

Extended Proposal

A qualitative study exploring how low-attaining, socially-disadvantaged children in year three dialogue about their mathematical learning.

Abstract [word count: 96]

This research draws on dialogic and participatory theories of learning. This is presented as a more socially-just classroom environment for low-attaining, socially-disadvantaged learners in mathematics, challenging accepted deficit thinking about their potential. Dialogic participation, the recognition of personal mathematical ‘funds’ and innate mathematical wiring, are argued for as key to developing mathematical aptitude and positive learner identity. A qualitative, ethnographic approach has been chosen to observe dialogue from low-attaining, socially-disadvantaged learners as a first step towards promoting awareness of their mathematical engagement. This is to inform practice and provide recommendations for a more socially-just learning environment.

Key words: dialogue, disadvantage, mathematics

[Total word count: 12, 030]

Table of contents:

Chapter 1: Introduction.....3

Chapter 2: Literature review: the topic.....6

Chapter 3: Literature review: conceptual framework.....17

Chapter 4: The research proposal.....26

Chapter 5: Research design, research methods & methods of analysis.....28

Postscript: Critical narrative reflection.....37

References.....38

Appendix A: Reflection grid.....54

Appendix B: Observation log.....57

Appendix C : Interview schedule.....58

Appendix D : Letter of consent to families & participants.....60

Appendix E : Information sheet for families.....62

Appendix F: Ethical appraisal form.....64

Chapter 1 : Introduction [word count : 895]

This research study proposes to look at the ways lower-attaining, socially-disadvantaged children in year three use dialogue to communicate and demonstrate their access to mathematical subject knowledge. It is hoped that by focusing on what children are actually saying and doing, it may provide an alternative narrative to the ‘fixed’ view of ability that pervades many English primary classrooms (Marks, 2013, 2014; Alderton and Gifford, 2018) and initiate a discussion about courses of action that could be taken in order to better promote their achievement.

The first part of the literature review focuses on two main approaches to education: the technical-rational perspective (Mockler, 2011) where changes in education are driven by the ‘what works’ (Biesta, 2010, p. 494) agenda that relies on quantitative methods to measure success of the system; and those who argue for a more sustainable and equitable approach that focuses on teaching and learning through more autonomous means (Murgatroyd & Sahlberg, 2016). Grouping by ability practises will be looked at in the literature and the ramifications highlighted for low-attaining, socially-disadvantaged learners and how this relates to the previous two approaches. This will then be contrasted with literature that indicates the malleable nature of ability and the classroom conditions that promote achievement for all learners, regardless of prior attainment. A case will be presented for thinking about low-attaining learners from backgrounds of social disadvantage in terms of their potential to make valid and significant contributions (Barclay, 2021) to the mathematics classroom.

Conceptually, it is proposed for this study that social interaction and dialogic exchange, where learner participation is actively sought and valued, are important factors in the development of mathematical competence and a positive mathematical learner identity (Sfard, 2017; Mercer and Sams, 2006; Gardee, 2019; Radovic et al., 2018). This draws substantially from Vygotsky (1978) and the sociocultural tradition. In keeping with a perspective on learner interaction, this qualitative study aims to look more closely at how learners from socially-disadvantaged backgrounds, who are perceived as low-attaining, are engaging through talk in lessons. Drawing from Bakhtin (1981), Ivinson (2018, 2020) and Sfard (2017), the conceptual

structure behind the research explores the democratic framing of knowledge through dialogue and how this opens up access to mathematical discourse to all learners.

Using the concept of ‘funds of knowledge’ (Moll et al., 1992), ideas will be explored that seek to identify the low-attaining, socially-disadvantaged learner as in possession of mathematical resources that may not be recognised by the school, but that are of importance to learner engagement and progress. In line with Bourdieu (1992), the recognition of restraints these learners experience due to the ‘mathematical habitus’ (Wright, 2020) imposed by the system, also suggests the ‘possibility of freedom’ (Bourdieu, 1992, p. 40). The proposed investigation aims to conduct research from the learners’ perspective by adopting an interpretivist paradigm that uses observation and semi-structured interviews to collect data to address the research questions.

This study seeks to investigate the following questions:

1. How do children who are socially-disadvantaged and placed in lower sets for mathematics dialogue about their learning in the classroom?
2. How might encouraging these children to elaborate on their mathematical knowledge impact their understanding of the subject?
3. As a consequence, how might this impact their self-efficacy and identity as a learner?

The rationale for the above questions comes from my professional experience within the proposed setting, where despite good results at the end of key stage two, some of the most disadvantaged learners do not make the same progress. Additionally, as fixed-ability thinking is often justified and even necessitated by managerial and accountability norms at the site (Alderton and Gifford, 2018), taking an approach that draws from the voice and experiences of the learner, allows for the exploration of the possibility that ideas about aptitude may be less fixed than is often presumed. This, in turn, may lead to a different way forward.

The chosen research topic relates to many themes located within the learning and teaching pathway on the Masters’ program, including dialogic and participatory learning, identity and giving children a voice. Tutor feedback from TMA01 (Appendix A) drew attention to the need to narrow the focus of the original first question from looking at how learners were experiencing ability grouping to seeing how they were using talk in lessons. The more the

concept of dialogue was studied, the more I was drawn to designing a research project that explicitly looked at learner use of language (both external and internal communication) to explain or signpost their mathematical thinking and confidence to participate.

The proposed site of the research is a large primary school in a small, rural town. Between-class ability grouping has been used in key stage two for many years and discourses about ability are often fixed and perpetuated. The school adopted Maths No Problem as a scheme, based on the Singapore mastery approach. While this has raised standards more generally, there is still a sustained and significant gap between those who meet expectations and those who do not. Children who are disadvantaged tend to dominate lower sets across the key stage. It is hoped that this small study may contribute a more detailed and informed understanding of mathematical dialogue from low-attaining, socially-disadvantaged learners. This would be to suggest ways practice could be developed to build on the knowledge they already possess and to consider alternative approaches that empowers democratically-inspired, dialogic participation.

Part A: The Literature Review

Chapter 2: Literature review [word count: 3851]

Introduction

In this chapter, empirical research will be considered in order to evaluate the mathematical opportunities for learners classed as low-attaining and disadvantaged. The impact of two solicitudes in education (Murgatroyd and Sahlberg, 2016) will be weighed against three key issues highlighted by the research and their consequences for low-attaining learners from disadvantaged backgrounds: the frequent use of grouping by ability and the belief that ability in mathematics is either innate or fixed; the importance and kinds of mathematical identity learners operationalise; the depth and type of knowledge accessed and the context in which this does or does not flourish. This will be contrasted with specific items of grey literature from government sources in order to critically examine whether their position is actually as knowledge-deficient as often presumed (Bal, 2012) and whether there are discourses and difficulties within social and political systems interconnected with, and influencing, education that perpetuate their lack of mathematical attainment (Francis et al., 2017a; Alderton and Gifford, 2018).

Contrasting ideological influences on educational policy

Murgatroyd and Sahlberg (2016) provide a helpful starting point for understanding the direction educational policy has taken within countries such as England. This macro picture gives a contextual reference for understanding the educational experience of learners, tracing its influence down to the micro context of the classroom environment.

The first ideology discussed is the agenda of the Global Educational Reform Movement (GERM), aligning with the priorities of neo-liberalism with its emphasis on, 'commercial and market principles' (Murgatroyd and Sahlberg, 2016, p. 10). Within England, this has resulted in measuring value in education through variables such as productivity, efficiency and learning as an economic duty (Hall and Pulsford, 2019; D'Agnese, 2015). Under neo-liberalism, education is presented as a meritocratic system (Owens and St. Criox, 2020), capable of rewarding hard-working and resilient individuals and providing social and cultural capital for

increased social mobility (Owens and St. Criox, 2020). Productivity is an especially significant feature since the success of the system is numerically measured through international and national testing comparisons (Biesta, 2010), reiterated in government requirements that ninety percent of children in primary schools reach age-related expectations by 2030 (Department for Education, 2022).

An alternative approach focuses on equity and the '[development] of the person as a citizen, imaginer and lifelong learner' (Murgatroyd and Sahlberg, 2016, p. 12; Biesta, 2015a, 2015b). The thinking underpinning this approach prioritizes the establishment of democratic reasoning and the freedom of critical engagement (Ball, 2003; Buchanan, 2015; Shih, 2018). Care for the person, as well as for the explicit teaching of pure mathematics, are suggested as being two sides of the same socially-just, educational goal, although acknowledged as a difficult duality to pursue and sustain in practice (Watson, 2021; Wright, 2020). Exposure to challenging content within an exploratory framework is suggested as a key factor to making progress, regardless of prior attainment (Clarke, 2021; Sfard, 2017). With the addition of the capabilities approach, largely through the work of Sen (2013), expounded in practical ways by Nussbaum (2003) and applied specifically to children by Biggeri (2007), this discourse includes the vision of seeing people from birth as both capable and needy; their dignity supported in either circumstance by the development of political and social systems that promote justice (Nussbaum, 2003).

The discussion will now move on to look at what research and articles from grey literature have to contribute to an understanding of the issues around mathematical attainment within England. Links will be made between findings and the two approaches to education. The intention is that by laying this foundation, it will provide a justification for the rationale behind the research focus.

The 'long tail' of underachievement

Sustained underachievement in mathematics is recognized as a perplexing and long-standing problem in the English education system, effecting a disproportionate number of learners from disadvantaged and minority backgrounds (Whitty, 2010; Hodgen, Foster and Brown, 2022). International comparisons provided through the administration of surveys, such as the

Trends in International Mathematics and Science Study (TIMSS), reveal a significant gap between the highest and lowest attaining learners (Richardson et al., 2020). The continuation of this trend, despite improvements in performance in the most recent survey (Richardson et al., 2020; Department for Education, 2022), has been a cause for concern among researchers into mathematics education and for those in government circles (Hodgen, Foster and Brown, 2022; Office for Standards in Education, Children’s Services and Skills, 2021). On a national level, the trajectory for poor mathematical performance from disadvantaged learners is acknowledged from the outset of their educational journey, where many fail to meet age-related expectations at either primary or secondary junctures (Ofsted, 2021). Mathematics is an extremely visible subject in the curriculum, with a high social and cultural exchange value (Lerman, 2000; Hodgen, Foster and Brown, 2022). According to the Department for Education (2013), most primary schools in England spend one hour a day on mathematical instruction. Developing one’s potential in this domain is believed to be greatly beneficial for individual and national progress (Wheater et al., 2016; Hodgen, Foster and Brown, 2022).

Under neo-liberalism, with the dependence of value resting on issues of productivity, efficiency and life-long learning as an economic necessity, this over-arching macro discourse has shaped the micro discourse in the classroom (Hall and Pulsford, 2019; Murgatroyd and Sahlberg, 2016). While presenting itself as a meritocratic system, where equality becomes attainable through hard work and perseverance (Owens and St. Croix, 2020; Francis et al., 2017b), the practices enacted in many classrooms mitigate against this realisation by placing the cause of the deficit within the learner (Alderton and Gifford, 2018) and by constructing pedagogical discourses that limit access to mathematical consciousness (Straehler-Pohl et al., 2014) justified by perceptions about aptitude (Marks, 2013, 2014). As Bourdieu (1986) proposes, this negatively impacts the distribution of social and cultural capital. Structural restraints hinder the access low-attaining, socially-disadvantaged learners have to forms of capital that according to neo-liberalism, accumulate through school experience and lead to increased social mobility.

Ability grouping practices in England

The school site for which this proposal is designed makes extensive use of ability grouping across classes for mathematics in key stage two. Therefore the next part of the review investigates literature discussing its impact on learners, their identity and achievement, with particular attention given as to whether this is a socially just way to organise learning.

The belief in the effectiveness of ability grouping has been a recurring, at times inconsistent, political and social discourse that came to the fore during the time of New Labour onwards as a continuation of the politicization of education begun under Thatcher (Whitty, 2010; Department for Education and Employment, 1997). It was viewed as an important means by which to raise standards (The Guardian, 2006). The responsibility for endorsing this narrative was later taken up by Ofsted (Ofsted, 2021), where schools at secondary level were expected to use ability grouping to effectively organise mathematical learning unless adequate evidence of other successful practices could be provided (Dracup, 2014; Ofsted, 2021; Francis et al., 2017a). In an attempt to drive up standards, ability grouping became the preferred mechanism through which it was believed knowledge could be filtered at the presumed correct level, enabling lower- and middle-attaining learners to make better progress, thus preventing ‘bright’ learners from being held back (Ofsted, 2021).

Filtering access to knowledge: social justice considerations

Given this position within educational policy in England, it is concerning to note that research spanning over twenty years (Linchevski and Kutscher, 1998; Mercer and Sams, 2006; Clarke, 2021) indicates there are negligible such concerns for higher attainers. Additionally, research suggests that middle- and low-attaining learners make more academic gains when not grouped homogenously (Mercer and Sams, 2006; Clarke, 2021). Linchevski and Kutscher (1998) found that when low-achieving learners were exposed to more challenging content, they made better progress. Moreover, Straehler-Pohl et al., (2014) proposed that ability grouping directly impacts who has access to which artefacts for learning, with significant and unfavourable differences for the low-attaining, socially-disadvantaged. This may include lack of exposure to mathematically challenging content and discourse (Straehler-Pohl et al., 2014); ‘triaging’ learners by prioritising those who are considered a more promising return on

investment (Marks, 2014); being taught by less experienced staff (Wiliam and Bartholomew, 2004; Marks, 2014; Straehler-Pohl et al., 2014); frequent changes of teacher and difficulties in locating spatial resources in school (Marks, 2014).

While government sources such as the Ofsted report into the teaching of mathematics (Ofsted, 2021) present a politically and socially neutral view of ability grouping practices, other research suggests this is not the case (for example, Marks, 2013, 2014). Wiliam and Bartholomew (2004) conducted a quantitative study tracking a large cohort of secondary students from six schools and concluded from their data that set allocation had a significant impact on General Certificate of Secondary Education (GCSE) exam grades when compared to key stage 3 tests. Although there may be valid reasons for grouping students by using previous test scores as a guide, the practices in the study by Wiliam and Bartholomew (2004) raised questions as to why some from socially-disadvantaged backgrounds were allocated to a lower set than their key stage 3 scores would indicate. According to Wiliam and Bartholmew (2004), justifying the use of ability grouping to secure votes from more powerful groups in society would appear more important than establishing equity of provision.

Justifications for deficit thinking

One of the recurring themes to emerge around ability grouping practises for mathematics is the persistent belief among teachers, either explicitly or implicitly, that ability is something innate and fixed (Alderton & Gifford, 2018, Marks, 2014; Francis et al., 2017b). The differences in attainment are attributed to the belief that the 'natural order' in society is being reflected in the classroom (Marks, 2014; Francis et al., 2017a). This is often without critically evaluating whether the consistent under-achievement of certain groups of learners is a systemic, rather than an individual or inherent problem (Gutierrez, 2013). Bourdieu (1992) warns against such 'ready-made thoughts' (p. 40) encountered through educational experience, which present an internalisation of social practices (Navarro, 2003), and place limits on thinking. From the literature, limits are expressed through professional judgements about 'ability' being internalised by learners and carried through the key stage (Campbell, 2021), impacting what they themselves believe they are capable of achieving, within and beyond the subject domain, performing a self-fulfilling function (Francis et al., 2017b).

Identity within mathematics

The next part of the review looked at how learner perception of ability within mathematics is shaped by experiences within the classroom, including teacher judgements and interactions (Campbell, 2021; Gardee, 2019) and peer engagement (Gardee and Brodie, 2023; Mercer and Sams, 2006). These perceptions have a lasting impact on the way learners relate to the subject (Boaler and Selling, 2017) and the way they see themselves as a learner (Gardee, 2019). Following Biesta (2010), who argues for a careful consideration of the consequences of educational practices on learner subjectivities, this is an especially important issue for the socially-disadvantaged, who are often over-represented in the lowest groups (Francis et al., 2017b). Identity as a concept is discussed in detail in chapter four. This discussion will focus on how identity interacts with belief systems learners have about their mathematical potential and how this is effected, or not, by the 'habitus' created by the teacher.

Within a sociocultural framework, a child's academic successes or failures are attributed in part to the social interactions that take place within the classroom community (Mercer and Howe, 2012). This includes how teachers make different mathematical identities available to their students through their pedagogical actions (Sfard, 2017), belief systems about ability and their own epistemological position towards mathematical instruction (Gardee, 2019; Marks, 2013; McGuillicuddy and Devine, 2020). Gardee (2019), in his South African-based study examining the alignment between the mathematical identity of learners and teacher social practices, concluded that the belief system and relational style of the teacher had a significant impact on the extent to which the learner saw themselves as a mathematician. The more open the stance taken, achieved through availability for support, challenging, independent work and the belief by the teacher that all could attain, the more all learners voiced positive engagement and evidenced progress through test results. These findings are considered significant in view of the proposed research. What the study did not cover is an observation of the dialogic exchanges between learners in the classroom, which was acknowledged by the researcher in their conclusion. This indicates that there is scope for further exploration into learner interactions, as is proposed in this dissertation.

Socialisation into neo-liberal identities

In England, with neo-liberalism shaping educational policy (Ball, 2003; Hall and Pulsford, 2019), Alderton and Gifford (2018) suggest that learners must be centred on self-improvement and be judged according to the educational choices they do or do not make that support their academic journey. This is a process that begins as soon as children start school (Bradbury, 2019a, 2019b). Drummond (2008) states that conformity and obedience are implicitly woven into expectations from Early Years onwards. Children who do not fit into acceptable identities are judged to be deficient in some way, affecting perceptions of their educability, even if the actual mathematical content of their contributions are significant (Heyd-Metzuyanim and Graven, 2016; Marks, 2013; Lambert, 2015).

Conversely, those who are considered mathematically higher-achieving may have access to privileged identities, reinforcing 'ability immobility' (McGullicuddy and Devine, 2020, p. 562), where learners link their perceptions about their potential to a fixed ability narrative embedded in and absorbed from classroom culture (Gardee, 2019; Marks, 2013).

Ofsted (2021) present a different perspective on the significance of social interaction within the classroom in their report into the teaching of mathematics. They quote research by Winheller, Hattie and Brown (2013), who concluded from their study that from the student perspective, there was a weak causal link between self-efficacy in mathematics and their relationship with the teacher or their peers. Student confidence was more strongly tied to performance. Biesta (2015b) might suggest that this is indicative of neo-liberal policies that have promoted the marketisation of education, where learners act as consumers. A more critical perspective would conclude that this also ignores issues of inequality and uses research data to validate a system that sustains an hegemony on who has access to mathematical knowledge (Gutierrez, 2013).

In contrast to the study by Winheller, Hattie and Brown (2013), Gardee (2019) used interviews and observational data to reveal a detailed view of learners' perceived connections between classroom 'habitus', their ability within the subject and the way they saw themselves as a learner, all of which were linked to their performance. This supports the rationale given in this dissertation for drawing from the interpretivist paradigm in order to further explore the dialogic behaviour of low-attaining, socially-disadvantaged learners.

It is also apparent in research literature that not all learners accept the identity offered, preferring to define their mathematical identity positively, yet independently, from classroom culture (Lambert, 2015; Lambert et al., 2022; Gardee, 2019). In contrast to the research by Winheller, Hattie and Brown (2013), learners can identify as separate from classroom culture when they dislike the pedagogic and social actions of the teacher (Gardee, 2019). It would suggest that not only are learners keenly responsive to their mathematical environment, but that some draw from a different resource-base that enables them to engage with the subject on their own terms. This research finding is considered significant to the proposal and links to the following concept of ‘funds of knowledge’.

Broadening definitions of knowledge

Although the concept of ‘funds of knowledge’ has historically been applied to understanding the ‘localised, embodied knowledge’ (Iverson, 2018, p. 539) from which disadvantaged or minority families draw as a cultural and social set of navigation tools (Moll et al., 1992; Rios-Aguilar et al., 2011), it could additionally be expanded to develop an understanding and exploration of mathematical knowledge evidenced within the same students, on the basis of their shared human propensity for mathematical development (Devlin, 2000). Lambert (1975) suggests that the school curriculum represents a ‘selection from culture’ (quoted in Husbands, 2015, p. 49) and that ‘powerful knowledge’ presents a challenge to schools to provide learners with transformative opportunities to develop knowledge that provides, ‘useful ways of thinking about the world’ (Husbands, 2015, p. 48). Iverson (2018) suggests rather than seeing knowledge as an end in itself, confined to school expectations, to see it as fluid, combining ‘scientific and practice-based knowing’ (p. 551) that leads to expertise: knowing how to use what you know (Husbands, 2015).

Participatory access or transmission?

The view of knowledge acquisition proposed by Ofsted (2021) conflicts with participatory understandings of learning. ‘Foundational knowledge’ in the complimentary forms of ‘declarative and procedural knowledge’ (Ofsted, 2021, p. 11) are the means through which it

is proposed that all learners, especially the disadvantaged, gain access to mathematics. However, in practice this often results in a dull, repetitious curriculum (William and Bartholomew, 2004; Marks, 2014) that fails to give scope for exploratory identities to emerge (Sfard, 2017). From a critical perspective, this is danger of producing disempowered, dependent learners who fail to connect with the subject (Sfard, 2017; Boaler and Selling, 2017) or discover their ability to implicitly recognise its relational, structural organisation (Reber, 1989).

While declarative knowledge has its place in learning, under Moscardini's study (2010), lower-attaining learners showed that they were capable of developing mathematical, evaluative sense-making along the same trajectory as those in mainstream. This is further supported by the proposition that the human species is inherently capable of developing mathematical thinking, through learning to count and the use of language (internally and externally) to manipulate symbols (Devlin, 2000). From neuroscience, brain scans have showed that children as young as five can, 'extract numerical information as fast as adults' (Goswami, 2006, p. 4). It may be that a key question to ask educators is how best can they support students in making explicit the knowledge they are already wired to access.

Knowledge transfer: a way forward

In relation to mathematics, some researchers note the complexity of transfer from domains outside school, such as home and community, into the domain of academic, school knowledge (Lerman, 2000). Rios-Aguilar et al., (2011) suggest that the process of converting 'funds of knowledge' in a given area such as mathematics into social and cultural capital valued by the school, would benefit from further research. Lerman (1999) states that knowledge is generated around particular pathways, separated by the context in which they were established, where the learner is in danger of confusing ideas that have contrasting social backings. This indicates that an intentional focus is needed to find ways of connecting different sources of knowledge to equip learners to become 'agents of change' (Sen, 2013, p. 7), converting what they know into personally transformative capital.

Boaler and Selling (2017) in their longitudinal study, defined the difference for learners as either developing 'adaptive' or 'routine' expertise (Boaler and Selling, 2017, p. 83). The

former led to learners having not only a greater appreciation of mathematics, but they were more likely to see its value in their lives. This may indicate the potential for successful transfer of mathematical knowledge into social and cultural capital that improves social mobility for the disadvantaged learner (Rios-Aguilar et al., 2011; Boaler and Selling, 2017).

The research findings here suggest that all learners, especially lower-attaining, disadvantaged learners, benefit from developing agency via finding their own methods, having access to practical resources and in having opportunities to practise mathematical communication (Moscardini, 2010; Barclay, 2021; Lambert, 2015). Sfard (2007) argues that these methods are perceived as intricately woven into the inner communicative processes that govern the emergence of mathematical knowledge.

Challenging deficit thinking

The last section of research literature presented in this chapter challenges deficit views of learners by looking at what kinds of mathematical understanding low-attaining students were capable of demonstrating. It was undeclared in the two studies whether they were also disadvantaged. Although small in scale, the ideas generated support the thrust of the rationale that dialogic reasoning and participation are essential to learners being able to access mathematical knowledge.

Moscardini (2010) investigated the way children in three Scottish primary schools for children with moderate learning difficulties solved word problems. Using principles from an established program, Moscardini explored how these children made use of modelling, generalisation and justification when finding solutions. A key finding from this study was that they were able to intuitively solve problems without direct instruction and that the strategies they employed were, in many cases, significantly superior to previous class-based assessments. An exploratory, discursive framing (Sfard, 2017) supported their access. It would be unwise to make generalisations from such a small study. However, the findings are still significant particularly as they seem to validate the idea that learners have an implicit grasp of mathematical principles, patterns and relationships (Sfard, 2017; Devlin, 2000) and that these are encouraged in a communicative, interactive and exploratory environment (Sfard, 2017; Lambert et al., 2022; Mercer and Sams, 2006).

The lower-attainer as an equal

The second study looked at how lower-attaining learners contributed to reasoning within mixed-ability pairs. Using the principle of ‘mathematical noticing’ (Lobato et al., 2013, quoted in Barclay, 2021, p. 210), learners used manipulatives and their observations of, ‘pattern, structure and property’ (Barclay, 2021, p. 208) to lead to deeper mathematical thinking. It was discovered that the lower-attaining learner often contributed insight in advance of their higher-ability partner. This further supports the proposition that we have an intuitive basis on which we access mathematical knowledge, especially when given the opportunity to use talk to make thinking public and meaning a negotiated, discursive practice (Moscardini, 2010; Bruner, 2002; Mercer and Sams, 2006). The linguistic, symbolic capital of the higher-attainer (Gal, 1989; Navarro, 2006) that usually positioned them to succeed within the lesson, was interrupted by a lesson design that focused on dialogue about mathematical relationships.

Conclusion

Two contrasting approaches to education policy were used to create a wider frame to contextualise the organisation of mathematical learning within the classroom and the impact this has on low-attaining, socially-disadvantaged learners. The stance adopted by Ofsted (2021) focuses on the behaviourist aspects of learning as acquisition. The difficulty with maintaining this position exclusively is that knowledge can be viewed as a possession that leads to power and position (Sfard, 1998). This is without giving enough heed to the participatory aspects of knowledge construction that enables all learners to make mathematical progress (Gardee, 2019) or to the power of dialogic interaction that encourages learner ownership of the process (Sfard, 2017).

Robeyns (2006) suggests that the human capital model for education needs to be balanced with the aims of a rights-based, capabilities approach, where learners are subsequently better positioned to convert their school mathematical experiences into social and cultural capital. This challenges behaviourist, rationalist understandings of learning mathematics. It moves the discourse away from a purely quantitative evidence-base to reassess what it is we are trying to achieve in the field of education in the long-term (Biesta, 2010), which necessarily widens the research base from which we draw to analyse its impact (Sfard, 2007).

Chapter 3: The Conceptual Framework [word count: 3031]

Introduction

Having explored literature associated with issues surrounding the recurring problem of low attainment among socially-disadvantaged learners, the following chapter will focus on concepts and theories that connect specifically to the research questions and the underlying philosophy of the proposed research. By critically evaluating theorists on dialogue, knowledge and identity, it will provide a conceptual foundation from which to understand the framing and purpose of the research questions.

Central to the proposal are ideas from the sociocultural tradition (Vygotsky, 1978), with the addition of ideas from Bakhtin (1981) about the importance of dialogic activity in promoting democratic access to mathematical knowledge. This is with an emphasis on developing a participatory view of the lower-attaining, socially-disadvantaged learner and to conceptualise them as thinking, contributing members of the classroom in line with Lave and Wenger's (1991) communities of practice. Foremost in this is the understanding that mathematics presents itself as a discursive activity through which, if assuming a realisation view, learners bring into existence via their communicative activities (Planas, Morgan and Schutte, 2018). It is an empowering act.

Using the concept of 'funds of knowledge' from Moll et al., (1992) and Ivinson's (2018, 2020) ideas about intergenerational knowledge, a theoretical argument will be made for questioning assumptions about the kinds of mathematical knowledge low-attaining, socially-disadvantaged learners possess. Bourdieu's (1986) ideas about capital and 'habitus' will be drawn on to develop this discussion. While the descriptive capacity of habitus and capital makes explicit the issues of power that work against low-attaining, socially-disadvantaged learners making mathematical progress, they also suggest ways in which, through reflexivity, they may be overcome.

Theories about identity and specifically, mathematical learner identities (MLI) (Radovic et al., 2018) will also be conceptualised. Research from the previous chapter demonstrates the connection between the identity and the mathematical attainment of low-attaining, socially-disadvantaged learners and is thus of importance to the proposed research study.

Researcher positionality and proposed methodology

The interpretivist paradigm has been adopted for this research proposal. The researcher's current belief is that social context is where meaning emerges (Cohen, Manion and Morrison, 2018), involving a complex interplay between intramental and intermental thinking (Vygotsky, 1978) and the intersectionality (Crenshaw, 1991) of social, cultural and political systems as they impact affordances and constraints experienced by social actors. The interpretivist paradigm positions participants as active in the process of making meaning (Cohen, Manion and Morrison, 2018), where social reality is in a state of continual realisation (Bryman, 2001). Mathematically, subject-based realities are seen as dialogically constructed by learners (Sfard, 2017), varying in 'form and content' (Corbetta, 2003, p. 13), depending on the individual or group.

An ethnographic perspective is seen as an appropriate methodology through which to gather data on the dialogic, communicative behaviours of low-attaining, socially-disadvantaged learners in the mathematics classroom. Gobo (2008) describes ethnography as a methodological pathway, a 'style of thinking and doing, not a mere technique' (p. 15), involving a 'pivotal cognitive approach' (p. 19) to gaining knowledge in response to the research enquiry.

The value of an ethnographic approach is that it may act to provide access to a different narrative to the 'what works' (Biesta, 2010, p. 494) hegemony in educational policy, by aiming to hear from the learners most impacted by the neo-liberal re-designing of classrooms (Hall and Pulsford, 2019), which appears to be sustaining, not improving, their lack of attainment (Alderton and Gifford, 2018). Although an ethnographic approach has been chosen, this is not without an awareness of current debates around the differences in definitions and methodology (Murphy and Dingwall, 2001; Gobo, 2008), particularly when Hammersley (2018) suggests its very existence is challenged by the current political preference for quantitative or mixed methods research.

It is recognised that what is proposed here is not ethnography in the fullest sense of its methodological outlook, but in line with Lutz' (1984) definition, ethnographic, due to the temporal limitations of being a Masters' student (Hammersley, 2006) and the pragmatic decision to adopt this approach as a 'research strategy' (Hammersley, 2018, p. 7) that may

lead to useful, context-specific knowledge. Observation of low-attaining, socially-disadvantaged learners is considered central to the process (Gobo, 2008).

Key theorists and concepts

A sociocultural perspective

Due to my interest in the mathematical, ‘educational functions of classroom talk’ (Mercer and Howe, 2012), sociocultural theory provides key ideas for considering ways in which language can impact learning and consequently, help to promote the positive development of learner identities (Mercer and Howe, 2012; Mercer and Sams, 2006; Gardee, 2019). Straehler-Pohl et al., (2014) and Barclay (2021) argue that this is especially important for the socially-disadvantaged, lower-attaining learner.

Sociocultural theory draws on dialogic practices, as they contribute to our understanding of cognition and potentially provide the basis for greater equity by valuing and seeking the participation and voice of each learner (The Open University, 2021a). In contrast to the ‘fixed ability’ thinking discussed in the previous chapter, Vygotsky’s (1978) zone of proximal development (ZPD) moves beyond describing what learners can already do to an orientation towards their future potential (Iverson, 2020), defined in this context in terms of developing capabilities that learners find meaningful and fulfilling (Sen, 2013) in an environment where they feel confident to participate (Lave and Wenger, 1991).

Learning through talk and talking to learn

This research proposal has been influenced by theorists and research contributing to our understanding of the place dialogue has in the learning process. Vygotsky (1978) saw cognition as a primarily social process, with higher order thinking posited as nurtured through the use of language (McLeod, 2023). Patterns of ‘inner speech’ (Ardila, 2016, p. 4) develop within learners through collaborative engagement, leading to cognitive expansion, while at the same time stimulating an internal discussion as a form of communication with oneself (Bakhtin, 1981; Sfard, 2017).

Sfard (2017) states that mathematical knowledge is a particular form of communication, involving dialogic interrogation of a signifier (a mathematical concept or object) and its realisations. According to Erath et al., (2018) this kind of discursive interaction is the process of learning to explain, as proficiency in general language use, and explaining to learn, as entry into mathematical discourse. Words become a window through which to gaze on mathematical concepts, while at the same time, learners must construct the frame through their use of subject-specific discourse to be able to see the mathematics involved (Lave and Wenger, 1991; Adler, 1999).

Dialogue as democratic participation

Dialogic pedagogy has been described as a more democratic approach to teaching and learning, with its decentralisation of power in order to create an intentionally open space for learners to establish meaning jointly with the teacher and their peers (The Open University, 2020a). From Bourdieu (1992) we gain a significant perspective about knowledge in line with Sfard (2017), in that he argues that what is needed are the ‘means for constructing facts in such a way that models can be developed’ (p. 45). Learners need, through dialogic action, to interrogate signifiers (mathematical facts) in order to construct models of their realisations.

This relates to the second and third research questions, in that how learners interrogate these ‘signifiers’ may reveal significant insight into their understanding. Moore (2012) suggests that language becomes an important evaluative tool in school for assessing how learners demonstrate the knowledge they possess. This is compounded by the very specific, context-bound language required by schools in England, with their ‘strong pragmatic, linguistic and interactional expectations and presuppositions’ (Gal, 1989, p. 351). Bourdieu’s theories around capital, suggest that linguistic practices accepted in education, are a form of symbolic capital that can be converted into other forms (Gal, 1989). Using Bourdieu’s theory of ‘reproduction’ (Bourdieu and Passeron, 1990) it is then possible to see why more socially-advantaged learners succeed in the school system (Wright, 2020). They know how to convert linguistic capital to their advantage. The ‘pathologising’ and ‘othering’ of difference based on perceptions of ability (Francis et al., 2017b, p. 105), as expressed through linguistic practices,

may work to alienate socially-disadvantaged students from moving beyond the periphery of engagement.

Exploratory talk

The concept of 'exploratory talk' has also informed the research proposal. It was first suggested by Barnes and Todd (1977) and developed further by Mercer (1995) and Mercer and Dawes (2011), and is a way for learners to sort out their own thinking, putting ideas into a public, visible space that allows both the person speaking and those listening to evaluate them (Barnes, 2008). It becomes an essential part of the learning process, as it allows sufficient time for the processing and integration of new concepts (Barnes, 2008). One of the key aspects of exploratory talk is the understanding that knowledge is distributed among different participants, irrespective of ability, and that through discussion, those 'pieces' can be presented, contributing towards intersubjectivity (Nathan, Eilam and Kim, 2007; Mercer and Howe, 2012). As Bakhtin (1981) states, meaning is a negotiated act between more than one participant, not the sole possession of an authoritative figure.

Social implications of classroom talk

Mercer (2013) builds on the concept of exploratory talk through his discussion of the potential of the 'social brain' (p. 148), suggesting that our capacity to navigate social complexity as human beings has an enormous impact on our ability to think individually and collectively. This has important implications for those considered low-attaining and socially-disadvantaged in mathematics. According to Lave and Wenger (1991), learning is situated and emerges out of participation within a community. For low-attaining, socially-disadvantaged learners, the extent of dialogic participation has a bearing on the kinds of mathematical learning they are able to access (Erath and Prediger, 2015). In view of the findings from studies examining the benefits for all learners when learning is organised dialogically, it is difficult to see why Ofsted (2021) would not vocalise support for its implementation. This is congruent with the earlier decision by the Department for Education (2016) to focus on 'outcomes, not methods' (p.

124), leading to questions about politically-motivated decisions to rely on test results as the primary way to measure the success of the system (Biesta, 2015a).

Application to practice

Although this may be challenging to facilitate at the research site due to the prevalence of monologic pedagogy and the adherence to the managerial, performance-based organisation of the school, the use of careful observation over the course of several weeks, may build a more informed picture of how low-attaining, socially-disadvantaged learners communicate mathematically. Recent professional developments within the school regarding mathematics, particularly the introduction of the National Centre for Excellence in Teaching Mathematics (NCETM) material to develop dialogic reasoning, may make the negotiation of the research project easier.

Forms of powerful knowledge

As mentioned in the introduction, views about knowledge, specifically what access and what kinds of knowledge low-attaining, socially-disadvantaged learners have in their possession, is a key underlying idea to this proposal. Moll et al., (1992) first established the concept of ‘funds of knowledge’ to validate valuable ways of being and doing by those from minority backgrounds to challenge deficit views of their knowledge within school. Two important observations were made in the study that have relevance to this discussion: the way relationships within school were described as ‘thin’ and ‘single-stranded’ (p. 134) compared to outside the school structure, with consequences for knowledge acquisition; and the fact that the ‘funds’ children had access to outside education were acquired through legitimate peripheral participation (Lave and Wenger, 1991) and not transmitted via adults.

Farrington et al., (2012) build on this sense of looking at the ‘whole child’, not just their school performance, by drawing attention to the importance of developing noncognitive skills; the skills that learners need to have, and may, according to Moll et al., (1992) demonstrate in other areas of their lives, in order to succeed in school. Lee (2016) highlights an additional consideration with regard to the hierarchical approach to knowledge acquisition, which is of

particular importance to the subject of mathematics. Lee (2016) suggests that assumptions about what novices need to access before they can move on to more complex learning has serious consequences for disadvantaged learners. Exposure to 'pure mathematics' was recognised by the National Foundation for Educational Research (NFER) as a significant factor in disadvantaged learners performing well in school (Wheater et al., 2016). Research studies examined in chapter two (Barclay, 2021; Moscardini, 2010; Gardee, 2019), would seem to validate the importance of conceptual exposure for learners of every attainment level making progress.

Bourdieu's (Bourdieu and Passeron, 1990) ideas about capital and 'habitus' provide a means to conceptualise the affordances and constraints involved in being able to operationalise 'funds of knowledge' to improve the educational opportunities for low-attaining, socially-disadvantaged learners. 'Habitus', defined as 'the way society becomes deposited in persons in the form of lasting dispositions' (Wacquant, 2005, p. 316), impacts access to forms of capital that can be leveraged to improve social mobility (Gal, 1989).

Research by Boaler and Selling (2017) suggest that there are long-term implications of developing different forms of 'mathematical habitus' (Wright, 2020). The promotion of participatory, dialogic enquiry was shown as more likely to develop 'adaptive' rather than 'routine' expertise, affecting social mobility in subsequent years. As Navarro (2006) notes, 'habitus' is not something 'fixed or permanent' (p. 16), providing the basis for envisioning ways to transfer 'funds of knowledge' into forms of capital that improve the prospects of the disadvantaged. Rios-Aguilar et al., (2011) suggest that exploring the connection between 'funds of knowledge' and capital is an important line of research in order to understand how to challenge the limited access to educational goals students from disadvantaged backgrounds often experience. This research proposal seeks to examine dialogic participation as a way to bridge a connection between them.

Application to the research proposal

Rios-Aguilar et al., (2011) acknowledge that understanding how transfer can be accomplished is under-theorised in research. From a mathematical perspective, Lerman (1999) suggests that transfer from one context to another, for example within-school mathematics to every-

day mathematics, is not a straightforward process and can lead to conceptual confusion. As discussed earlier in the chapter, Moore (2012) emphasises the specific language use expected in school, which strongly applies to mathematics. This research proposes that dialogic and participatory framing of the learning environment may facilitate their integration, empowering learners to recognise when and where to use forms of capital to their advantage.

Identity as narrative

Since the turn in mathematics education towards the inclusion of sociocultural theories (Lerman, 2000), knowledge and identity have been viewed as deeply linked and anchored to social practices (Gutierrez, 2013). Although acknowledged as a difficult and ‘slippery’ concept to define (Wetherell, 2010, p. 4) Sfard and Prusak (2005) offer a helpful starting point by describing it as a collection of significant narratives about an individual, a ‘[product] of a collective storytelling’ (p. 14) shaped by social activity and rooted in ‘communicational practice’ (p. 16). Identities can be actual or designated; grounded in the present state of affairs or orientated towards the future (Sfard and Prusak, 2005). Stories that are told about learners from discourses framed around perceptions about ability may go some way to explain their self-fulfilling power (Francis et al., 2017b), as learners construct identities around a designated narrative from a ‘significant narrator’ (Sfard and Prusak, 2005, p. 18).

Radovic et al., (2018) and Gardee (2019) challenge this conception of identity on the basis that it presents a limited definition, bounded by choice of paradigm and omitting the importance of individual agency. Marks and O’Mahoney (2014) go further to describe the difficulties in what they suggest are two opposing views. The first is rooted in interpretivism, where there is no ‘core’ identity (Darragh, 2016); the second is empirical and dependent on interpreting individual identity as expressed through group membership. The one relies too much on taking what individuals say at face value without weighing the contextual constraints that may be limiting which identities are encouraged. The other does not take enough account of the subtleties of individual contributions to the group (Marks and O’Mahoney, 2014).

The importance of agency

Following the predominant sociological acceptance of identity as action (Darragh, 2016), Gardee (2019) develops the idea of identity as becoming (Lave and Wenger, 1991) by including agency as 'key to the construction of learners' identities' (Gardee, 2019, p. 379). Agency is a concept used to understand why people behave the way they do (The Open University, 2020b). Frost (2006) claims it is something innate to humans while Priestley, Biesta and Robinson (2015) describe it as something enacted by means of the environment and therefore achieved via 'agentic spaces' (p. 2).

In terms that specifically apply to the learner, agency has also been presented as the power to act, making decisions about the future direction of learning, being independent and self-directed when navigating subject discourses and classroom routines (The Open University, 2020c). Marks and O'Mahoney (2014) suggest that agency is an important part of identity; whether we adopt a coercive or independent position regarding discourse coming from organisational and governmental sources. It enables the subject to interface between their personal and social identities as they respond to their environment.

Application to the research proposal

Given the complexity of different conceptions about identity, this proposal has opted for the narrative perspective from Sfard and Prusak (2005) with the addition of agency as a response to affordances offered by the environment (Priestley, Biesta and Robinson, 2015). It is felt that these interpretations more closely match the research intent of discovering the mathematical and personal perspective of the learner. This is with the understanding that what is presented by learners of themselves and their learning is just one view. Hammersley (2006) points out that any school-based ethnographic perspective will only reveal partial information. It is acknowledged that learners' lives consist of many intersecting 'worlds', of which school is just one. This perspective will inform the reflexive stance of the researcher and will be discussed again in chapter five.

This chapter has drawn from sociocultural understandings of learning, particularly from dialogic theories, as well as participatory approaches in order to provide a framework around

the research enquiry that focuses on learner dialogue, demonstration of knowledge and identity. An interpretivist paradigm and ethnographic methodology has been chosen in order to address the research questions.

Part B: The Research Proposal

Chapter 4: The Research Proposal [word count: 612]

The title of this research project is:

A qualitative study exploring how low-attaining, socially-disadvantaged children in year three dialogue about their mathematical learning.

This research proposal aims to investigate how low-attaining, socially-disadvantaged learners are using dialogue within mathematics. The reviewed literature showed that lower-attaining, disadvantaged learners are often excluded from engaging in the classroom due to the persistent belief in 'fixed-ability' thinking, exposure to a limited curriculum and restricted access to participate. It is felt that a return to looking at what learners are actually dialoguing about within lessons may prove insightful and rewarding. The opportunity to express ideas and articulate reasoning is presented as an essential part of developing confidence within the subject. Mercer and Sams (2006) suggests that ability is malleable, effected by opportunities to participate and engage in tasks through dialogue thus encouraging the discovery of its patterns, relationships and connections.

Identity is a second key area of this proposed study. Gardee (2019) and Gardie and Brodie (2023) state that developing a positive identity as a mathematician is often dependent on the roles made available by teachers and peers and is related to the kinds of mathematical participation offered within the classroom (Sfard, 2017). The practice of grouping by or projecting perceptions of ability, is seen to have a negative impact on self-confidence within mathematics, resulting in learners absorbing labels as a form of self-fulfilling prophecy (Francis et al., 2017b). In the interests of social justice, identity is an important consideration as assumptions about ability are projected via the regulatory discourse of the school (Bernstein,

2000) and in some cases, teacher judgement (Campbell, 2021). McGuillicuddy and Devine (2020) state that this is absorbed by the learner as 'truth' and projected towards future achievement. Therefore having opportunities to dialogue about mathematical concepts through the data gathering process, may encourage a shift out of a deficit view of self into a more autonomous, agentic positioning.

Concepts from Bakhtin and Bourdieu, describing power relations in language use and mechanisms of reproduction in society, not only provide a framework for understanding how inequality is sustained generationally, but, in the exposure of those devices, provide a way for these to be overcome. It is proposed that one pathway to achieve this is through the work of Moll et al., (1992), Iverson (2018, 2020) and Rios-Aguilar et al., (2011), where 'funds' of mathematical knowledge include drawing attention to the resources children bring with them into school. This may contribute to raising achievement through their recognition and integration.

Dialogue is key to this process. From a professional perspective, Module EE830 content about theories of learning initiated a train of thought about how to improve mathematical learning opportunities for the disadvantaged in my current educational context. While originally focusing on learner experiences in TMA01, the focus shifted onto looking at dialogue as this was seen in the literature as a key element of developing confidence and participation. Feedback from TMA02 highlighted the work of Moll et al., (1992) and tutor suggestions about drawing more from Bakhtin and Bourdieu helped to frame the conceptual underpinning of the research proposal. This has also informed my research position, as the learner perspective becomes important to understand if deficit models surrounding their achievement are to be avoided.

The research questions are as follows:

1. How do year three children who are socially-disadvantaged and placed in a lower set for mathematics make use of talk in the classroom?
2. How might encouraging these children to elaborate on their mathematical knowledge impact their understanding of the subject?
3. As a consequence, how might this impact their identity as a learner?

Part B: Methodology

Chapter 5: Research design, research methods and methods of analysis [word count: 3158]

Introduction

This chapter presents the design frame, research methods and forms of analysis considered appropriate in order to address the research questions outlined in chapter four. Reasons will be given for their choice, drawing from the conceptual framework introduced in chapter three and informed by researcher paradigm position. It will be followed by a description of the proposed methods and an ethical evaluation, concluding with how the data will be analysed. Issues of ensuring credibility, trustworthiness and confirmability will be addressed throughout.

Research design: an ethnographic approach

This proposal intends to use semi-structured interviews as part of an ethnographic perspective. In contrast to the arguably ‘tabula rasa’ view of low-attaining, socially-disadvantaged learners inferred within Ofsted’s (2021) report, who see declarative knowledge as the basis for mathematical learning, this study would like to build a ‘descriptive, analytical and explanatory’ (Cohen, Manion and Morrison, 2018, p. 292) picture of how these learners are engaging with and evaluating mathematical concepts through talk. This is seen as critical to broadening the discussion on attainment, as it avoids ‘within-child deficit’ views of learners (Alderton and Gifford, 2017, p. 53) by recognising the resources from which they are already drawing (Bal, 2012).

The gathering of this type of qualitative data allows for a predominantly inductive approach to analysing conclusions, where meaning can be inferred from participant actions and patterns can be identified (Bouchrika, 2023). This is with the awareness that there may be elements of deduction, as according to Mills and Morten (2013), many qualitative studies involve both as the research progresses. Delamont and Atkinson (2019) refer to the researcher as entering the field with ‘foreshadowed problems’ (p. 8). These have focused on issues connected with the experiences of low-attaining, socially-disadvantaged learners in mathematics and have

been discussed during the previous two chapters. As Billups (2021) suggests, it is hoped that by adopting this research design, the researcher may ‘uncover and understand’(p. 61) any patterns among a small group of participants identified as both lower-attaining and socially disadvantaged. As Mills and Morton (2013) indicate, ‘foreshadowed problems’ inform the researcher’s mind, while maintaining an open mind regarding data gathered from the field. While the researcher’s familiarity with the field stems from having worked as a supply teacher there for the past six years, this perspective will be countered by a conscious effort to discover the ‘emic’ perspective of the participants directly (Hammersley, 2006). This positions the researcher as having an ‘etic’ perspective with regarding their experience and therefore a synthesis will be sought between both in order, as proposed by Madden (2017), to comprehend observed learner actions against a broader picture of their attainment.

An intended outcome of the research would be to promote further practise-based investigation into how these learners can draw from their personalised knowledge-base (Bal, 2012) to access subject content with greater confidence, thus increasing their chances of making progress within school.

Research methods and instruments

Jeffrey and Troman (2003) suggest three types of ethnographic time frame for organising the frequency of visits to research sites: compressed, selective intermittent and recurrent. For this study, I propose to opt for the second time mode, selective intermittent, which would allow flexibility as to the regularity of visits over a slightly longer time period. Billups (2021) suggests that developing familiarity with the field is an essential part of sensitising the researcher to the functioning of the classroom environment and macro context of the school.

It is acknowledged, as Coffey (2018) stresses, that there are challenges in recording even familiar events and details with a fresh perspective on their meaning, particularly as I am well-acquainted with the school’s organisation. Reflexivity and transparency about personal beliefs and values will need to be continuously evaluated to leave the voice of participants paramount and thus encourage a sense of trustworthiness in the findings (Billups, 2021). It is hoped my familiarity with the setting will be a strength of the research, enabling keener awareness of the ecological and consequential implications, while maintaining awareness of my own

positionality (The Open University, 2021c). In addition, I would follow advice to 'bracket' my own judgements and bias to allow the viewpoint of the participants to direct the findings, by mentally and emotionally 'stepping back' from interactions to listen to what they are saying (Billups, 2021; Schwandt, Lincoln and Guba, 2007).

These initial visits are envisaged as taking place near the start of the school year, to permit time for the completion of pilot testing of the research instruments, recommended by Opie (2004). It also gives participants time to accept the presence of the researcher as 'normal' and to develop rapport.

Mills and Morton (2013) suggest that while there is no correct way to keep field notes, their focus should be clear. In this case, their initial purpose would be to provide contextual information with which to triangulate data collected later through participant observation and semi-structured interviews. Hammersley and Atkinson (2007) advise writing at length in order to restrict researcher interference and maintain a sense of events being anchored to the context. As recommended by Cohen, Manion and Morrison (2018) and Coffey (2018), notes would be written up at the end of each visit. Field notes are to be used throughout research enquiry. In fact, Coffey (2018) highlights the significant role they play in gleaning understanding from participant observation and interviews in order to accurately situate the dialogue and actions of social actors.

Participant observation

Delamont and Atkinson (2019) describe participant observation as a key component to any ethnographic study, varying in terms of researcher involvement on a continuum from either non-participant observation to full immersion within the social context (Billups, 2021). It is felt that a participant observation role is appropriate in this context, as the researcher will be focused on children with whom they may already have a degree of familiarity and therefore dialogic exchange is anticipated as more likely to occur naturally (Coffey, 2018). Delamont (2021) states that this method provides the researcher with the opportunity to glean insights about what learners are really saying and doing, while allowing moments for informal questioning to occur, as the need arises (Coffey, 2018).

In the interests of producing credible and trustworthy findings, awareness of the way the presence of the researcher may affect participant behaviour through any kind of informal engagement will be mitigated for by careful attention to the way field relations are initiated and sustained, as recommended by Wang (2013). This is considered to be of particular importance due to the complexities of working with children and the likelihood of them wanting to alter the way they behave when conscious of being observed. This will be reflected on through researcher journalling, separate to field notes, to evaluate the impact and extent of researcher involvement during observations and remain focused on the 'pivotal cognitive mode' (Gobo, 2008) of the observation of the participants. Delamont and Atkinson (2019) state that levels of participation can change over the course of a project, which would allow time for the researcher in this context to consider limiting participation at the beginning in order to adjust to a different role previously held within the school. Mills and Morton (2013) suggest that this can be indicated by instigating pauses in order to record notes, thus signalling the additional persona of a researcher.

The observation log (Appendix B) will involve a maximum of three participants, identified through early engagement with the field and after consultation with the teacher. Clark (2011) discusses the significance of other communicational cues, such as gesture and facial expression, when interpreting participant engagement and interaction. The field of research in this area is growing (Coffey, 2018; Planas, Morgan and Schutte, 2018), and it is felt that for this study, their inclusion would serve two purposes: to create an holistic picture of the participants' mathematical profile, who may not always be confident in using mathematical discourse and to act as a prompt for researcher participation if, for example, a carefully chosen question might help to draw out their thinking. Delamont and Atkinson (2019) suggest that all such events must be recorded chronologically, as this builds an unfolding picture of the phenomena.

In addition, Sfard (2017) considers mathematical notation to play a key part in making visible the inner dialogue of the learner with the interrogation of mathematical concepts. Therefore it is anticipated that keeping photographic evidence of workings will form part of field notes, which could be subsequently annotated for additional analysis in order to provide further data to address the research questions.

Semi-structured interviews

Semi-structured interviews are proposed in order to provide opportunities to further address the second and third research questions. Although Billups (2021) recommends a different type of interview schedule for an ethnographic study, focusing more on topics than a list of specific questions, O'Reilly (2009) states that by maintaining a consistent ethnographic perspective towards the encounter, different types of interview, including semi-structured, can be utilised in the field. Coffey (2018) agrees that conversations can be held with participants with 'varying degrees of organization and structure' (p. 49). Moreover, Slayton (2018) recommends the semi-structured interview format for novice researchers as it allows them to have the framework in place enough to then really listen carefully to what the respondent is saying. Central to the inclusion of this method is the importance of having developed a rapport with participants over a period of time before an in-depth interview takes place (O'Reilly, 2009; Billups, 2021). Therefore it is anticipated that observations will precede interviews to establish rapport with participants.

Hammersley (2006) notes that some advocates of ethnography prefer not to use this method, due to the conviction that it produces socially-constructed data within an event and it is therefore not a genuine reflection of what happens 'on the ground' (Delamont, 2021). However, this could be a useful way to develop an awareness of the 'layers of reality' (Troman, 1997, quoted in Jeffrey and Troman, 2003, p. 543) that make up learners' mathematical worlds. As Reznitskaya and Gregory (2013) suggest, by giving participants the opportunity to dialogue about mathematics, it may enhance their self-efficacy as they engage in the meta-cognitive process of thinking about thinking and this is of particular importance to the second and third research questions.

Semi-structured interviews will be used to discover learners' position towards mathematics more generally and, as Heyl (2001) states, specifically the meanings they place on their knowledge and experiences, which may include discussion about a key area, such as number, as this would be familiar to participants. The possibility for extension of conceptual understanding will be factored in by providing a space to evaluate and exchange ideas in a dialogic, participatory way (Reznitskaya and Gregory, 2013). As O'Reilly (2009) suggests, questions may arise from observational data, where the researcher seeks to understand particular phenomena in depth. As Farrugia (2017) advises when interviewing children,

physical and visual prompts, such as multilink cubes and number cards, will be employed to help prompt and navigate concept discussion. A proposed interview schedule is appended (Appendix C).

Informal interviewing may occur, as Coffey (2018) suggests, as part of the participant observer role when seeking clarity or further understanding. For example, when participants are returning to their own classrooms after a lesson. This will be planned for in the ethical considerations around gaining consent, as participants will need to be clear about such expectations.

Research participants

The participants I would like to involve in this proposed study would be a small group of learners (no more than three) in the lower set for mathematics in year three who are socially-disadvantaged. This is the point in their school experience where they are set across the year group for the subject, although within-class ability grouping is frequently practised in key stage one.

Defining low-attainment and social disadvantage

For the purpose of this proposal, 'disadvantage' is conceptualised as a combination of either social or economic circumstances that prevent some children from being able to harness the benefits within education (Raffo et al., 2022). Consideration will be given to include participants who are on the Free School Meals (FSM) register, as Gorard (2012) argues that this has been shown to be a reasonably accurate indication of need, with a clear correlation to lower-attainment at significant junctures of compulsory education. Regarding attainment, the participants would be 'working towards' age-related expectations at the point of entering key stage two, as outlined by the National Curriculum for England (Department for Education, 2014). In summary, the above factors will be discussed with the class teacher as to which children would act as a 'best fit' after considering the above criteria.

Credibility, trustworthiness and comparability

The credibility of the research has been considered throughout the design process. As recommended by Schwandt, Lincoln and Guba (2007), sustained engagement over several weeks combined with persistent observation, is intended to increase the value of findings. Member checks will also be carried out with participants, giving them the opportunity to clarify their thinking and the conclusions drawn by the research from it, as recorded in the Ethical Appraisal Form (Appendix F).

Developing a position of analytical detachment is an essential part of looking critically at data because it prevents bias from creeping into the evidence and helps to ensure the trustworthiness of the findings (Tanner & Davies, 2009; Schwandt, Lincoln and Guba, 2007). Practically this would be encouraged through allowing time for reflection before beginning the analysis and cross-checking analysis by using more than one method of looking at the data, be it auditory or graphic (Elliott, 2022).

Cohen, Manion and Morrison (2018) suggest that through ‘thick descriptions’ (Geertz, 1973, quoted in Cohen, Manion and Morrison, 2018, p. 293), issues of comparability can be achieved. Specifically to this project, by providing extensive detail about the characteristics of the mathematical dialogue of low-attaining, socially-disadvantaged groups of learners, readers may be able to draw comparisons to similar types of learners, thus potentially extending the value of the project beyond the immediate context. This could include other year groups as well as similar educational settings. As noted before in the discussion about field notes, recording needs to be as immediate as possible to the events described, to assist with accuracy, reflection and assessment of what may need to be pursued. This is with a given caveat that ethnographic-type research can involve an ‘act of faith’ (Delamont and Atkinson, 2019) about entering the field and producing results when operating in an exploratory manner. However, the literature review work has provided valuable insights into what could be anticipated.

Ethical considerations

Gobo (2008) describes the complexity of entering the field and establishing access to participants through a gatekeeper. Particular to the proposed research context is the unforeseen circumstance of a new headteacher starting at the site in September. In order therefore to comply with the need for informed consent and transparency regarding the study, the first task would be to provide the gatekeeper (headteacher) with sufficient information about the project as well as personal information about my work at the school to contextualise the project and my own professional involvement. Advice would be sought about how the research could be conducted and carried out. As suggested by Hammersley (2006) and Kay (2019), maintaining access may be an on-going and reflexive issue in order to ensure protection of the learners involved. It would also be important to highlight the potential positive consequences of conducting the study to the school (The Open University, 2021b). This is with an awareness of the new headteacher's interest in discovering ways that learning opportunities could be improved, as revealed in a letter of personal introduction to school families sent via email at the close of the previous school year.

Informed consent, confidentiality & dissemination

As the proposed study is primarily concerned with children as participants, the process of gaining informed and on-going consent is regarded as extremely important. Following published guidelines (BERA 2018) parental and child consent will be sought (Appendix D), with an information sheet for families provided (Appendix E) once permission has been given by the gatekeeper. Additional consent will be requested to make an audio recording of the interviews (Opie, 2004). This will be followed up in school, after initial consent has been obtained, with an opportunity to ask questions. Consent will be re-negotiated before the interview and half-way through the project, with assurances given that any withdrawal on their part will result in their data being destroyed. As suggested by the British Educational Research Association (BERA, 2018), consent may also need to be re-established if unforeseen events take place within the personal circumstances of the participants over the course of the project and care will need to be taken that the prolonged engagement does not have a negative impact on them.

In the interests of transparency, (BERA, 2018) participants will be assured that their data will only be read by the researcher, be anonymised after transcription of field notes and interview data, and stored on a password-protected device to comply with the *Data Protection Act 2018*. How their data is to be used will be fully explained.

Dissemination of findings will be via a report to be shared with the gatekeeper and a simplified version of this offered to participants.

Data Analysis

Coffey (2018) suggests that within an ethnographic methodology, analysis is not a separate phase of the research process, but a necessary part of the cyclical nature of gathering, evaluating and making decisions about further data collection. It is anticipated that this will feature in the analysis of data gathered to some extent, given that it is not ethnographic in the fullest sense. Hammersley (2011) states that making such judgements as research unfolds is an essential component, which will be shaped by the nature of the enquiry and the need to proceed ethically. Coffey (2018) further advises that this is an on-going process to prevent an overwhelming accumulation of field notes and interview data to be analysed.

Mills and Morton (2013) state that immersion in the data is the first step in analysis. This is in order to familiarise oneself with each part and begin an initial recording of the themes and issues that emerge. Fetterman (2020) advises refining the data into 'relevant, manageable topics' (p. 101) that can be further analysed through comparison and contrast in order to document hypotheses. These can then be further tested in the field (Gobo, 2008). As Coffey (2018) suggests, this would be kept chronologically so that in this situation, the unfolding picture of how learners are discussing mathematics and how, why or if this changes over the course of fieldwork, can be traced.

Triangulation between different types of data gathered, essential to validity (Fetterman, 2020), would be used to verify information and test hypotheses from comparable topics. Fetterman (2020) indicates that this can also be a useful way to reveal negative cases, which can lead to pursuit of information to bring clarity.

EP Postscript

Narrative critical reflection [word count: 475]

The final section of the proposal will reflect on my learning and development throughout the Learning and Teaching modules. These reflections focus on two areas: personal and academic development.

Personal development goals for this module centred around academic and research skills. Tutor comments and suggestions on reading material to support the theoretical development of the ideas relevant to my research proposal (Appendix A) allowed me to reflect on other contributions to the discussion I was building around mathematical knowledge. I saw how theory both supports research intent while at the same time can be open to new interpretations and applications. As Bourdieu (1992) describes, theory should not confine possibilities for new discovery, but inspire them. As I familiarised myself with the work of Bourdieu and Bakhtin, editing each chapter became more productive as I was able to see where their ideas connected with empirical research, supporting the rationale of the proposal.

The structuring and synthesis of those ideas presented a new challenge. The academic technique of 'foregrounding' key ideas and concepts at the beginning of a chapter, needed to be more intentional. My tutor suggested I read some of the examples of excellent dissertations under the 'resources' tab on the module website (Appendix A). It proved to be an insightful and extremely helpful experience. As Sadler has argued, the example of a *quality* piece of work can have far more of an impact on learning than examining a list of *qualities* (Sadler, 2002). My draft sat well within the descriptive category, rather than critical analysis.

Academically, I learned to approach the writing process differently. During feedback, my tutor and I discussed the way that it is not linear, but cyclical, involving smaller quantities of time. This is partly because writing and thinking inform each other (The Open University, 2022) and both become clearer with frequent practice. It was encouraging to read comments on the 'writing café' and see that this was reflected in the experience of other students on the module (Brennan, 2023). It became more productive to work on several chapters simultaneously, switching back and forth between them, building an understanding of the

interconnectedness between each stage. Developing the methodology clarified the theoretical underpinning and *vice versa*.

Conducting an extended review of the literature has provided me with a detailed understanding of the debates around socially-just ways to organise mathematical learning, the power of dialogue as a mechanism to stimulate and extend thinking and the ‘big thinkers’ that frame those positions. It has also allowed me to develop the capacity to synthesise ideas and research findings; something that represented a personal challenge to sustain over the length of a dissertation at this level. Should further academic goals be pursued in the future, an extended proposal has prepared me well for the process of carrying out research.

References:

- Adler, J. (1999) ‘The Dilemma of Transparency: Seeing and Seeing through Talk in the Mathematics Classroom’, *Journal for Research in Mathematics Education*, vol. 30, no. 1, pp. 47-64.
- Alderton, J. & Gifford, S. (2018) ‘Teaching mathematics to lower attainers: dilemmas and discourses’, *Research in Mathematics Education*, vol.20, no. 1, pp. 53-69, DOI: 10.1080/14794802.2017.1422010.
- Ardila, A. (2016) ‘L.S. Vygotsky in the 21st century’, *Psychology in Russia: State of the Art*, vol. 9, no. 4, pp. 4–15.
- Bakhtin, M. (1981) *The Dialogic Imagination*, Austin, University of Texas Press.
- Bal, A. (2012) ‘Kindness is Society: Participatory Justice for All’. In L. G. Denti & P. A. Whang (eds.) *Rattling Chains : Exploring Social Justice in Education*. Rotterdam: Sense Publishers, pp. 99-110.

Ball, S. (2003) 'The teacher's soul and the terrors of performativity', *Journal of Education Policy*, vol. 18, no. 2, pp. 215-228, <http://dx.doi.org/10.1080/0268093022000043065>.

Barclay, N. (2021) 'Valid and valuable: lower attaining pupils' contributions to mixed attainment mathematics in primary schools', *Research in Mathematics Education*, vol. 23, no. 2, pp. 208-225.

Barnes, D. (2008) 'Exploratory talk for learning'. In N. Mercer & S. Hodgkinson (eds.) *Exploring talk in school*. London: Sage, pp. 15-25.

Barnes, D., & Todd, F. (1977). *Communication and learning in small groups*. London: Routledge and Kegan Paul.

Bernstein, B. (2000) *Pedagogy, symbolic control and identity: Theory, research, critique*, 2nd edn, Oxford, Rowman & Littlefield.

Biesta, G. (2010) 'Why "what works" still won't work: from evidence-based education to values-based education', *Studies in Philosophy and Education*, vol. 29, no. 5, pp. p.491-503.

Biesta, G. (2015a) 'Resisting the seduction of the global education measurement industry: notes on the social psychology of PISA', *Ethics and Education*, vol. 10, no. 3, pp. 348-360, DOI: 10/1080/17449642.2015.1106030.

Biesta, G. (2015b) 'What is Education For? On Good Education, Teacher Judgement, and Educational Professionalism', *European Journal of Education*, vol. 50, no. 1, pp. 75-87.

Biggeri, M. (2007) 'Children's Valued Capabilities', in M. Walker & E. Unterhalter, (eds.) *Amartya Sen's Capability Approach and Social Justice in Education*. New York, NY: Palgrave Macmillan US. Available at: <https://ebookcentral.proquest.com/lib/open/detail.action?docID=307584> (Accessed: 25 April 2023).

Billups, F. (2021) *Qualitative Data Collection Tools: Design, Development, and Applications*. Qualitative Research Methods. Thousand Oaks, CA: SAGE Publications, Inc.

Boaler, J. and Selling, S. (2017) 'Psychological Imprisonment or Intellectual Freedom? A Longitudinal Study of Contrasting School Mathematics Approaches and Their Impact on Adults' Lives', *Journal for Research in Mathematics Education*, vol. 48, no. 1, pp. 78-105.

Bouchrika, I. (2023) 'Types of Research Design: Perspective and Methodological Approaches'.

Available at: <https://research.com/research/types-of-research-design#:~:text=However%2C%20what%20is%20research%20design,in%20building%20a%20thesis%20statement>. (Accessed: 25th July 2023).

Bourdieu, P. (1986) 'The forms of capital' (trans. R. Nice), in J. Richardson, (ed.) *Handbook of Theory and Research for the Sociology of Education*, New York, Greenwood, pp. 241–58.

Bourdieu, P. (1992) 'Thinking about limits', *Theory, Culture & Society*, vol. 9, no.1, pp. 37–49.

Bourdieu, P. and Passeron, J.C. (1990) *Reproduction in education, society and culture*. London: Sage.

Bradbury, A. (2019a) 'Datafied at four: the role of data in the "schoolification" of early childhood education in England', *Learning, Media & Technology*, vol. 44, no. 1, pp. 7-21.

Bradbury, A. (2019b) 'Making little neo-liberals: The production of ideal child/learner subjectivities in primary school through choice, self-improvement and 'growth mindsets', *Power & Education*, vol. 11, no. 3, pp. 309-326.

Brennan, J. (2023) 'Writing Café – July 2023', *Module Forum*, in *EE822: Masters multi-disciplinary dissertation: education, childhood and youth*. Available at: <https://learn2.open.ac.uk/mod/forumng/discuss.php?d=4406697> .

British Educational Research Association (2018) *Ethical guidelines for educational research*. 4th edn. Available at: <https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018> (Accessed: 26 July 2023).

Bruner, J. (2002) 'Tenets to understand cultural perspective on learning', in B. Moon, A. Shelton-Mayes, S. Hutchinson, (eds) *Teaching, Learning and Curriculum in Secondary Schools*. London: Routledge Falmer, pp. 10–24.

Bryman, A. (2001) *Social Research Methods*, Oxford: Oxford University Press.

Buchanan, R. (2015) 'Teacher identity and agency in an era of accountability', *Teachers and Teaching*, vol. 21, no. 6, pp. 700-719.

Campbell, T. (2021) 'In-class "ability"-grouping, teacher judgements and children's mathematics self-concept: evidence from primary-aged girls and boys in the UK Millennium

Cohort Study', *Cambridge Journal of Education*, vol. 51, no. 5, pp. 563-587, DOI: 10/1080/0305764X.2021.1877619.

Clark, A. (2011) 'Multimodal map making with young children: exploring ethnographic and participatory methods', *Qualitative Research*, vol. 11, no. 3, pp. 311-330.

Clarke, D. (2021) 'Calling a spade a spade : The impact of within-class ability grouping on opportunity to learn mathematics in the primary school', *Australian Primary Mathematics Classroom*, vol. 26, no.1, pp. 3-8, [Online]. Available at: <https://web-p-ebSCOhost.com.libezproxy.open.ac.uk/ehost/pdfviewer/pdfviewer?vid=0&sid=9870daad-fbfe-471d-8154-cafd1737575f%40redis> (Accessed: 17 December 2022).

Coffey, A., (2018) *Doing Ethnography*. Qualitative Research Kit. London: SAGE Publications Ltd. Available at: <https://doi.org/10.4135/9781526441874> (Accessed: 8 Aug 2023).

Cohen, L., Manion, L. and Morrison, K. (2018) *Research Methods in Education*. 8th edn. Oxford: Routledge.

Corbetta, P. (2003) 'Paradigms of Social Research', in P. Corbetta (ed.) *Social Research: Theory, Methods and Techniques*. London: Sage Publications Ltd., pp. 8-30.

Crenshaw, K. (1991) 'Mapping the Margins: Intersectionality, Identity Politics, and Violence Against Women of Colour', *Stanford Law Review*, vol. 43, pp. 1241-1299, DOI: 10.2307/1229039.

D'Agnesse, V. (2015) 'PISA's colonialism: Success, money, and the eclipse of education', *Power & Education*, vol.7, no. 1, pp. 56-72.

Darragh, L. (2016) 'Identity research in mathematics education', *Educational Studies in Mathematics*, vol. 93, pp. 19-33.

Data Protection Act 2018, c. 12, Available at: <https://www.legislation.gov.uk/ukpga/2018/12/contents/enacted> (Accessed: 4 August 2023).

Delamont, S. (2021) 'What do you mean by the term "ethnography"?' *EE822: Masters multi-disciplinary dissertation: education, childhood & youth*. Available at: [---

{ 41 }](https://methods-</p></div><div data-bbox=)

sagepub-com.libezproxy.open.ac.uk/video/what-do-you-mean-by-the-term-ethnography

(Accessed: 24 July 2023).

Delamont, S. & Atkinson, P. (2019) 'Ethnographic Fieldwork', in Paul Atkinson (ed.) *Sage Research Methods Foundations*. London: SAGE Publications Ltd. Available at:

<https://dx.doi.org/10.4135/9781526421036771315> (Accessed: 31 October 2022 & 10

August, 2023).

Department for Education and Employment (1997) *White Paper: Excellence in Schools*, (Cm 3681). Available at: <http://www.educationengland.org.uk/documents/wp1997/excellence-in-schools.html> (Accessed: 29th March 2023).

Department for Education (2013) *NFER Teacher Voice Omnibus: March 2013 Survey:*

Mathematics teaching in schools Research Report. Available at:

<https://www.gov.uk/government/publications/teacher-voice-omnibus-march-2013-survey-mathematics-teaching-in-schools> (Accessed: 25th June 2023).

Department for Education (2014) *The national curriculum in England: Key stages 1 and 2 framework document*. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425601/PRIMARY_national_curriculum.pdf (Accessed: 25th July 2023).

Department for Education (2016) *White Paper: Educational Excellence Everywhere*, (Cm 9230). Available at: <https://www.gov.uk/government/publications/educational-excellence-everywhere> (Accessed: 25 July 2023).

Department for Education (2022) *Opportunity for all Strong schools with great teachers for your child* (CP 650). Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1063601/Opportunity_for_all_strong_schools_with_great_teachers_for_your_child_web_accessible.pdf (Accessed: 13th April 2023).

Devlin, K. (2000) *The Math Gene: How Mathematical Thinking Evolved And Why Numbers Are Like Gossip*. New York: Basic Books.

Dracup, T. (2014) *The politics of setting*. Available at:

<https://giftedphoenix.wordpress.com/2014/11/12/the-politics-of-setting/> (Accessed: 29th March 2023).

Drummond, M. (2008) 'Assessment and values: a close and necessary relationship', in S. Swaffield, (ed.) *Unlocking Assessment: Understanding for Reflection and Application*, Abingdon, Routledge, pp. 3-19.

Elliott, A. (2022) 'Analysing qualitative data' in *Tutor Group Forum, EE831: Learning and teaching: understanding your educational practice*. Available at:

<https://learn2.open.ac.uk/mod/forumng/discuss.php?d=4036043> (Accessed: 22 August 2023).

Erath, K., & Prediger, S. (2015) 'Diverse epistemic participation profiles in socially established explaining practices', *CERME 9*, pp. 1190-1199.

Erath, K., Prediger, S., Quasthoff, U., & Heller, V. (2018) 'Discourse competence as important part of academic language proficiency in mathematics classrooms: the case of explaining to learn and learning to explain', *Educational Studies in Mathematics*, vol. 99, no. 2, pp. 161–179. Available at: <https://doi.org/10.1007/s10649-018-9830-7>. (Accessed: 23 May 2023).

Farrington, C., Roderick, M., Allensworth, E., Nagoaka, J., Keyes, T., Johnson, D., & Beechum, N. (2012) *Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance. A critical literature review*. Chicago: University of Chicago Consortium on Chicago School Research.

Farrugia, M. (2017) 'A case study on teaching mathematical language: An experience with 5-year-old children', *SAGE Research Methods Cases* [Online]. Available at <https://dx-doi-org.libezproxy.open.ac.uk/10.4135/9781473999978> (Accessed 24 July 2023).

Fetterman, D. ed., (2020) *Ethnography: Step-by-Step*. Applied Social Research Methods. Vol. 0. Thousand Oaks, CA: SAGE Publications, Inc. Available at:

<https://doi.org/10.4135/9781071909874> (Accessed 17 Aug 2023).

Francis, B., Archer, L., Hodgen, J., Pepper, D., Taylor, B., & Mary-Claire Travers, M.C., (2017a) 'Exploring the relative lack of impact of research on “ability grouping” in England: a

discourse analytic account', *Cambridge Journal of Education*, vol. 47, no. 1, pp. 1-17, DOI: 10.1080/0305764X.2015.1093095.

Francis, B., Connolly, P., Archer, L., Hodgen, J., Mazonod, A., Pepper, D., Sloan, S., Taylor, B. & Tereshchenko, A. (2017b) 'Attainment Grouping as self-fulfilling prophecy? A mixed methods exploration of self-confidence and set levels among Year 7 students', *International Journal of Educational Research*, vol. 86, pp. 96-108.

Frost, D. (2006) 'The concept of "agency" in leadership for learning', *Leading and Managing*, vol. 12, no. 2, pp. 19-28.

Gal, S. (1989) 'Language and political economy', *Annual Review of Anthropology*, vol. 18, pp. 345-367.

Gardee, A. (2019) 'Relationships between teachers' practices and learners' mathematical identities', *International Journal of Mathematical Education in Science and Technology*, vol. 52, no. 3, pp. 377-403, DOI: 10.1080/0020739X.2019.1688403.

Gardee, A. & Brodie, K. (2023) 'A framework for analysing the relationships between peer interactions and learners' mathematical identities: accounting for personal and social identities', *Educational Studies in Mathematics*, vol. 113, pp. 443-473.

Gobo, G., (2008) *Doing Ethnography*. Introducing Qualitative Methods. London: SAGE Publications Ltd. Available at: <https://doi.org/10.4135/9780857028976> (Accessed 13 Aug 2023).

Gorard, S. (2012) 'Who is eligible for free school meals? Characterising free school meals as a measure of disadvantage in England', *British Education Research Journal*, vol. 38, no. 6, pp. 1003-1017.

Goswami, U. (2006) 'Neuroscience and education: from research to practice?' *Nature Reviews Neuroscience*, vol. 7, pp.406–413.

Gutierrez, R. (2013) 'The sociopolitical turn in mathematics education', *Journal for Research in Mathematics Education*, vol. 44, no. 1, pp. 37-68.

Hall, R. & Pulsford, M (2019) 'Neoliberalism and primary education: Impacts of neoliberal policy on the lived experiences of primary school communities', *Power and Education*, vol. 11, no. 3, pp. 241-251.

Hammersley, M. (2006) 'Ethnography: problems and prospects', *Ethnography and Education*, vol. 1., no. 1., pp. 3-14, DOI: 10.1080/17457820500512697.

Hammersley, M. (2011) 'The Issue of quality in qualitative research', *Questioning qualitative inquiry: Critical essays*. London: Sage, pp. 158–79.

Hammersley, M. (2018) 'What is ethnography? Can it survive? Should it?', *Ethnography and Education*, vol. 13, no. 1, pp. 1-17.

Hammersley, M. & Atkinson, P. (2007) *Ethnography*, Abingdon, Oxon: Routledge.

Heyd-Metzuyanim, E. and Graven, M. (2016) 'Between people-pleasing and mathematizing: South African learners' struggle for numeracy', *Educational Studies in Mathematics*, vol. 91, no. 3, pp. 349-373.

Heyl, B., (2001) *Handbook of Ethnography*. SAGE Publications Ltd. Available at: <https://doi.org/10.4135/9781848608337> (Accessed 14 Aug 2023).

Hodgen, J., Foster, C. and Brown, M. (2022) 'Low attainment in mathematics: An analysis of 60 years of policy discourse in England', *The Curriculum Journal*, vol. 33, pp. 5-24.

Husbands, C. (2015) 'Which Knowledge Matters Most?', in J. Simons & N. Porter, (eds.) *Knowledge and the Curriculum A Collection of Essays to Accompany E. D. Hirsch's Lecture at Policy Exchange*. London: Policy Exchange, pp. 43–50.

Ivinson, G. (2018) 'Re-imagining Bernstein's restricted codes', *European Educational Research Journal*, vol. 17, no. 4, pp. 539-554.

Ivinson, G. (2020) 'The power of living knowledge: re-imagining horizontal knowledge', *Asia-Pacific Journal of Teacher Education*, vol. 48, no. 1, pp. 15-29.

Jeffrey, B. & Troman, G. (2003) 'Time for Ethnography', *British Educational Journal*, vol.30, no. 4, pp. 534-548.

Kay, L. (2019) 'Guardians of research: negotiating the strata of gatekeepers in research with vulnerable participants', *Contemporary Issues in Practitioner Education*, vol.1, no. 1, pp. 37-52.

Lambert, R. (2015) 'Constructing and resisting disability in mathematics classrooms: a case study exploring the impact of different pedagogies', *Educational Studies in Mathematics*, vol. 89, no. 1, pp. 1-18.

Lambert, R., Hernandez-Saca, D., Mireles-Rios, R. & Monroy Castro, M. (2022) "'It is like a feeling": Theorizing Emotion in Mathematics through Complex Embodiment', *Mathematics (Basel)*, vol. 10, no. 6, p. 937 - . Available at: <https://doi.org/10.3390/math10060937>.

Lave, J. & Wenger, E. (1991) *Situated learning. Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lee, C. D. (2016) 'Examining conceptions of how people learn over the decades through AERA presidential addresses: diversity and equity as persistent conundrums', *Educational Researcher*, vol. 45, no. 2, pp. 73–82. DOI: 10.3102/0013189X16639045.

Lerman, S. (1999) 'Culturally Situated Knowledge and the Problem of Transfer in the Learning of Mathematics', in P.L. Burton & L. Burton (eds.) *Learning Mathematics : From Hierarchies to Networks*, Taylor & Francis Group, London, pp. 93-107.

Lerman, S. (2000) 'The social turn in mathematics education research', in J.Boaler (ed.) *Multiple perspectives on mathematics teaching and learning*. Westport, CT: Ablex Publishing, pp. 19-45.

Linchevski, L. & Kutscher, B. (1998) 'Tell Me with Whom You're Learning, and I'll Tell You How Much You've Learned: Mixed Ability versus Same-Ability Grouping in Mathematics', *National Council of Teachers of Mathematics*, vol. 29, no. 5, pp. 533-554.

Lutz, F. (1984) 'Ethnography: The holistic approach to understanding schooling', in R. Burgess (ed.) *Field Methods in the Study of Education*. Falmer Press: Lewes, pp. 107–119.

Madden, R. (2017) *Being Ethnographic: A Guide to the Theory and Practice of Ethnography*. London: SAGE Publications Ltd. Available at: <https://doi.org/10.4135/9781529716689> (Accessed 18 Aug 2023).

Marks, R. (2013) "'The Blue Table Means You Don't Have a Clue": the persistence of fixed-ability thinking and practices in primary mathematics in English schools', *Forum*, vol. 55, no. 1, pp. 31-44. [Online]. Available at: <https://doi.org/10.2304/forum.2013.55.1.31> (Accessed: 9th March 2023).

Marks, R. (2014) 'Educational triage and ability-grouping in primary mathematics: a case-study of the impacts on low-attaining pupils', *Research in Mathematics Education*, vol. 16, no. 1, pp. 38-53.

Marks, A., & O'Mahoney, J. (2014) 'Researching identity: A critical realist approach'. In P.K. Edwards, J. O'Mahoney, & S. Vincent (eds.) *Studying organisations using critical realism: A practical guide*. Oxford: Oxford University Press, pp. 66-85.

McGuillicuddy, D. & Devine, D. (2020) "'You feel ashamed that you're not in the higher group" - Children's psychosocial response to ability grouping in primary', *British Educational Research Journal*, vol. 46, no. 3, pp. 553-573.

McLeod, S. (2023) 'Vygotsky's Sociocultural Theory of Cognitive Development' [online] Available at: <https://www.simplypsychology.org/vygotsky.html#Zone-of-Proximal-Development> (Accessed 12.06.23).

Mercer, N. (1995) *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon: Multilingual Matters.

Mercer, N. (2013) 'The social brain, language, and goal-directed collective thinking: A social conception of cognition and its implications for understanding how we think, teach, and learn', *Educational Psychologist*, vol. 48, no. 3, pp. 148-68 [Online]. Available at: <https://www.tandfonline.com/doi/abs/10.1080/00461520.2013.804394> (Accessed 23 August 2022).

Mercer, N., & Dawes, L. (2011). 'The value of exploratory talk,' in N. Mercer, & S. Hodgkinson (eds.) *Exploring talk in school*. London: Sage, pp. 53-78.

Mercer, N. & Howe, C. (2012) 'Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory', *Learning, Culture and Social Interaction*, vol. 1, pp. 12-21.

Mercer, N. & Sams, C. (2006) 'Teaching Children How to Use Language to Solve Maths Problems', *Language and Education*, vol. 20, no. 6, pp. 507-528.

Mills, D. and Morton, M. (2013) *Ethnography in education*. 1st ed. Los Angeles: SAGE.

Mockler, N. (2011) 'Beyond 'what works': understanding teacher identity as a practical and political tool', *Teachers and Teaching*, vol. 17, no. 5, p. 517-528, DOI: 10.1080/13540602.2011.602059.

Moll, L.C. Amanti, C., Neff, D., Gonzalez, N. (1992) 'Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms', *Theory into practice*, vol. 31, no. 2, pp. 132–141. Available at: <https://doi.org/10.1080/00405849209543534>.

Moore, R. (2012) *Basil Bernstein: The Thinker and the Field*. London: Taylor & Francis Group. Available at: <https://ebookcentral.proquest.com/lib/open/detail.action?docID=1101328> (Accessed: 23 December 2022).

Moscadini, L. (2010). "'I like it instead of maths": how pupils with moderate learning difficulties in Scottish primary special schools intuitively solved mathematical word problems', *British Journal of Education*, vol. 37, no. 3, pp.130-138.

Murgatroyd, S. and Sahlberg, P. (2016) 'The Two Solitudes of Educational Policy and the Challenge of Development', *Journal of Learning for Development*, vol. 3, no. 3 [Online]. Available at: <http://jl4d.net/index.php/ejl4d/article/view/147/170> (Accessed: 2 March 2022).

Murphy, E. and Dingwall, R., (2001) *Handbook of Ethnography*. SAGE Publications Ltd. [Online]. Available at: <https://doi.org/10.4135/9781848608337> (Accessed 9 Aug 2023).

Nathan, M., Eilam, B. & Kim, S. (2007) 'To Disagree, We Must Also Agree: How Intersubjectivity Structures and Perpetuates Discourse in a Mathematics Classroom', *The Journal of the Learning Sciences*, vol. 16, no. 4, pp. 523-563.

Navarro, Z. (2006) 'In Search of Cultural Interpretation of Power', *Institute of Development Studies Bulletin*, vol. 37, no. 6, pp. 11-22.

Nussbaum, M. (2003) 'Capabilities as fundamental Entitlements: Sen and social justice', *Feminist Economics*, vol. 9, no. 2–3, pp. 33–59.

Office for Standards in Education (2021) *Research review series: mathematics*. Available at: <https://www.gov.uk/government/publications/research-review-series-mathematics/research-review-series-mathematics> (Accessed: 27th March 2023).

Opie, C. (2004) 'Research procedures' in C. Opie, (ed.) *Doing Educational Research: A Guide to First-Time Researchers*. London: SAGE Publications Ltd., pp. 95–129 [Online]. Available at: <http://sk.sagepub.com.libezproxy.open.ac.uk/books/doing-educational-research/n6.xml> (Accessed : 22 August 2023).

O'Reilly, K., (2009) *Key Concepts in Ethnography*. SAGE Key Concepts. London: SAGE Publications Ltd. Available at: <https://doi.org/10.4135/9781446268308> (Accessed 14 Aug 2023).

Owens, J. & de St Croix, T. (2020) 'Engines of social mobility? Navigating meritocratic education discourse in an unequal society', *British Journal of Educational Studies*, vol. 68, no. 4, pp. 403-424.

Planas, N., Morgan, C. & Schutte, M. (2018) 'Mathematics education and language: lessons and directions from two decades of research' in T. Dreyfus, D. Potari, S. Prediger & K. Ruthven (eds.) *Developing research in mathematics education. Twenty years of communication, cooperation and collaboration in Europe*. New York: Routledge, pp. 196-210.

Priestley, M., Biesta, G.J.J. and Robinson, S. (2015) 'Teacher agency: what is it and why does it matter?' in R. Kneyber & J. Evers, (eds.) *Flip the System: Changing Education from the Bottom Up*. London: Routledge, pp. 1-11.

Radovic, D., & Black, L., Williams, J. & Salas, C. (2018) 'Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature', *Educational Studies in Mathematics*, vol. 99, pp. 21-42.

Raffo, C., Cascella, C., Demkowicz, O., Emery, C., Harris, D., Hennessey, A., Pampaka, M. & Lupton, R. (2022) *The relationship between socio-economic disadvantage and the attainment gap in the English education system: Protocol for a systematic review*. Education Endowment Fund. Available at: <https://educationendowmentfoundation.org.uk/education->

[evidence/evidence-reviews/socioeconomic-disadvantage-and-the-attainment-gap](#) (Accessed: 22 July 2023).

Reber, A (1989) 'Implicit learning and tacit knowledge', *Journal of Experimental Psychology: General*, vol. 118., no. 3, pp. 219-235.

Reznitskaya, A. and Gregory, M. (2013) 'Student thought and classroom language: Examining the mechanisms of change in dialogic teaching', *Educational Psychologist*, vol. 48, no. 2, pp. 114–33.

Richardson, M., Issacs, T., Barnes, I., Swensson, C., Wilkinson, D., & Golding, J. (2020) *Trends in International Mathematics and Science Study (TIMSS) 2019: National report for England (Research Report RP1086)*. Department for Education.

Rios-Aguilar, C., Marquez Kiyama, J., Gravitt, M. & Moll, L. (2011) 'Funds of knowledge for the poor and forms of capital for the rich? A capital approach to examining funds of knowledge', *Theory and Research in Education*, vol. 9, no. 2, pp. 163-184.

Robeyns, I. (2006) 'Three models of education: Rights, capabilities and human capital', *Theory and Research in Education*, vol. 4, no.1, pp. 69-84, DOI: 10.1177/1477878506060683.

Sadler, R. (2002) 'Ah! ... So that's 'quality'', in: P. Schwartz & G. Webb (eds.) *Assessment: case studies, experience and practice from higher education*. London: Kogan Page.

Sen, A. (2013) 'The Ends and Means of Sustainability', *Journal of Human Development and Capabilities*, vol. 14, no. 1, pp. 6–20.

Sfard, A. (1998) 'On Two Metaphors for Learning and the Dangers of Choosing Just One', *Educational Researcher*, vol. 27, no. 2, pp. 4–13.

Sfard, A. (2007) 'When the Rules of Discourse Change, but Nobody Tells You: Making Sense of Mathematics Learning From a Commognitive Standpoint', *The Journal of the Learning Sciences*, vol. 6, no. 4, pp. 565-613.

Sfard, A. (2017) 'Ritual for ritual, exploration for exploration: Or, what learners are offered is what you get from them in return' in J. Adler & A. Sfard, (eds.) *Research for Educational Change: Transforming researchers' insights into improvement in mathematics teaching and learning*. London: Routledge, pp. 41-63.

Sfard, A., & Prusak, A. (2005) 'Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity', *Educational Researcher*, vol. 34, no.4, pp. 14–22. <https://doi.org/10.3102/0013189X034004014>.

Shih, Y. (2018) 'Rethinking Paulo Freire's dialogic pedagogy and its implication for teacher training', *Journal of Education and Learning*, vol. 7, no. 4, pp. 230–5.

Slayton, J., 2018. *Skills for Conducting a Semi-Structured Interview*, Sage Video. [Streaming Video] London: Sage Publications Ltd. Available at: <https://doi.org/10.4135/9781526442642> (Accessed 15 August 2023).

Straehler-Pohl, H., Fernández, S., Gellert, U. & Figueiras, L. (2014) 'School mathematics registers in a context of low academic expectations', *Educational Studies in Mathematics*, vol. 85, no. 2, pp. 175-199.

Schwandt, T.A., Lincoln, Y.S. and Guba, E.G. (2007) 'Judging interpretations: But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation', *New Directions for Evaluation*, 114, pp. 11-25. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/ev.223> (Accessed: 14 August 2023).

Tanner, R. & Davies, S. (2009) 'How engagement with research changes the professional practice of teacher-educators: a case study from the Welsh Education Research Network', *Journal of Education for Teaching*, vol. 35., no. 4, pp. 373-389. DOI: [10.1080/02607470903220448](https://doi.org/10.1080/02607470903220448)

The Guardian (2006) 'Extend ability setting to every school, says Cameron', 9th January [Online]. Available at: <https://www.theguardian.com/education/2006/jan/09/schools.uk2> (Accessed: 25th March 2023).

The Open University (2020a). 'Sociocultural learning', *Module EE830: Learning and teaching: educating the next generation*. Available at: <https://learn2.open.ac.uk/mod/oucontent/view.php?id=1627887§ion=2.1.1> (Accessed: 27th May 2023)

The Open University (2020b). '7.3 Preparing for Learning Event 2: teacher agency', *Module EE830: Learning and teaching: educating the next generation*. Available at:

<https://learn2.open.ac.uk/mod/oucontent/view.php?id=1627872§ion=3.1> (Accessed: 16th June 2023)

The Open University (2020c). '4.7 LCE for learner agency', *Module EE830: Learning and teaching: educating the next generation*. Available at:

<https://learn2.open.ac.uk/mod/oucontent/view.php?id=1765304§ion=7> (Accessed: 16th June 2023)

The Open University (2021a). '7.3 Dialogic pedagogy', *Module EE831: Learning and teaching: understanding your educational practice*. Available at:

<https://learn2.open.ac.uk/mod/oucontent/view.php?id=1765314§ion=3> (Accessed: 21st June 2023)

The Open University (2021b) 'Thinking about the benefits of research', *Module EE831: Learning and teaching: understanding your educational practice*. Available at:

https://learn2.open.ac.uk/mod/oucontent/view.php?id=1765325§ion=5#activity_9_6 (Accessed: 26 August 2022).

The Open University (2021c) 'Positionality', *Module EE831: Learning and teaching: understanding your educational practice*. Available at:

<https://learn2.open.ac.uk/mod/oucontent/view.php?id=1765328§ion=6> (Accessed: 22 August 2023)

The Open University (2022) '11.6 The writing process: making and expressing meaning', *Module EE822: Masters multi-disciplinary dissertation: education, childhood and youth*.

Available at: <https://learn2.open.ac.uk/mod/oucontent/view.php?id=1946371§ion=6> (Accessed: 20 August 2023).

Vygotsky, L. S. (1978) *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wacquant, Loïc (2005) 'Habitus', in J. Becket & Z. Milan (eds.) *International Encyclopaedia of Economic Sociology*. London: Routledge, pp. 317-320.

Wang, X. (2013) 'The construction of researcher–researched relationships in school ethnography: doing research, participating in the field and reflecting on ethical dilemmas', *International Journal of Qualitative Studies in Education*, vol. 26, no. 7, pp. 763-779.

Watson, A. (2021) *Care in mathematics education : alternative educational spaces and practices*. Cham, Switzerland: Palgrave Macmillan.

Wetherell, M. (2010) The field of identity studies. In M. Wetherell & C. Mohanty (eds.) *The SAGE handbook of identities*. London, California, New Delhi and Singapore: Sage publications, pp. 3-26.

Wheater, R., Durbin, B., McNamara, S. and Classick, R. (2016) *Is mathematics education in England working for everyone? NFER analysis of the PISA performance of disadvantaged pupils*. Slough: NFER.

Whitty, G. (2010) 'Revisiting School Knowledge: some sociological perspectives on new school curricula', *European Journal of Education*, vol. 45, no. 1, pp. 28-45.

Wiliam, D. & Bartholomew, H. (2004) 'It's not which school but which set you're in that matters: the influence of ability grouping practices on student progress in mathematics', *British Educational Research Journal*, vol. 30, no. 2, pp. 279-293.

Winheller, S., Hattie, J. & Brown, G. (2013) 'Factors influencing early adolescents' mathematics achievement: High-quality teaching rather than relationships', *Learning Environments Research*, vol. 16, no. 1, pp. 49-69.

Wright, P. (2020) 'Visible and socially-just pedagogy: implications for mathematics teacher education', *Journal of Curriculum Studies*, vol. 52, no. 6, pp. 733-751, DOI: 10/1080/00220272.1790667.

Appendix A: EMA Reflection Grid

Category	Feedback received, targets achieved and areas of development worked on	How this shaped my dissertation
<p>Knowledge and understanding</p>	<p>TMA01 feedback – narrowing the focus of the first research question. Feedback: ‘ This is very broad and you may think about narrowing the focus here- we can discuss.’</p> <p>TMA02 feedback drew my attention to the concept of ‘funds of knowledge’. Feedback: ‘You could consider Moll et al.’s ideas of Funds of Knowledge and Rios-Aguilar, C., Kiyama, J.M., Gravitt, M. and Moll, L.C. (2011) ‘Funds of Knowledge for the Poor and Forms of Capital for the Rich? A Capital Approach to Examining Funds of Knowledge’, <i>Theory and Research in Education</i>, vol. 9, no. 2, pp. 163-184.’</p> <p>Moll et al. (1992) – this was also supplied as a reference to explore further.</p> <p>Feedback from second draft submission from chapter three: my tutor suggested I draw more from Bakhtin (ideas about dialogic learning) and Bourdieu to support the theoretical underpinning.</p>	<p>I re-worded the question, taking out ‘experience’ to focus instead on the issue of dialogue within mathematics lessons, as this fitted in with the development of my research focus. I considered ‘communication’ instead of ‘dialogue’ but decided on the latter as it better explained the conversational aspect of learning I was interested in exploring.</p> <p>I located the suggested articles from the library and found that it complimented ideas gleaned from Ivinson (2018; 2020) about different forms of knowledge and how this might be leveraged to the advantage of under-privileged learners. This then fed into a discussion in the literature review.</p> <p>My tutor helped provide reference details to locate sources for both theorists. Their ideas were woven into each chapter to sustain a consistent theme across the dissertation.</p>

<p>Critical analysis and evaluation</p>	<p>Feedback from the first draft submission: ideas were not expressed clearly; suggestions were made to re-order paragraphs to achieve a better flow in the analysis and evaluation of the literature, with the comment made that I had left too much for the reader to infer.</p>	<p>I spent an entire week re-drafting chapter two, with the aim of making the line of argument clear. Where a reference had been made, I asked myself the question, 'have I made the reason for its inclusion explicit?'</p> <p>Writing the methodology chapter helped evaluate the concepts discussed in chapter three and <i>vice versa</i>.</p>
<p>Structure, communication and presentation</p>	<p>Feedback from the first draft submission from chapter two: my tutor queried my use of referencing, as I tended to group references at the end of the sentence rather than attributing each idea within the sentence as it unfolded.</p> <p>References made needed to be more fully explained rather than leaving the reader to infer.</p> <p>My tutor suggested I read some of the examples from the university website as a guide.</p> <p>Feedback also stated: 'the inclusion of ideas of social justice could be introduced at the start and foregrounded along with neoliberalism'</p> <p>Your subheadings really need developing further so that they indicate what is being discussed (the themes) and this all could be clearly introduced at the start so the reader knows what to expect'</p>	<p>I went back and referenced each component in a sentence more accurately, sometimes beginning with a reference in order to vary the structure of the presentation of concepts/ideas.</p> <p>The online 'chat' function under the library tab proved to be an invaluable tool in bringing clarity to referencing when uncertainty arose.</p> <p>I examined different examples online of excellent dissertations and began to get the 'feel' for the kind of explicit structure expected at this academic level. I also re-read TMA01 and TMA02, where I had managed to capture the lucid style needed. This led to a lengthy, but ultimately rewarding, re-drafting of chapter two. At the same time, I made lists of paragraph themes in order to keep the focus tight and read my work</p>

		<p>to my 'study buddy' to check for clarity of communication.</p> <p>I went back over Module material, especially from EE831 and EE822, taking note of the areas that addressed the research process. I also followed-up on website links to writing tips from different academics. These were insightful, particularly the suggestion that the active voice is preferred to the passive voice in academic writing. Going back over my drafts, I tried to correct this, as I tended to use the latter.</p>
--	--	--

Appendix B – Observation Log

Adapted from Billups (2021), p. 138

Title of study:	Date/Time/Day of week:	Number of participants:	Setting:

	Individual behaviours	Group behaviours	Nonverbal cues	Conversation topics/threads
Participants				
Setting/ Space / Resources				
Types of ongoing activities				
Researcher reflections & follow-up				

Appendix C – Semi-structured interview schedule

Adapted from Billups (2021), p. 50

Date:	Time & place:
Interviewer:	Interviewee:






- Review process for interview, how long it will last, the purpose of the questions
- Remind participant that the data will be kept confidential and stored securely
- Secure consent for the interview & further consent to make an audio recording
- Give participant opportunity to ask any questions before starting

Questions

1. I would like to know what you think about maths. What do you think maths is all about?
 - (Probe) Can you tell me more about what you know about (concepts they have just mentioned)? (Remind them they can use multilink/digit cards/whiteboard, if that helps).
2. What words do you use in lessons to talk about (e.g. numbers)?
 - (Probe) Can you choose one of those words and tell me what you think it means? How would you explain it?
3. Can you think of ways that you use maths at home or in your life?
 - (Probe) Can you tell me of any other ways you use maths?
4. Are there people outside school (friends/family) that you can ask for help? If so, who?

- (Probe) What makes them a good person to ask?

5. How confident do you think you are about learning maths?

 Unconfident	 Not very confident	 Fairly confident	 Confident	 Very confident
--	---	---	---	---

- (Probe) Can you tell me why you think this?/Which areas of maths do you find easy/hard?
- (Probe) What do you think makes those areas easy/hard to understand?

6. Is there anything else you would like to tell me about maths?

(Researcher: thank the participant for their time and let them return to the classroom).

Appendix D: Research project consent form

[To be completed by all participants and their parents/guardians/carers]

Dear Parents/guardians/carers

Please could you read the following questions with your child and help them to complete it.

Please indicate YES/NO to each question and return to the school office by 22/09/23.

Have you read the information about this study?	YES	NO
Has the nature and aims of this study been explained to you?	YES	NO
Do you understand what this study will involve?	YES	NO
Do you understand how data will be collected about you from the study?	YES	NO
Are you happy with how your data will be stored?	YES	NO
Have you asked all the questions you want?	YES	NO
Have you had your questions sufficiently answered?	YES	NO
Do you understand that any personal information, such as your name, will not be shared?	YES	NO
Are you happy to take part in the observation?	YES	NO
Are you happy to take part in an interview?	YES	NO
Are you happy for an audio recording to be made of the interview?	YES	NO

If any answers are 'no' feel free to ask for further information. However, if you **don't** want to take part, please just let the researcher know (as soon as practical) and **don't** sign your name.

If you consent to participate, please write your name and today's date. You can withdraw consent up to the point when I will begin writing my report (09/02/24).

Your name _____

Date _____

Return form to: Ruth Vasquez via the school office

Thank you for your help.

Appendix E: Information sheet

Information letter for participants and parents/carers/guardians

I, Ruth Vasquez, would like your child to take part in a study investigating how children use language in their maths lessons. This will involve a weekly observation, beginning in October and ending at Easter. I would also like to talk with your child about their learning and about how they use mathematics in their lives outside school. I have been studying for a Masters in Education with the Open University, and this research was planned during my studies. This will generate findings relevant to and of value to the school and possibly to other similar schools.

➤ What is the aim and focus of the study?

The aim of the observation and the interview is to gain a perspective on the activities taking place in [add name of setting]. The investigation is designed to contribute to knowledge and practice into the ways children talk about maths and the data collected from the observations and interview is designed to help answer: How do children talk about their learning in the mathematics' classroom? How might encouraging children to talk about their mathematical knowledge impact their understanding of the subject? How might this impact their confidence and sense of identity?

➤ Why am I being invited to participate in this research?

Your child has been chosen because I would like to hear from children in your year group. I am interested in learning from them what they think about mathematics and how, through talk, they show their understanding. Outline permission has been granted from senior leadership at the school [include name of who signed the Dissertation Ethical Agreement Form] and the teacher in the classroom where the observations will take place. Permission has also been granted to request an interview. Your child's experiences and opinions will be valuable in answering the questions set for the study.

➤ If I take part in this research, what will be involved?

Observations will be conducted once a week for the duration of the maths lesson (approximately 60 minutes). I will be sitting in the space next to your child and will take notes on their activities. This may mean asking questions from time to time to understand what they are doing more fully. For those involved, it will not change what they are asked to do in class.

An additional part of the study involves an interview. This should take no more than 20 minutes and I will make sure that I have checked with your teachers that when and where we talk is the most convenient for you and them. Our conversation will not be videoed but I will make notes about what you say. Permission has been given from [include specific name or title of setting gatekeeper] for me to invite you to this interview. I would like to ask your consent to make an audio recording of our discussion so that I can refer back to what was said more accurately than would be possible just from my notes. If you do not wish to be audio recorded, I will rely only on my written notes. Only I will have access to the audio recording. I do not need to share this with those at the University or in this practice setting. In any part of the interview which will be shared with my tutor or form part of the final dissertation report, you and anyone else you name during our discussion will be referred to by a false name (pseudonym) and you will be asked if you would like to suggest what name I use.

If you are reading this as a parent/carer/guardian, please explain this information to your child, if they are below the age of 18. A consent/assent form has been provided for participants and parents/guardians/carers to complete if they are happy to take part in the study. Please hand in completed forms at the school office by 22/09/23.

➤ **Will the data collected during observation/interview be kept private?**

Your participation will be treated in **strict confidence** in accordance with the *Data Protection Act 2018*. No personal information about you will be shared with anyone else. In the case of the audio recording, notes from the interview and observations, these will be kept private only to me and typed up as soon as possible. However, if you let me know anything during either observation or the interview which I consider means that you might be unsafe or have been involved in a criminal act, because this is a safeguarding concern, I will need to pass this information immediately to the organisation's Designated Safeguarding Officer. When I make anonymised records of the observations and interview, as outlined above, these will be stored securely on password protected devices and the original notes (and recording) will then be destroyed. I can confirm that neither you as an individual nor the setting will be identifiable in my submissions to the University or any presentations I make of my findings to others interested in the research study.

➤ **What happens now?**

After reading this information sheet with your parent/guardian/carer, please read and complete the consent form. Whether you agree or not is entirely up to you and your parent/guardian/carer, as the invitation is for you to take part voluntarily. You can change your mind later and withdraw from the study by letting me know and I will destroy the information (consent forms, interview files and observation notes) I have created. This will be possible up until 09/02/24, when I will be using your information as part of my assessment.

➤ **What if I have other questions?**

If you have any questions about the study, I would be very happy to answer them. Please contact me at: [REDACTED]

Appendix E

E822 Ethical Appraisal Form

Masters: Education, Childhood and Youth



Section 1: Project details

a.	Student name	Ruth Vasquez	
b.	PI		
c.	Project title	A qualitative study exploring how low-attaining, socially-disadvantaged children in year three dialogue about their mathematical learning.	
d.	Supervisor/tutor	Dr Adele Creer	
e.	Qualification	Masters in Education	X
		Masters in Childhood and Youth	

f.	MA pathway (where applicable)	Learning and teaching
g.	Intended start date for fieldwork	September 2023
h.	Intended end date for fieldwork	April 2023
i.	<p>Country fieldwork will be conducted in</p> <p><i>If you are resident in the UK and will be conducting your research abroad please check www.fco.gov.uk for advice on travel.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p>Because ethical appraisal should precede data collection, a completed version of this form should be included with TMA02 for those developing a Small-Scale Investigation (SSI) and as part of the EMA submission for those completing an Extended Literature Review and Research Proposal (EP) form of the Dissertation.</p> </div>	England

NB: it should be noted that The Open University is unable to offer liability insurance to cover any negative consequences students might encounter when undertaking ‘in-person’ data collection. It is therefore very important that you follow appropriate research protocols which should include seeking Gatekeeper permissions to undertake any data collection within your setting and adhering to ethical principles for the safety of yourself and your participants.

Fill in section 1 of this document with your personal details and brief information about your research.

For section 2, please assess your research using the following questions and click yes or no as appropriate. If there is any possibility of significant risk please tick yes. Even if your list contains all “no” you should still return your completed checklist so your tutor/supervisor can assess the proposed research.

Section 2: Ethics Assessment		Yes	No
1	Does your proposed research need initial clearance from a ‘gatekeeper’ (e.g. Local Authority, head teacher, college head, nursery/playgroup manager)? <i>Yes, this will be the headteacher</i>	X	
2	Have you checked whether the organisation requires you to undertake a ‘police check’ or appropriate level of ‘disclosure’ before carrying out your research? ¹ <i>A DBS is held by the researcher</i>	X	
3	Have you indicated how informed consent will be obtained from your participants (including children less than 16 years old, school pupils and immediate family members)? Your consent letters/forms must inform participants that they have the right to withdraw from the study at any time. ² <i>Information letters will be sent out to parents/guardians and children explaining the aims of the</i>	X	

¹ You must agree to comply with any ethical codes of practice or legal requirements that maybe in place within the organisation or country (e.g. educational institution, social care setting or other workplace) in which your research will take place. If required an appropriate level of disclosure (‘police check’) can be obtained from the Disclosure and Barring Service (England and Wales), Disclosure Scotland, AccessNI (Northern Ireland), Criminal Records Office (Republic of Ireland), etc.

² This should normally involve the use of an information sheet about the research and what participation will involve, and a signed consent form. You must allow sufficient time for potential participants to consider their decision between the giving of the information sheet and the gaining of consent. No research should be conducted without the opt-in informed consent of participants or their caregivers. In the

	study and their right to withdraw at any time. Consent will then be obtained from parents/guardians and assent will be sought from the children at each stage of the study. The headteacher will also complete a gatekeeper consent form for teachers of the school to be involved and the class teachers will complete a consent form for observations to be carried out in their classes.		
4	Will your proposed research design mean that it will be necessary for participants to take part in the study without their knowledge/consent at the time (e.g. covert observation of people in nonpublic places)? If so have you specified appropriate debriefing procedures? ³		X
5	Does your proposed design involve repetitive observation of participants, (i.e. more than twice over a period of more than 2-3 weeks)? Is this necessary? If it is, have you made appropriate provision for participants to renew consent or withdraw from the study half-way through? ⁴ Yes, participants will be reminded of their right to withdraw from the study. Should they do so, their data will be immediately deleted. Repetitive observations are needed in order to address the research questions.	X	
6	Are you proposing to collect video and/or audio data? If so have you indicated how you will protect participants' anonymity and confidentiality and how you will store the data? An audio recording will be made of the interviews, which will be stored securely on a password-secure device. Participants will be given pseudonyms and after transcription, the audio recording will be deleted. Participants will be asked at the interview if they are happy to agree to an audio recording. If not, then recording will not proceed.	X	
7	Does your proposal indicate how you will give your participants the opportunity to access the outcomes of your research (including audio/visual materials) after they have provided data? Participants will be given the opportunity to listen to a transcription of the audio recording, where they can voice any points of disagreement. A simplified summary of outcomes will be shared with participants and a more detailed report made available to the headteacher.	X	
8	Have you built in time for a pilot study to make sure that any task materials you propose to use are age appropriate and that they are unlikely to cause offence to any of your participants? Both the observation and interview schedule will be piloted before use with a similar group of participants in another class within the year group after the initial visits have taken place.	X	
9	Is your research likely to involve discussion of sensitive topics (e.g. adult/child relationships, peer relationships, discussions about personal teaching styles, ability levels of individual children and/or adults)? What safeguards have you put in place to protect participants' confidentiality? Thoughts about ability levels may surface during interviews. Participants will be reminded that anything they share will be confidential and that the focus of the interview is about listening to and valuing their perspective.	X	
10	Does your proposed research raise any issues of personal safety for yourself or other persons involved in the project? Do you need to carry out a 'risk analysis' and/or discuss this with teachers, parents and other adults involved in the research?		X

case of children (individuals under 16 years of age) no research should be conducted without a specified means of gaining their informed consent (or, in the case of young children, their assent) and the consent of their parents, caregivers, or guardians. This is particularly important if your project involves participants who are particularly vulnerable or unable to give informed consent (e.g. children under 16 years, people with learning disabilities, or emotional problems, people with difficulty in understanding or communication, people with identified health problems). There is additional guidance on informed consent on the Masters: Education and Childhood and Youth website under Project Resources.

³ Where an essential element of the research design would be compromised by full disclosure to participants, the withholding of information should be specified in the project proposal and explicit procedures stated to obviate any potential harm arising from such withholding. Deception or covert collection of data should only take place where it has been agreed with a named responsible person in the organisation and it is essential to achieve the research results required, where the research objective has strong scientific merit and where there is an appropriate risk management and harm alleviation strategy.

⁴ Where participants are involved in longer-term data collection, the use of procedures for the renewal of consent at appropriate times should be considered.

11	Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		X
12	Will the study involve recruitment of patients or staff through the NHS or the use of NHS data?		X

If you answered 'yes' to questions **12**, you will also have to submit an application to an appropriate National Research Ethics Service ethics committee (<http://www.nres.npsa.nhs.uk/>).