick and Jackie's cases enable both pupils to cope with the demands of schooling to a large extent. Equally, the attitudes towards education, largely derived from parental opinion and actions and experiences pupils from PLS (like Jackie, Nick and Catherine) have had, are compatible and therefore support a productive approach towards learning mathematics. Their experiences have effectively created a habitus that aligns with the structuring practices of school mathematics. Bourdieu's concept of cultural reproduction illustrates how this is possible through the workings of the family (Harker, 1990).

The attitudes of the members of the various social classes, both parents and children, and in particular their attitudes towards school, the culture of the school and the type of future the various types of studies lead to, are largely an expression of the system of explicit or implied values which they have as a result of belonging to a given social class. (Bourdieu, 1974, p. 33).

His concepts of habitus and cultural capital pinpoint how social class advantage is maintained through parental involvement in students' education. This interest could also be narrowed down to cultural attitudes that portrayed the significance of education and therefore encouraged a work ethic (Lupton, 2006).that enhanced academic success (Catsambis and Beveridge, 2001). This was clearly seen in PLS where the pupils understood what was expected from them.

Having a feel for the game is important; it enables the player, in this case the student, to be able to read the game, predict the expectations, anticipate actions and engage in activities in a meaningful way. (Jorgensen et al., 2014b, p. 231)

However, there is the need to recognise that pupils come into the classroom through diverse avenues, equipped with different ways of seeing, thinking and talking in addition to different degrees and varieties of cultural capital (Woods, 1990, p. viii). The demands placed on pupils who are disadvantaged by having a culture that is distinct compared to the dominant culture or where schools differentiate by setting or banding; the result is that these pupils have three choices - struggle, cope or resist. Pupils' response to stressful situations include adopting strategies that meant,

...transforming the reality of school from something they find tedious, irrelevant and perhaps oppressive, to something more light-hearted and tolerable that they initiate and control. (Woods, 1990, p. 209)

Woods' conclusion that this behaviour may also carry some symbolic connotations for the official programme is pertinent.

The different ways pupils responded to their experiences within the mathematics groups examined suggest a relationship between social class and educational experience. Whilst some pupils were merely complying and some worth more accepting of the official pedagogic discourses, the others were resisting and opposing all that it had to offer them. Woods' (1979) description of pupils' adaptations reflect these forms of responses, particularly the instrumental compliance where pupils in PLS have shown they understand the value of a qualification in mathematics because of the link it has with future prospects. The other extreme is the intransigence mode where students are 'indifferent to the school's ends and rejects its means' (p.76)

characterised by persistent detestations of rules and regulations, lesson disruptions, truancy, verbal and non-verbal assaults on teacher, etc. which characterised lessons observed in CPS. These varied dispositions have consequences for students learning and success in school mathematics.

Disruptive behaviour was a major issue in CPS. It had discipline measures that indicated a certain level of expectations. To manage this situation effectively, CPS had a pastoral unit where students were expected to get the needed guidance and skills to function in school. However, I could not readily see the impact these measures had on students. Members of this unit would often negotiate with students, making compromises to get student to comply even when it appeared that students were taking advantage of members of staff.

However, upon reflection, I see how my assumption that pupils were taking advantage of teachers had made me come to this conclusion without necessarily considering deep underlying factors that impact on pupils' attitude in school and the classroom. For instance, pupils' reasons for disengaging mirrors that reflected in Archer *et al.* (2010) Hillside Park school where students expressed a desire for respect and reciprocity, stating that they opted to disengage from lessons where they could not understand, felt marginalized or ignored (p.101). It is so easy to evaluate and compartmentalise students when they come into classrooms without necessarily accommodating the total and unique circumstances of these students.

In relation to pupils' perspectives on their experiences, pupils' description of the mathematics they encountered suggested they had to practice decontextualized procedures and memorize formulas that were not relevant to their contexts and they had to comply. This is akin to Povey *et al.*'s (1999) notion of silencing, where learners experience themselves as voiceless and mindless. Across the two schools, pupils maintained the view that their lessons were not practical (and did not prepare them for the real world, a view also reported in the literature (Arnot and Reay, 2006). This is closely related to Bourdieu and Passeron's (1990) argument that schools privilege particular cultural arbitraries compared to others. This makes it easy for certain pupils to align with the demands of school mathematics. In similar terms, Dowling (1998) used the notion of the *esoteric domain* to describe academic mathematics that appeals to high attainers and prepares them for further education, in contrast, the *public domain* interests lower attaining pupils and positions them as interested in

practical, manual, functional numeracy tasks. These class-based educational differences exacerbate even cause, inequitable outcomes and influence students' perspectives about learning.

This study further demonstrates that the neighbourhoods and families that pupils come from and the school they attend influence the way pupils describe the value (either use or exchange) of the mathematics they do in school. This agrees with Sealy and Noyes' (2010, p. 240) stance that pupils' notion of the 'relevance' of mathematics is related to cultural capital and social position.

In PLS, situated in a middle-class area, the findings show that pupils' perception is that mathematics is important for getting into college, this resonates with pupils' perspectives on the use of mathematics in Onion's (2004) study and Nathan's certainty he would never use complex mathematical formulae, in Sealy and Noyes' (2010, p. 243) study of Larkstone school. In addition, most of the pupils understood that a qualification in mathematics could open doors to greater opportunities.

In contrast, pupils in CPS could relate more with the use value of mathematics and spoke rarely of its link to future prospects which is not surprising. CPS is situated in a predominantly white working class area where education was not considered a main link to social mobility in the light of past experiences of deep rooted unemployment and the intergenerational influences that prevailed here (Lupton, 2006; Smyth *et al.*, 2010). It is possible the pupils could have adapted to the local context and traditions (Kintrea, 2011) which they found themselves steeped in. This may have implications for their attitudes or the effort they give to learning and to school generally.

It is equally known in the Sociology of class that working-class pupils are usually socialized into immediacy, whilst middle class into future proofing or the bigger picture phenomena (see Gee *et al.*, 2001). A counter argument may be to make mathematics relevant by making it more practical but less useful in terms of gaining certification (Williams, 2012). However, this presents a double bind and the pupils in their own ways give into its demands. This is another manifestation of the concept of collusion mentioned earlier, particularly where pupils contemplate the relevance of mathematics to them in the immediate present, neglecting the role/link this plays in their future.

The expectation might be that all the pupils in these groups will feel constrained by virtue of their attainment group. But this was not the case with pupils in PLS. They remained hopeful and positive. This is indicated through the research evidence that suggests that middle class youth view the 'world as their oyster' such that nothing was viewed as unattainable or regarded as 'not for people like me', rather it was down to exploring options and possibilities on the basis of desire or preference (Archer *et al.*, 2010).

This is evident in the difference between pupils' attitude to career choice in these schools – a significant element. However, pupils' choices of careers are not neutral; Grenfell and James illustrate this clearly,

Young people make career decisions within what we refer to as horizons for action. The horizons are the perspectives on and possibilities for action given in any field or intersection of fields. Such action includes choice, as the latter has practical consequences. We can see how the dispositions of habitus and the positions of education and the labour market both influence horizons for action and are inter-related. (Grenfell and James, 2003, p. 97)

Considering that CPS is situated in an area marked by a history of the school to work transition (Gates *et al.*, 2007; Rutter *et al.*, 1979), this could have steered pupils like Phil towards employment rather than qualifications. This agrees with Archer *et al.*'s (2010) view that 'aspirations as contextually produced, shaped by young people's identities, embodied practices and structural locations' (p.80). This is not denying that these young people have the right to determine their choices and give the impression it is entirely their decision, yet, 'the nature of their aspirations, and the sorts of identity discourses and resources that they are able to draw on to construct these narratives, are inevitably inflected by the social contexts in which they live' (*ibid.*, 2010, p. 80). Consequently, pupils' backgrounds and the places where they come from into mathematics classrooms and schools in general influence their learning experiences.

Locality provides more than a backdrop for young people's lives, but also the collective context that shapes values and meanings – what Bourdieu described as a 'logic of practice' (Bourdieu 1977). Individual

young people are not determined by their localities, yet their options and identities are constrained or enabled by them (Henderson et al., cited in Archer et al., 2010, p. 94).

The significance of pupils' background for the learning of mathematics and for education generally cannot be underestimated.

9.1.3 Schools' tactics and teacher selection

An equally significant point is what schools demand from their teachers. This particular finding was not expected and it was not something this study set out to investigate. However, this is a paradigmatic case that highlights how some schools end up having 'strong' teachers and how this impacts on their attainment and outcomes. This is consistent with Ball's (2004) observation that GCSE attainment percentages and league table positions cannot be simply tied to good teaching and effective learning but are products of a complex set of policy strategies and practical tactics which support the fabrication of performance. Such tactics may include excluding students who threaten the reputation or performance of the school or staff dismissal as seen in this case.

PLS had expectations and standards for its teachers and this was realized through various adopted performance management processes. These processes would not accommodate any perceived compromise in the quality of teaching staff. This meant it adopted a stern stance when faced with anything that would jeopardize the attainment levels of students and its reputation as a school. But it also questioned the support given to teachers as they carried out their duties, sometimes in challenging circumstances. PLS had a good reputation and this on its own made it attractive to teachers seeking employment and to parents also. Nevertheless, it is possible to argue that PLS could focus on improving teaching and learning because they had fewer issues resulting from their particular student intake and context.

Miss Freeman was a newly qualified teacher who was keen to develop the students' thinking and problem solving skills. However, she was faced with an apparent struggle to marry her values and beliefs with the values espoused by the school and the entrenched traditional ways of teaching mathematics which the students now considered the acceptable pattern.

Miss Freeman had to negotiate the clash that arose as a result of the difference between what was expected from her as a teacher of mathematics in an 'outstanding school and her habitus and social/educational experience reflected through her teaching style and dispositions (Gates, 2006; Noyes, 2004; Zevenbergen, 2002). This was a difficult period for Miss Freeman which resulted in stress and burnout. What were the issues here? The school had to answer to demanding middle class parents? The school wanted to achieve its quota given this was supposed to be a borderline class? More so the school was rated outstanding and therefore, has enjoyed a prominent position on the GCSE performance league table.

This case illustrates the structural influences, whether external or internal, that comes to bear on the teaching and learning of mathematics within classrooms. In line with this, Ball (2004) discusses performativity in education as 'a mode of regulation and terror (Lyotard's word) that involved judgements, comparisons and displays as means of control, attrition and change' (p.143). He further describes the structure of surveillance that obtains in organizations where control is the order of the day, the prominence of 'figures, performance indicators, comparisons and competitions have resulted in a situation where contentment of stability is elusive, purposes are contradictory, motivations blurred and self-worth slippery' (p.144) which have all resulted in 'a new subjectivities- a new kind of teacher' (p.145).

The implication here is one has to play the game the way the system wants it or end up in an awkward position. Thus, part of playing the game is collusion in ones' own exclusion. Nolan's (2012) evaluation of the practices of mathematics teacher education confirms that the school serves as 'a site of (re)production and regulation of teaching practices' (p. 213). Also, her analysis clearly explains some of the issues Miss Freeman had to negotiate in PLS, namely the lack of fit between habitus and field.

Bourdieu's social field theory helps view the competing and conflicting demands on prospective teachers and their transitions in a new light, understanding that the passive act of wanting to change one's habitus is easier said than done when the orthodoxy of the school playing field remains intact (Nolan, 2012, p. 213). This orthodoxy includes discourses that Nolan argues regulate practices and stifle opportunities for pedagogical innovation, which could also explain the practices seen within LAMGs.

Miss Freeman's contract was not renewed and she moved on to teach in a sixth form college. However, after two academic sessions, she decided teaching was not for her. I do not have any research data that allows me to judge whether she was a good teacher or not but her case does provide a window into understanding how it is that newly qualified teachers tend to leave the profession after a few years.

9.2 Critical Commentary on Lessening the Influence of Disadvantage

According to issues raised in Chapter 4, the implication of a claim to critical theory involves a twofold objective of description and transformation. Thus, this section considers the implications of the findings of this research for the teaching and learning of pupils in LAMGs.

In relation to policy, the UK government through various initiatives has endorsed academic selection, despite several decades of research that evidence its limitations. In fact, differentiation by ability or attainment has resulted in 'limited access to knowledge for some pupils, domination of pedagogic practices by teachers, preferred teachers for 'elite' pupils and enforcement of social divisions among pupils' (Blatchford et al, 2008 cited in Gillard, 2009, p. 69). It is not clear why concerns about underachievement, poor attitudes and exclusion have often been met with calls for more differentiation by ability or attainment. More recently, Francis et al., (2017) point out the need to muster equally powerful discourses to disrupt 'the formidable discursive hegemony, in which setting and other 'ability' grouping practices are signifiers within discourses of standards and 'natural' distinction that constitute technologies of privilege. These discourses are central to the (re)production of privilege, and to its defence' (p.10).

In relation to this study, the negative perceptions of pupils in PLS, observed in their description of mathematics as a 'barrier', 'chore' or feelings of powerlessness are closely related to their experience of indiscriminate setting allocations that restrict the level of work they do and therefore the grades they can achieve is a clear indication that implies that the mathematics education offered to pupils in LAMG negates pupils' sense of agency, autonomy and need for powerful knowledge (and includes them as agents of their own exclusion) that positions pupils to make informed decisions.

School mathematics through the curriculum adopted and the pedagogy favoured should furnish pupils with skills and dispositions that they will find beneficial to become fully functioning members of a democratic society.

In relation to practice, this will entail a move away from the notions that uphold the development of basic skills or the functional aim of mathematics education (as demonstrated in CPS) to one that (in the light of critical literacy) recognises the need to use these mathematical skills to interpret and influence the world positively and in the process, influence pupils' engagement and the value pupils place on learning mathematics.

Consequently, there is a need to envision mathematics classrooms as a place where the mathematics pupils learn positions them to challenge the inequities in their own circumstances and the society. This is a stance that is reiterated below; the expressed sentiments echo my reflections as this thesis draws to a close,

To be fair to all children the system must equip them for life, not just the workforce and allow school to be a place where they find social enlightenment, not social advantage. Without the understanding that some children have greater barriers to overcome and that school is the one place where they can gain the skills, confidence and resilience they will need to overcome them, we are certain to fail the children who most need help. (Nandy, 2012, p. 677)

In response to this proposal and following Hart's (1998, p. 164) conclusion, one way forward could be to focus on pupils' 'engagement' rather than attainment as a lens that provides knowledge about individuals, which is then used to inform teaching. The quality of pupils' engagement with the learning experience will indicate what they have learnt and not some ascribed attainment level. Consequently, to encourage pupils to invest their emotional and intellectual resources into learning instead of resisting learning or merely going through the motions, the pedagogical aim needs to nurture conditions that improve the quality of engagement in LAMG and by implication the quality of learning.

This demand on teachers' pedagogical practices would come up against entrenched habits and dispositions of teachers which Nolan (2012) drawing on a Bourdieuan

framework, explains are products of their experience of firstly being pupils, pupils teachers and then teachers. Consequently, in mathematics education, teachers need to recognise the need to employ pedagogic models, giving due regards to what may be easily overlooked and making rules and expectations explicit (Delpit, 1997) through narratives, examples and illustrations that allow access to the gaining of school knowledge. The game plan here is to abate the strong link between social class and achievement in school which in keeping with Bernstein's (1990) stance involves adjusting the pedagogical practices that prevail in classroom. The result envisaged is a mathematics education that allows all pupils access to 'the discourse patterns, interactional styles, and spoken and written language codes that will allow them success in the larger society' (Delpit, 1997, p. 585).

Where this access is lacking, these discourse patterns marginalise and exclude some pupils and it is for this reason, pupils' perspectives on their learning experience are significant; firstly, critiquing the practices that have become normalised and secondly, echoing the voices of learners who have experienced aspects of the system that constrain commitment and progress.

9.3 Contribution and Areas for Future Research

This study has contributed to knowledge within mathematics education through the description and interpretation of the impact of disadvantage on the learning experiences of particular group of pupils, specifically pupils in LAMGs.

In response to the question of differences and similarities between the two schools in this study, whilst most research studies have tended to focus on distinct contexts to understand the impact of disadvantage on learning, the pupils in this study come from similar backgrounds in some respect, yet different in others. The level of expectations and standards obtained varied across the two schools. This was seen in the way students interacted with teachers and fellow students, the quantity and quality of work done, students' response to doing homework and the nature/depth of preparation towards their GCSE examinations. Another striking feature was the behaviour management strategies adopted in both schools. Whilst compliance to school standards was relatively easier to solicit PLS where pupils who had as part of their cultural experience the requirement to show deference to constituted authority,

in CPS students on many occasions proved difficult to manage and this influenced the classroom atmosphere in unpredictable ways.

Existing research has tended to focus on the advantages and disadvantages of ability grouping (a term still used by many schools) with little attention given to how low attaining groups work to maintain social distinctions. Though there is much written about equity in the literature, this study has taken advantage in each case of the controversies that exist in the extant literature. In this way, the individual case studies add to current understanding of how the micro-processes within schools and low attainment groups create different experiences and outcomes for pupils. These include the low level of expectations reflected in the nature of tasks assigned to students; the instructional approach and methods adopted which were mostly teacher-centred practices which to an extent could explain the lack of interest and engagement of pupils in mathematics classrooms. In the same vein, the structural nature of the field imposing constraints on 'who, what and how' mathematics is taught by implication imposes options that do not serve students well ultimately.

The characteristics of pupils' background impact upon their learning, engagement and achievement in LAMG in different ways. For example, the focus of interactions in these classes was either social or mathematics related depending on students' social backgrounds (and school). Also, students' sense of responsibility and commitment to a desired outcome was clearly evident in the choices students made in both schools. These dispositions are key qualities for success and reflected the influence of their backgrounds. Similarly, the influence of family and social networks provided the needed focus, support, values and involvements that positioned students to succeed at school mathematics.

In addition, this study has also demonstrated other manifestations of how pupils collude in their own exclusion indicated for instance, through pupils' perspectives that indicate the lack of relevance of mathematics to them and echoed through the question 'when am I going to use this?' Although they might not use it, this is not the point but that as a result, this attitude, restrains pupils to only thinking about the immediate possibility which effectively constrains what they can achieve in the future. This offers an understanding of how pupils contribute to their own exclusion by colluding in this process through socialized attitudes and social practices.

Taken together, the findings of the study established that there is a harmonious process going on in both PLS and CPS, which involves teachers and pupils working together, presenting a system that works perfectly but where the mechanisms function differently such that the two contexts almost engender different responses from pupils. The system in PLS, works in harmony, presenting a setting where the pupils collude, through productive compliance which helps them get on and succeed irrespective of their backgrounds. In CPS, there is a form of resistive compliance; one that is regressive in the sense that this does not let pupils produce success. This compliance is manifested in the form of helplessness, resignation and passive resistance which is not disconnected from helplessness. The combination of these traits constitutes barriers that curtail pupils' progress. Even so, these traits could also serve as an alert on how to recognise pupil disengagement in LAMGs which then allows for the development of strategies for dealing with these issues.

From the outset this thesis has critically considered the ways in which inequality is constructed into existing practices within mathematics education with particular reference to the impact of disadvantage on the learning of mathematics and the resultant consequences for pupils in LAMGs and all earlier criticisms remain upheld in light of the data analysis. However, the call for tackling the structural inequities within mathematics education offers a number of challenges. Firstly, in what ways can the socialized attitudes of pupils that promote a negative approach to mathematics, be altered within mathematics education? Secondly, the anxiety and memory lapses that occur as a result of testing regimes and the coverage of substantial curricular content (which pupils describe as not relevant to them), raises the question: what is the pedagogy for helping people remember things who cannot remember things easily? What is the solution to the gap that needs to address how to teach mathematics to pupils who find formal academic learning unappealing and difficult?

Reflecting on the research outcomes has raised the question of what would I have done differently given the opportunity to carry out the research again. It would have been insightful to maintain contact with pupils and follow through with obtaining the final GCSE results of the pupils in the study, to give opportunity for a close up inspection of how the pupils performed across the schools and attainment groups and the impact the results might have for the next stage in their careers and therefore provide a longer term engagement to watch the processes of social exclusion. It was

my intention to undertake this, but the schools involved were not enthusiastic about continuing to participate in the project and that in some way signalled the probable end of this project. It remains an important feature for a future study.

However, my focal aim has been to explore the various influences on the teaching and learning experiences of pupils in low attaining mathematics groups in socially distanced schools. This study maintains that the differential attainment usually portrayed as a consequence of effective teaching and learning strategies pale in the face of strong socioeconomic and socio-cultural influences on pupils' capacity to engage with the demand of mathematics education and more so for pupils in LAMGs. The study has established the need to acknowledge this dilemma; the tensions and contradictions pupils grapple with in their learning journey as a result of social and cultural differences and how LAMGs reinforce the status quo.

Following on from the questions raised above emerges a research prospect that would seek to undertake an empirical investigation of the ways that low SES students could be encouraged, by the nature of their classroom experiences and relationships, not to see school mathematics and indeed education as an unbearable set of encounters that would in due course be resisted. In this regard, the seminal work of Bernstein (1996) could be drawn on to examine and develop positive and powerful messages that schools through various processes (curriculum, pedagogy and assessment) could employ to frame students' perceptions of their current or future reality. It is possible that in some ways, this may begin to challenge the strongly entrenched socialized attitudes of pupils that deter their success.

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List of Appendices

1. *Participant information sheet*
2. *Participant Consent form*
3. *Survey Questionnaire*

**University of Nottingham, School of Education,
Room C14, Dearing Building, Jubilee Campus,
NottinghamNG8 1BB**

Project Title: Investigating pupils' experiences in mathematics groups

Lead Investigator: Stephanie Nwabuikwu, MA, PGCE, Bsc.

Participant Information Sheet

Dear Participant,

Firstly, thank you for indicating your interest in my research study which forms part of my PhD research degree.

My study aims to explore various influences that impact on the mathematical learning experiences of pupils in schools. My supervisors on this project are Peter Gates and Andrew Noyes.

You have been invited to take part in a research study because of the need to understand how and what it takes for you to do well in mathematics lessons.

Before you decide whether to take part it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully discussing any aspects with colleagues or friends if you wish to. Please feel free to ask me if there is anything that is not clear or if you require more information on any aspect of my study.

Having carefully read this information sheet if you wish to be involved further as a participant, please sign the attached consent form which will be countersigned by

myself and a copy will be provided to you. If you do decide to take part, you are still free to withdraw at any time and without giving a reason.

Background to the study

My study aims to understand the effect of various influences on the learning and attainment of pupils in mathematics classrooms. Your support would be invaluable in exploring strategies aimed at making mathematics more meaningful for these pupils.

What does the study involve?

From September, 2013 to July, 2014 I will be collecting data from a range of participants. Data will be gathered using classroom observations, confidential questionnaires and in-depth interviews. These will be held at a mutually convenient time and place lasting approximately 30 minutes and will be audio taped but can be stopped at any point during the interview.

What do you have to do?

If you wish to be involved as a participant please indicate your interest by signing the consent form. I will make regular contact with you mostly during mathematics lessons. I can confirm that at no time will you be put under any undue pressure to be involved in the research activities and at all times have the right to withdraw from the project. No prejudice or risk will occur should you wish to withdraw from the project. Data generated up to date of withdrawal may be used in the findings unless you request otherwise.

What if something goes wrong? /Who can you complain to?

In the unlikely event of a complaint, please initially raise your concerns with me or failing that please contact either one of my supervisors, contacts details provided at the end of this sheet.

Will my taking part in this study be kept confidential?

This research has received ethical approval from the School of Education with all data generated handled according to British Educational Research Association (BERA) guidelines (www.bera.ac.uk). All data that is collected about you during the course of

the research will be kept on a password protected database and is strictly confidential. The collection of data from participants will be anonymised throughout the research process and in any future publications as well as the PhD thesis. All data collected will be treated in the strictest confidence unless not doing so will result in harm to participants. No academic staff, or School of Education staff, supervisors, colleagues, examiners or other research pupils will have access to your data or data generated.

What will happen to the results of the research study?

The study findings will be published as part of my PhD thesis in addition to any papers that may be published on my work. The final thesis, subject to a successful Viva, will be held electronically on The University of Nottingham e-thesis facility in addition to the School of Education library (as required by the University). This will be no sooner than September, 2017 and should you wish to be notified of any publications based on this study please inform me. All data will be anonymised.

Contact for Further Information

If at any stage during this study you wish to contact me my details are as follows, email: ttxsn11@nottingham.ac.uk, or by post using the address at the top of the information sheet.

For your information my PhD supervisors at the School of Education are Peter Gates peter.gates@nottingham.ac.uk and Andrew Noyes andrew.noyes@nottingham.ac.uk.

May I take this opportunity to thank you for agreeing to assist me in my research project.

Yours faithfully

Stephanie Nwabuikwu



**University of Nottingham, School of
Education, Dearing Building, Jubilee Campus,
Nottingham, NG8 1BB**

Project Title: Investigating pupils' experiences in mathematics groups

Participant Consent Form

Please read this form and sign it once the lead investigator has explained the aims and procedures of the study fully to you.

- I voluntarily agree to take part in this study.
- I confirm that I have been given a full explanation by StephanieNwabuikwuand that I have read and understand the information sheet given to me which is attached.
- I have been given the opportunity to ask questions and discuss the study with the above investigator on all aspects of the study and have understood the advice and information given as a result.
- I authorise the investigator to disclose the results of my participation in the study but not my name.
- I understand that I can ask for further instructions or explanations at any time.
- I understand that I am free to withdraw from the study at any time, without having to give a reason for withdrawing.
- I understand that information about me recorded during the study will be kept in a secure database. If data is transferred to others it will be made anonymous. Data will be kept for 7 years after the results of this study have been published.

Name:

Signature:

Date:

I confirm that I have fully explained the purpose of the study and what is involved to and I have given the above named a copy of this form together with the information sheet.

Investigators Signature:

Name:

Participant Code

YEAR 10 SURVEY



*Thank you for agreeing to take part in this research. I am very grateful for your assistance. This questionnaire is being completed by Year 10 pupils in other local schools as part of my research project. You will be asked a number of questions in several sections. **Read each question carefully** then mark your answer by ticking the box which you think most clearly applies to you. You can withdraw from this study at any time and no one will mind but any information you can give will be really useful to me.*

All of your responses on this questionnaire will be treated in the strictest confidence.

Thank you again.

Stephanie Nwabuikwu

School of Education,

University of Nottingham

Section E: What teachers want from you

How far do you agree with the following statements about this school?	All	Most	Few	none
The teachers really believe that all pupils can achieve.				
The teachers believe that learning is important.				
The teachers set homework at least once a week.				
The teachers mark and return homework promptly.				
All teachers have the same rules about behaviour.				
The teachers are only interested in the pupils who do well in tests and exams.				
The teachers make sure that it is quiet and orderly during lessons.				
The teachers seem to like teaching.				

Section F: Learning Mathematics

What level Mathematics would you be entered for?

Higher tier

Foundation tier

Don't know


Please tick

Which Maths group are you in?

Teacher name

Name of Group

What grade do you;
need to get in maths at the end of year 11? A* A B C D E F G U
want to get in maths at the end of year 11? A* A B C D E F G U
expect to get in maths at the end of year 11 A* A B C D E F G U



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"No, I can't explain my D in math. That class teaches us about numbers, not letters!"

Section G: Describing your Maths class....

	Strongly agree	agree	disagree	strongly disagree
1: My Maths teacher...				
Knows the subject well				
Explains things clearly				
Gets me interested				
Helps if I don't understand something				
Gives feedback on how I am doing				
2: My Maths lessons...				
are interesting				
are sometimes too difficult				
have some real-world connections				
Have no connection to anything				
are fairly easy				
have too much content (stuff) to learn				
3: In my Maths group...				
Most students are interested				
There's a good working atmosphere				
Some students struggle with the work				
We help each other				
Most students like the teacher				
Some students are disruptive				
Exercises help me to learn				
There is too much homework				
There are too many tests				
Tests help to show what I have learnt				
I get feedback on my progress				
Tests help me to identify my weaknesses				
4: Learning at home				
I get my homework done on time				
I work with friends outside of lessons				
I have help from a private tutor				
I can get help from parents or siblings				
I phone up friends to discuss homework				
5: What would help you do better in Maths?				
More individual attention				
Clearer reasons for doing some topics				
More practical applications				
More opportunities to ask questions				
More discussion of assessment tasks				
More feedback from teachers				
Less content (stuff) to cover				

Section H: Describing Maths Teaching



"Heads, you failed to learn. Tails, I failed to teach."

In maths lessons, how often do the following things happen? (Tick one box for each statement)

In Maths lessons the teacher...	Almost always	Most of the time	About half the time	Occasionally	Almost never
Asks us to work through practice exercises.					
Expects us to work mostly on our own, asking a neighbour from time to time.					
Shows us which method to use, then asks us to use it.					
Allows us choose which questions we do.					
Asks us to compare different methods for doing questions.					
Shows us how different maths topics link together					
Tries to prevent us from making mistakes by explaining things carefully first.					
Expects us to follow the textbook or worksheet closely.					
Expects us to learn through discussing our ideas.					
Asks us to work in pairs or small groups					
Allows us create and use our own methods.					
Tells us which questions to do.					
Shows us just one way of doing each question					
Encourages us to make and discuss mistakes.					
Jumps between topics as the need arises.					
Never given things to do outside school					

About Your Family

	Not at all	not very often	often	Very often
Do you discuss with your parents what you have been doing at school?				
Do your parents help you with your homework?				
Do you need help with your homework?				

Do you have any of the following at home?	Yes	No	Sometimes	Always
Access to a computer for homework				
Internet access				
Desk or table for your sole use				
A separate room or quiet place for homework				

Which of the following best describes when your mother and father (or guardians/responsible male or female) completed their full time education?

	Mother	Father
little or no school education		
16 years		
18 years		
21 years		
Don't know		

Which best describes your mother's and father's (or guardians/responsible male or female) current work?

	Mother	Father
Does not work: homemaker		
Unemployed		
Working full-time		
Working part-time		
Working for her/himself		
Retired		
Other (please specify)		

What is your mother's main job? (e.g. school teacher, nurse, shop assistant). *If she is not working now tell me her last main job.

What is your father's main job? (e.g. school teacher, nurse, shop assistant). *If he is not working now tell me his last main job.

This is the end of the questionnaire.
Well done for completing it and thanks very much for your help.

Student Interview Key Questions and Probes

Exploring the value of Place

- Nature of neighbourhood, Peers, Network, Role models

Q1. Where about do you live? (show on a map)

Q2. What's it like where you live? Are there any other school mates around?

Q3. Do most adults go to work? What do you do for fun in the area?

Q4. Are you allowed to stay out late?

Q5. Would you move out of the area when you get older?

Exploring self perception/ learner identity/ family backgrounds

- Personal history with maths (including parents, siblings)
- Enjoyment/trepidation
- Maths lessons different/expectations
- Level of challenge

Q1. Can you describe your learning experience in maths starting from primary school? Parents/siblings experience, lessons any different? Teacher treatment? Easy or difficult?

Q2. Can you describe a recent lesson you enjoyed? Why do you think you enjoyed it?

Q3. If you could change maths lessons, what would you change?

Exploring grouping, Pedagogy, self identity

- Satisfaction (exam level, grade)
- Group dynamics
- Behaviour
- Teacher expectations
- Use of Resources/TA/learning support
- Level of challenge
- Pace
- Self concept

Q1. How do you feel about being in this group? What do your parents think?

Q2. Which groups are your closest friends in?

Q3. What do you think about putting students into sets/groups?

Q4. Why do you think you are in this group? If you could choose today, which group would you choose to go into and why?

Exploring future plans

- Maths link to future
- Importance of maths
- Level of commitment/motivating factor

Q1. What are you planning to do after Yr 11?

Q2. What grade in maths do you need for that?

Q2. Do you think being good in maths will help you do particular things after school? What do you think maths is good for?