# A sociocultural exploration of young children's relationships with science: towards a practice theory of interest

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# A sociocultural exploration of young children's relationships with science: towards a practice theory of interest

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## Abstract

Much of the literature on pupils' engagement with science is founded on an assumption that interest in science is a personal characteristic, which is 'sparked' by activities that hold particular fascination for the learner. In contrast, this thesis develops a practice theory of interest in science, which adopts a sociocultural view and holds that children's interests are enacted as part of their developing identities at home and school. Building on Holland et al.'s (1998) concept of 'identity in practice' and González, et al.'s (2006) 'funds of knowledge', a practice theory of interest maintains that children's interests cannot be studied in isolation from their fluid and constantly forming identities, and are *situated* in a social, cultural and historical context. Such interests and identities are *positional*, and are often developed and enacted in accordance with major structural divisions in society. Interests also emerge in response to *discourses*, in the context of the cultural worlds in which we engage.

Viewing science interest in these terms has particular methodological implications, and this study utilises the Mosaic approach (Clark and Moss, 2011), a multi-methods data generation technique designed to listen to children's perspectives on their lives, which acknowledges adults and children as co-constructors of knowledge and understanding. In a study spanning two years, I generated data with eight children in their first years at school, from ages 5 to 7.

Using the lens of a practice theory of interest in order to recognise and explore the social situatedness of children's relationship with science, this study examines the symbolic meaning of their interests and the cultural signs and tools they use to story themselves, and how they are storied by others. The findings indicate that children's science interests are deeply embedded in family and school practices, and that children express interest in specific aspects of science, which are noticed (and encouraged) by parents, but less so by school staff. It concludes that the format of school appears to be constraining, so that certain stories cannot be told, this has implications for practice.

# Contents

## List of Abbreviations

| | |
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| BAECE | British Association for Early Childhood Education |
| BERA | British Educational Research Association |
| DfE | Department for Education |
| EYFS | Early Years Foundation Stage |
| Ofsted | Office for Standards in Education |
| STEM | Science, Technology, Engineering and Mathematics |

# List of Figures

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> What if there were a world called academia, where books were so significant that people would sit for hours on end, away from friends and family, writing them? (Holland, 1998:49)

These words have often run through my mind and I appreciate the support from friends and family, who have believed that I would eventually finish and forgiven my absence over the last few years. Most of all, thanks to Paul for your plain talking and encouragement throughout the whole process.

# Chapter 1 Introduction

This study explores the social situatedness of children's relationships with science between the ages of 5 and 7. The purpose of my research is to gain, from a sociocultural perspective, a greater understanding of science interests as part of children's fluid and constantly forming identities. In this opening chapter, I position the study within the wider field of educational research and explain the rationale for my choice of research focus and personal motivations. Next, I provide background contextualisation regarding the pedagogy, curriculum and practice related to the age range of the children in this study, and introduce the research questions. The chapter concludes with an outline of the subsequent chapters of the thesis.

## 1.1 Rationale for the study

A study of interest is timely, as many sectors of the education community in England debate the tension between an emphasis on summative assessments (Department for Education (DfE), 2016) and a desire to nurture children's lifelong interest in curriculum subjects (Arthur et al., 2015). I have witnessed the rise of performativity during 25 years of experience working in the UK education system; yet the Teachers' Standards stress the importance of promoting a 'love of learning and children's intellectual curiosity' (DfE, 2011:11).

Against this backdrop, research that focuses on *interest in science* is particularly relevant, as many studies have written about a general decline in pupils' attitudes towards science from 11 years old onwards and the concern that fewer young people choose to study science subjects post 16 (Potvin and Hasni, 2014). The majority of published journal articles and reports about young people's interest in science focus on how secondary school science teachers could better stimulate or sustain interest in science in older pupils. There is a far smaller body of research on young children's emerging interest in science compared to studies involving older pupils (Patrick and Mantzicopoulos, 2015). However, I argue that exploring young children's relationships with science, as part of their identities is essential for our understanding of why some

children develop a positive interest in science in later life, whilst other children become disinterested.

Some of the current initiatives seeking to address the perceived decline in children's interest in school science do so from a premise that the problem can be *fixed*. For example, an Ofsted (Office for Standards in Education) survey of science provision in 180 schools chastises teachers for focusing improvement plans on achievement in science and advocates strategies to 'make science interesting', engage pupils and 'maintain curiosity' (Ofsted, 2013:26). How curiosity appears to be conceptualised in this report is typical of studies that treat *interest* and *curiosity* as interchangeable terms (see section 3.2). Rather than taking the design of new and exciting science activities as its starting point, my study explores a different approach, looking at how children story themselves, and are storied by others, as being interested in science (by 'story' I refer to the way we construct our identities, see p.37). This is why I have employed a participatory research method (the Mosaic approach (Clark and Moss, 2011)) to gather data from a wide range of sources. At the time of writing, no journal has published research that utilises the Mosaic approach to explore children's interest in science specifically. A further contribution to knowledge of this thesis is the application of a practice theory of interest (see Chapter 3), which sees children's interests and identities as inseparable.

## 1.2 Personal motivations and my research focus

My earliest memories are of crouching in my garden watching woodlice and spiders in their natural habitat. I used to help to care for our family pets – a cat and a dog – and eventually kept pets of my own – mice, snakes, lizards, fish, giant millipede and tortoise. During my childhood, I remember spending lots of time outdoors – climbing trees, making dens and exploring. As a family, we visited zoos, farms and adventure playgrounds, and watched wildlife programmes on television. I have a strong recollection of crawling round the living room with my older brothers pretending to be hyenas, lions and zebras, whilst listening to a wildlife record called *Sounds of the Serengeti*.

When I was at secondary school, I chose to study physics and biology, and then went on to study Botany and Zoology at university. I trained to be a secondary science teacher, and after 10 years of teaching became a science consultant, delivering professional development to primary and secondary teachers. When choosing a topic for my doctorate, I had just begun lecturing on science to primary trainee teachers. I recall that in my first session, I asked the students what they thought science is and why it is a core subject in the primary National Curriculum (DfE, 2013). One student put her hand up and said, 'I have to tell you, I don't like science and I never have'. This reminded me of my own experiences as a science teacher of pupils who clearly did not like the subject, and it piqued an interest in me to find out more about *attitudes* to science. I wondered why some people (including me) see science as a fascinating subject, whilst others (such as the student quoted) claim to have a deep-seated dislike of science.

I developed two initial research questions, which reflected my position at the time, as someone more familiar with research in a positivist paradigm than a sociocultural one:

- *How does interest in science and motivation to learn science develop between the ages of 5 and 7 years old?*

- *What types of interactions with adults support children's interest in science and motivation to learn science?*

These questions are very broad and cover a wide field; motivation alone is a huge topic (Schunk et al., 2013). I knew I had to narrow my questions down, yet felt – in these early stages of my research – unsure about which direction to go in. As part of my pilot study, I was trialling interview questions with 5-year-olds. Alex was busy drawing pictures of ants when I asked him what he enjoyed doing in school. Below is an extract from my research journal (Alex is a pseudonym):

> Alex: I enjoy cutting out things and drawing creatures like all this and I've got loads of them, because I make them every day. I used to be not good at stars but now I am. But I could do a circle for stars, because stars are actually circles.

> Zoe: And how do you know that?
> Alex: Because I saw some and they were round, then they go up like that and go back into a circle.
>
> (Extract from Research Diary, Pilot Study)

I visited the pilot school three times and each time I spoke to Alex, he told me more about science, for example, how the body works and why we have a brain. He also talked about conversations he had about science with his mother, who worked at the local hospital. I remember how excited I felt when describing my visits at my supervision meeting; I had discovered a focus I wanted to find out more about. In terms of motivation to conduct my research, my conversations with Alex were the tipping point – I wanted to know more about how young children storied themselves as individuals who were interested in science, situated in their family practice. I could find research studies of young children that focused on their generic interests, but fewer that studied interest in science specifically, which presented me with an opportunity to contribute to the field of science education research.

In choosing to focus on young children's interest in science, I perceived three benefits:

1. For the research community, education policy and practice – Applying a participatory method to researching children's interest in science raises important questions about early years curriculum and practice. Viewing children's interests from a sociocultural perspective challenges a conceptualisation of interest as an essentialist characteristic and the efficacy of initiatives that aim to *make* children interested in science.
2. For my professional responsibilities – As a lecturer in primary science education, the focus of my research provided me with the opportunity to develop my knowledge and understanding of early years practice and pedagogy. It has also enabled me to engage with sociocultural theories of identity and interest and the process of qualitative research, which I can develop further as my research career continues, as well as share with my colleagues and students.

3. For personal interest – As someone who has been passionate about science since my earliest memories, the opportunity to study children's emerging interest in science fascinates me. In addition, as a novice researcher, I have much to learn about interpretivist approaches to research.

Since this study concerns children age 5 to 7 in a school context, the following section explains how the English education system caters for children of this age range.

## 1.3 Curriculum and pedagogy in the early years

In England, from 4 years old, most children attend a Reception class. Following a year in Reception, children move into Key Stage 1 and attend school in a Year 1 and Year 2 class. For this study, I generated data with eight children during the last 6 months of Reception, followed by 12 months of data about the same children when they were in Year 1 and two final visits when the children were in Year 2.

My research bridges the transition from Early Years Foundation Stage to Key Stage 1. This section explains what this transition involves in terms of curriculum, pedagogical approaches and structure of the school day, as all are relevant to my study. The Department for Education (DfE) in England prescribes the curriculum that schools have a statutory obligation to follow during Reception and Year 1. Reception falls within the Early Years Foundation Stage (EYFS), which is from birth to 5 years old and early years providers follow a mandatory framework divided into seven areas of learning (DfE, 2017). Priority is given in EYFS to the prime areas of communication and language, physical development and personal, social and emotional development (British Association for Early Childhood Education (BAECE), 2012). Science is included in the area of learning: Understanding the world, in which children investigate, notice changes and learn about their local environment (see Appendix 1). Year 1 children follow the Key Stage 1 National Curriculum of ten statutory subjects; Science is one of three core subjects in this (DfE, 2013) (see Appendix 1).

Having described the curriculum, the remainder of this section considers early years pedagogy and practice. BAECE (2012:6) advocate that early years settings should

provide relevant resources arranged flexibly indoors and outdoors 'where children can explore, build, move and role play' and 'ensure children have uninterrupted time to play and explore'. Many early years settings in the UK, including the two schools involved in this study, embody this child-centred approach through their practice of continuous provision, also known as free-flow play (Bruce, 2001). Early years practitioners set up flexible and varied areas of provision around the classroom and children have free choice to spend as long as they like interacting with them. In free-flow play, activities are child-initiated rather than adult-directed. Areas of provision are designed by the practitioners to give opportunities for construction, role-play, creative arts, investigations and problem solving, and to practise counting and letter forming (Davis and Keller, 2009).

There can be a tension between children and educators on the purpose of play (Wood, 2013). Educators plan for play to lead to specific learning outcomes, whereas children can be resistant to adult control and maintain their own play culture (Wood, 2014). Areas of provision in a Reception class are designed to cover particular aspects of the EYFS curriculum, but often when children play in a group, the purpose of their play is not quite what the adults had intended (Brooker, 2011). Wood (2013:15) sums up, 'because play can be chaotic, anarchic, subversive and unpredictable, adults try to control and manipulate play both inside and outside the home'. I observed children subverting adult-planned activities for their own imaginary play, for example, a child in the home area used a biscuit cutter to make a 'gun' as part of a game of chase with other children.

The pedagogy of free-flow play, when children can choose the activities they carry out inside or outside the classroom and have the time to explore these spaces with their peers, provided the ideal environment for me to generate data with children during Reception. Key Stage 1, with its formal approach to learning and teaching, meant that time for data generation was more restricted, for example, to lunchtime, before and after school and Friday afternoons. The next section looks at what science education is, how it is treated as a school subject, and how I have operationalised it in order to study children's expressions of interest in science.

## 1.4 The nature of science and science education

This thesis understands the nature of science as socially and culturally embedded. For example, Abd-El-Khalick et al. (1998:418) define scientific knowledge and understanding as 'tentative (subject to change); empirically based (based on and/or derived from observations of the natural world) and subjective (theory-laden)'. Against a background of the nature of science as multidisciplinary and philosophically complex (Chalmers, 2013), school science presents a rather simplified view of science as the study of scientific concepts and processes (Goldsworthy and Feasey, 1997). To explain these two terms further, scientific concepts, such as energy or evolution, are the big ideas of science (Harlen, 2010), which the National Curriculum (DfE, 2013) groups into physics, biology and chemistry. Scientific processes relate to the scientific inquiry of answering questions through first hand investigation or through secondary sources, which the National Curriculum (DfE, 2013:4) refers to as 'working scientifically'. See Appendix 1 for a summary of the statutory curriculum relevant to the age of the children in this study.

Potvin and Hasni (2014) summarise findings from 621 peer-reviewed articles published between 2000 and 2012 that indicate interest in science begins at an early age, but wanes as children get older, particularly at the transition from primary to secondary education. The continuation of this decline is of grave concern to the science education community and politicians, since the number of students choosing to study science subjects in higher education has decreased significantly over the last 20 years. This headline masks a detail that some students identified as having a low interest in science and technology were very interested in a specific aspect of science (Yang, 2010). The issue of divergence of school science and children's interests is captured by Haeussler and Hoffmann (2000:704) who report that, with regards to physics, students tend not to be interested in:

> Inquiring the laws of nature for their own sake. Rather they are interested in physics in the context of its practical applications and in

the context of chances and risks which lie in physics-based technologies.

The ways in which interest in science is studied and data interpreted necessarily depends on how *interest* and *science* are conceptualised by researchers. Learning science in school is situated because it is defined and co-constructed in a context and 'by participating in the discursive activities of science lessons, learners are socialized into the ways of knowing and practices of school science' (Driver et al., 1994:11). Many studies focus on children's interest in science as a school subject and their aspirations to study science-based higher education courses or pursue a STEM (science, technology, engineering and mathematics) career (Macdonald, 2014). However, often the activities that children engage in, such as, tinkering or constructing, are not found in traditional school science lessons (Luce and His, 2015).

When asked what science is, many 4 and 5 year-olds cannot explain what the term means and would not recognise the kinds of activities they carried out as science activities (Crompton, 2013). Of course, not knowing what science is does not prevent children from engaging in numerous activities that could be categorised as science as they observe, experience and learn about phenomena. The implication for this study, which seeks to understand children's relationship with science, is that as a researcher, I need to apply an operationalised definition of what science is to what I observe children doing. This definition cannot be limited to a narrow view of science as only the science curriculum. I return to this question in Chapter 6 where I explain how I identified which children to write case studies about.

## 1.5 Overview of the study and research questions

During the course of two years, I generated data with eight children, through monthly visits to two schools (four children in each school), using participatory methods. The methodology I used is based on Clark and Moss's (2011) Mosaic approach, which is a framework for listening to children's perspective of their lives and uses creative polyvocal data generation techniques that do not rely on written words or verbal accounts. I generated data with child participants through observation, interview,

photographs and drawings, and with their parents and teachers using questionnaires and semi-structured interviews.

Children were social actors in the research and made active choices about how to express their interests, as well as reflecting on data collected during previous visits. The Mosaic approach has been used in many studies (Schiller and Einarsdóttir, 2009) and is regarded as an authentic and flexible methodology (Greenfield, 2011). However, there are many challenges to research with young children, and these are discussed in my research methods.

I selected three children as case studies and analysed their case records through the theoretical lens of a practice theory of interest. I focused on children's social practice in order to understand the ways that children story themselves as someone interested in science and how they are storied by others. Therefore, my research questions explore children's interest in science as part of their developing identities:

1. *How do children express their interest in science between the ages of 5 and 7?*
2. *What is the relationship between young children's identities and their expression of interest in science?*

## 1.6 Organisation of the thesis

This thesis is organised into eight chapters. This first chapter provides contextual background, personal reasons for the focus of the study and introduces the research questions. In Chapter 2, I review the different ways that interest has been conceptualised, and what impact the way scholars have theorised the process of interest development has on their approach to researching interest in science. The literature review also considers research that has focused on the social influences on children's interest in science and initiatives that aim to halt a perceived decline in this interest. Chapter 3 draws together a practice theory of interest, which views interest development as taking place in a sociocultural context and is based on the theories of 'funds of knowledge' (González et al., 2006:4) and 'identity in practice' (Holland et al., 1998:271).

Chapter 4 explains my methodological position, including issues of epistemology, ontology and subjectivity and the challenges of representing children's lived experiences. This leads to Chapter 5, which details the research design and selection of the schools and children who participated in the study. I justify my choice of multiple participatory research methods and describe each data collection technique in detail, including their limitations and ethical considerations. Chapter 6 describes the process of data analysis, from identifying the case study children, to analysing their case records through the lens of a practice theory of interest. Chapter 7 presents three case studies that explore the ways in which each child self-authors, and the ways in which they are storied by others. I use the term 'self-authoring' in the sense that children construct narratives of self, drawing on multiple discourses and the cultural resources available to them, see p.37 (Holland et al., 1998:269).

In Chapter 8, I provide a response to my research questions by discussing my central argument that children's interest in science should be understood through their practice and the relationship between their interests and identities. I evaluate the limitations of the study and make suggestions for future research. I conclude with what I have learnt about myself as a researcher, and the implications for the research community and educators about how we theorise children's interest in science.

# Chapter 2 Literature Review

## 2.1 Introduction

In this chapter, I review a range of studies that have researched interest in science and the different ways that scholars have conceptualised interest, in order to locate my work in the field. After discussing how interest has been theorised, I appraise the various approaches to researching interest, including studies that attempt to measure or observe children's interest in science, to explore interest in retrospect or to understand their interests as developing within a social context. I argue why this latter approach is most relevant when seeking a depth of understanding about how and why children express an interest in science.

A number of studies focus on a perceived problem of declining interest in science in secondary school, and these are matched by numerous initiatives that aim to stimulate children's interest in science, especially children of under-represented groups. As part of this review, I consider how such initiatives theorise the process of interest development. In the concluding part of this chapter, I set out how I have operationalised interest in this study and reflect on how this literature review has informed the development of my research questions.

## 2.2 Conceptualising the phenomenon of interest development

### 2.2.1 How is the concept of interest defined?

Interest is one of a group of similar and interrelated terms that describe people's actions and behaviour, such as motivation, attitude and curiosity. In order to distinguish it from these other terms, many writers define interest as a specific relationship between a person and their subjective environment (Akkerman and Baker, 2019). In this relationship, the object of interest is pursued; in other words, 'one cannot simply have an interest: one must be interested in something' (Gardner, 1996:6). Research on interest has a long tradition in psychology that can be traced back to Herbart (cited in Schiefele, 1991) who wrote about interest development in the

1800s as a desirable motivational condition of learning and one of the central goals of education.

Herbart's ideas influenced authors at the turn of the twentieth century, such as Dewey (1896:428), who describes interest as the 'psychical bridge' between individual and object and an internal desire that motivates someone in a particular direction:

> Genuine interest is the identification, through action, of the self with some object or idea, because of the necessity of that object for the maintenance of self-expression.

Dewey argues that if children are denied their interests, they will not be able to become the person they want to be. Conversely, if we can provide children with the physical, social and intellectual objects they desire, then 'mind will have met with what it needs in order to *be* mind' (Dewey, 1913:197). Dewey's definition of *genuine* interest is problematic, because it implies an essentialist view of interest, which somehow exists independent of discourses, and according to Sfard and Prusak (2005:15) an essentialist view of beliefs, attitudes or interests cannot be operationalised:

> The assumption that an intention (or tendency) exists in some unspecified "pure" form independently of, and prior to, a human action is a dubious basis for an empirical study.

Taking a sociocultural perspective, Hedges (2007:38) defines children's interests differently, as 'spontaneous, self-motivated play, discussions, inquiry, and/or investigations that derive from their social and cultural experiences', requiring multi-layered and deeper interpretations. However, Hedges' definition does not capture the specificity that distinguishes interest from a more general curiosity. This is addressed, however, by Pressick-Kilburn (2015:359), who also defines interest as originating in social interaction but refers to its specificity:

> Such interaction can be directly with others in real time, or with dialogic artefacts created by others, such as written texts, or with objects or activities that have sociocultural meaning or significance.

> Interest is framed as developing toward expression and identity as an individual interest over time.

As this quotation suggests, Pressick-Kilburn connects the specificity of interests with identity, and this is a concept to which I will return. The next section further considers interest as a process and some of the significant models of interest development put forward by key authors in the field.

### 2.2.2 How is the process of interest development theorised?

Krapp (2002:386) describes the personal specificity of the interest concept in his 'person-object theory of interest', which holds that an 'object' of interest can be concrete, an abstract idea or a process/activity. For Krapp (2002:386), the process of interest development is relational, where the 'individual, as a potential source of action, and the environment, as the object of action, constitute a unit'. Here, action includes physical actions as well as mental operations and the environment includes the social, subjective and objective environment[1].

Drawing on Fink's (1991) development model of growth, channelling and overlap, Krapp (2002) theorises that interest development is not necessarily linear and involves structural change. Krapp (2002) summarises that interest development proceeds in two developmental steps: situational interest and individual interest. This model of the relationship between a person and an object of interest is a psychological conceptualisation of interest as a product of intraindividual changes and can be criticised as being too abstracted from social practice: objects have social and cultural value, and hence are always subjective (Bergin, 2016).

A particularly influential psychological model of interest development is that put forward by Hidi and Renninger (2006:4), who describe interest developing in four phases: 'triggered situational, maintained situational, emerging individual and well-developed individual interest'. The first phase, triggered situational interest, is stimulated environmentally and causes a positive emotional response. In the second phase, situational interest is maintained and focused (Hidi, 2006). The third and fourth

[1] This theory is also known as the 'German person-object theory of interest' (Krapp et al. 1992:7), originally developed by Prenzel et al. (1986), Fink (1991) and Schiefele (1991).

phase involve individual interest, when a person is intensely interested in a certain object or abstract idea. Thus, this intense interest is not conceived by Hidi and Renninger as innate, but others using their theory have interpreted it as such; for example, Trend (2005:276) suggests that 'individual interest develops over months and years as a result of life experiences and, perhaps, innate preferences'.

The four-phase model is frequently referred to as the basis of theoretical frameworks in contemporary interest studies, with the ideas of *situational* and *individual* interest taken as a given. Krapp et al. (1992:10) explain the difference between these two terms as 'characteristics of the learning environment' and 'characteristics of the person', operationalised thus:

> An actually 'operating' interest can either be caused by an already existing dispositional (individual) interest or by the special conditions of a teaching or learning or work situation (interestingness). (Krapp and Prenzel, 2011:41)

The authors claim that if a student has a weak individual interest in a particular topic, then situational factors will have more bearing on whether the student is interested, compared to a student with a strong individual interest in that topic, who will be interested anyway.

In contrast, a sociocultural approach assumes that interactions between individuals and their environment are embedded in cultural and historical processes. Three examples of sociocultural theories of interest development are Valsiner's (1997) canalisation, where interests are actively constructed through the interaction of social and personal domains; Hedges' (2007) view of interests as representing deeper inquiries; and Azevedo's (2011) practice-centred theory of interest, which focuses on the individual's patterns of engagement in a long-term relationship with an interest.

Canalisation, developed by Valsiner (1997:87), describes the ways in which individuals, consistent with their values and goals, channel children's activities in certain ways; 'people construct personal meanings for the events they experience, with the assistance and boundaries provided by social structures and other individuals'. He also uses the term self-canalisation to represent the emergence of a 'self-constraining

system' (Valsiner, 1997:309). How this model differs to Hidi and Renninger's (1991) four-phase model is that it retains a dynamic relationship between self and environment, rather than viewing situational and individual interest as separate constructs. Indeed, research has yet to show whether situational interest and individual interest are the same psychological state or somehow different, and several studies, such as Pressick-Kilburn et al. (2005) who apply the theory of canalisation, do not separate out these two phases of interest development.

Hedges (2007) draws on funds of knowledge (González, et al., 2006) to theorise children's interests and inquiries as constructed during participation in everyday family life and postulates that what children are interested in has deeper cultural meaning. Funds of knowledge refer to the knowledge of multi-generational household functioning and well-being, situated in the lives of families, communities, and cultures. Hedges argues that children's imaginative play demonstrates and extends their interests, stemming from participatory learning in family and community experiences. Children's interests are a dynamic continuum, beginning with 'activity-based interests', followed by 'continuing interests' and then 'fundamental inquiry questions' (Hedges and Cooper, 2016:311).

A theory that also focuses on situated interests is Azevedo's (2011:147) 'lines of practice' theory, which describes persistent engagement as emerging from experiences in practice. Lines of practice are so called because they capture the long-term nature of a hobbyist's 'patterns of engagement' and 'preferences and conditions of practice' (Azevedo (2011:163). Within one hobby or interest-related activity, a person could participate in multiple lines of practice that shift according to changes in context.

### 2.2.3 How do children express their interests?

A number of psychologists and philosophers, such as Dewey (1913), James (1890) and Berlyne (1960), claim that there is a connection between interest and children's learning. Krapp and Prenzel (2011) refer to this as a cognitive-epistemic component, which means a readiness to acquire new knowledge and understanding, and motivation to learn. According to Iran-Nejad and Cecil (1992:325) interest has a positive impact on subsequent learning; 'learning is the cause and consequence of

interest'. Their evidence for this claim comes from an experiment where subjects read a story and then rated their inferences about one of the characters in the story. Half of the subjects read a story with a predictable ending, whilst the other half read a story with a surprise ending. Iran-Nejad and Cecil (1992) report that their subjects were more interested and learnt more from the surprise-ending story. Such a decontextualised study may be able to measure a significant difference between two groups but does not explain why people are interested by surprise-endings.

However, a view of learning as social in nature entails that the cognitive component of interest cannot be separated from context (Rogoff, 1998; Dahlberg et al., 2007). From a sociocultural perspective, learning occurs through collaborative relationships, as learners are enculturated into the practices of family and community (Pressick-Kilbourn et al., 2005). This process involves active meaning-making, enquiry and participation in social experiences in which children learn as members of their communities (Hedges and Cullen, 2005). Social interactions become internalised (Chaiklin, 2003) and when expressing interest, children ask questions that are important to them (Hedges and Cooper, 2016).

Studies of interest development also report that being interested generates an emotional response, including positive feelings of excitement, enjoyment or pleasure that are content specific (Krapp, 2000). According to Rautio (2013:399), engaging with what you are interested in can be enjoyable in itself, without any particular goal; she describes the autotelic practice of children collecting pebbles, stating 'the activity is enjoyed in itself and sustains itself'.

As this summary of some of the key authors who have contributed to conceptualising interest illustrates, there is no single definition of interest and several theoretical models of its development exist. Different researchers put emphasis on different features, leading them to investigate the phenomena of interest development in different ways, constructing their research questions and methodology accordingly, as the following section explores.

## 2.3 Researching interest in science

Many of the models of interest development propose that there are specific phases to the process. The most often cited of these is Hidi and Renninger's (2006) four-phase model, which is often the theoretical basis of studies about interest in science (Trend, 2005; Neitzel et al., 2008; Ainley and Ainley, 2011; Dohn, 2013; Palmer et al., 2017; Rotgans and Schmidt, 2017; Crouch et al., 2018; Renninger et al., 2018). According to Hidi and Renninger (2006), the external conditions that elicit the psychological state of situational interest can be referred to as *interestingness* and are characteristics of the learning environment. For example, a film, text or object can generate a general, temporary interest across a group. Schiefele (2009:198) defines a situational interest as 'a short term psychological state that involves focused attention, increased cognitive functioning, persistence, enjoyment or affective involvement, and curiosity'. Those authors who support the four-phase model assert that this external stimulus can result in an increased willingness to learn and lead to the development of individual interest, as the following study claims.

### 2.3.1 Studies that focus on young children's developing interest in science

In their study of children's interest from the age of 4 to 6 years old, Neitzel et al. (2008) report findings about how children's situational interest develops into individual interest. This study mapped the intensity and duration of different interests for 215 children, based on parents' responses to interview questions. The researchers classified interest into 11 domains, the most popular of which were conceptual, sociodramatic, creative arts, construction, sport and literacy. Conceptual interest was defined as 'activities that promoted the acquisition of declarative knowledge' (Neitzel et al., 2008:328); for example, interest in learning more about dinosaurs. Neitzel et al. (2008) summarise that on average children exhibited an interest in four topics and maintained specific interests for an average of 11 months, although some children sustained their interest across the whole study.

Some of the original researchers continued the study for a further two years with 121 children, and then analysed the responses from parents who reported their children's focused interest, looking specifically for science interest across four years of data

(Leibham et al., 2013). The researchers also tested the science achievement of the 8-year-olds and asked the children about their science-related self-concept, which included such statements as, 'work in science is easy for me' (Leibham et al., 2013:581). Over the four years, the study found that for boys, there was no relationship between science interest and science achievement, but for girls, an interest in science at age 4 did result in higher science achievement and science-related self-concept at 8 years old.

This study used parental questionnaires and interviews as their main source of data and as such relies on parents having a consistent view of what 'being interested' means when describing their children. Other studies investigating the interests of young children have also approached this from the parents' perspective, such as DeLoache et al., (2007) who documented children's extremely intense interests.

A common technique for gathering views about children's interests first-hand, rather than asking their parents, is to use a questionnaire and a rating scale. In a recent study, Oppermann et al. (2018:405), report that children in preschool centres with an explicit focus on science education were more interested in science than those children in centres without such a focus. They sampled 283 children aged 5 and 6 in 48 pre-school centres across Germany and asked children to rate their response to questions about science-related topics, such as butterflies, plants and magnets, on a four-point scale, for example:

> Please show me how much you would enjoy learning more about why steam rises over boiling water. Would you enjoy that very much, quite a lot, not that much, or very little?

To help young children access these questions, before asking children to give their response, the authors used two identical puppets who gave opposing responses, in order to reassure children that there were no right or wrong answers. One of the limitations of this study, identified by the authors, is that their classification of a pre-school as having a science focus relied on whether or not science was reported as a special focus by the centre manager. Considering that so much of what young children do in pre-school is connected to science, such as construction (see section 1.4), it is

notable that they ask a question about magnets, which are equipment in the *school* version of science. Such studies, which take a psychological approach, see the individual child as the unit of analysis (Nolen and Ward, 2008), acknowledging context as *influencing* individual interests, rather than 'something that shapes and is shaped by those who participate in it' (Edwards, 2004:86).

Walker et al. (2004) applied the concept of canalisation (Valsiner, 1997) to identify children's emerging individual interests in their multi-modal study, which took place in a classroom of 26 children (8-10 years old) carrying out a 10-week electricity project. Pressick-Kilborn (2015) also interpreted their findings using canalisation, alongside funds of knowledge, to theorise interest development, whilst Dohn (2013) analysed children's classroom practice and the ways in which they contributed to their community of practice (Wenger, 1998). Dohn (2013) collected data through observations of 40 lessons and interviews of 46 children aged 12-14. He reports findings that 'open-ended design tasks stimulate interest', and 'collaboration had a significant influence on interest', concluding that through students' joint practice, they contribute to their community of practice (Dohn, 2013:2061). Walker et al. (2004) also report the positive effect of collaboration on children's interest in science as one of their findings. These studies conceptualise children as active participants who are inextricably connected to their social and physical environment. They look for socially derived understanding, and their unit of analysis is children in their social historical context (Nolen and Ward, 2008).

A sociocultural approach recognises that the individual cannot be studied in isolation from the social (Gray and Murray, 2017). Learners are enculturated into the practices of communities, and develop shared understanding and constructed identity. This identity is embedded in discourses, contexts and children's epistemic concepts (Mantzicopoulos et al., 2009). In other words, children's thinking is not isolated inside their heads; instead it occurs through interaction 'between the individual and the collectively constituted and historically situated culture created through joint activity,' (Prout, 2005:52). Through culture and experience (Vygotsky, 1994), children develop a shared understanding of daily social routines and a sense of membership of a community to which they can contribute rather than simply copy (Wenger, 1998).

Rather than seeing children as making a free and open choice about what they would like to spend their time doing, their behaviours can be constrained by their identifying narratives across different contexts (Cooper, 2014). For example, children's interests could hold a deeper significance and be a rehearsal for adult life (Chesworth, 2016) or stem from a desire to participate in cultural practices (Colliver, 2017).

### 2.3.2 Studies that research interest in science in retrospect

A number of studies have researched children's interest in science by asking adults to describe their science interests as a child retrospectively. Such studies reveal the participants views on what interest is, how it begins, and what may have afforded or constrained their early interests. For example, Maltese and Tai (2010) spoke to established scientists in the United States, who had a well-developed individual interest in science, and worked backwards, by asking about the timing of their initial interest in science. The majority of the 85 scientists questioned (67%) said that this occurred before the age of 10 and 32% said that they had always been interested in science; for example: '"I think I've always been interested in science, as long as I can remember." (Male, Chemist)', (Maltese and Tai, 2010:677). The study also asked to whom the scientists attributed the initiation of their early interest. 40% of participants described an event in school or a particular teacher, 15% talked about a family member playing a role and 45% indicated that the source of their interest was intrinsic self-interest in the subject. Responses included:

> "I liked toys like tinker toys and building blocks and taking things apart and seeing how they worked from early on. Science play was kind of more my inclination". (Female, Chemistry Professor). (Maltese and Tai, 2010:677)

The authors acknowledge that a limitation to their data is that it is self-reported, but the scientists' stories give interesting insights into what they believe interest is, particularly the idea that they have always had an intrinsic interest in science.

Azevedo (2011) also investigated retrospective interest in science as part of a three-year ethnographic study of a young model rocketeer, David, who was age 14 at the start of the project. Azevedo describes how David began model rocketry at the age of 6

with encouragement from his father and continued to attend a weekly club from then on, sometimes with his family and later on his own. He reports that David has a long term, self-motivated interest in rocketry, 'embedded in a fabric of activities that span several practices' (Azevedo, 2011:176), including designing rockets and socialising (sometimes David did not bring any rockets to the weekly rocketry club and opted to socialise instead). In a second study, Azevedo (2018) retrospectively identified an emergent new interest from three years of data on an amateur astronomer. Data analysis embraced social and historical context to speculate on the motivations of the participant. The participant's drawings and notebooks evidence only occasional astronomical sketches for two years, then two triggers facilitated a rapid and sustained increase – he lost his job, so had time to draw, and decided to enter a competition. Following these triggers, the participant maintained and further developed his new individual interest in astronomical sketches.

Azevedo (2011:147) challenges the 'limited theoretical conception of individual interest' captured in Hidi and Renninger's (2006) four-phase model and Krapp's (2002) person-object theory of interest. Instead, a theory of lines of practice argues that context is key and a 'structural account of persistent engagement' captures the 'complexities in interest-based practice participation' (Azevedo, 2011:179).

## 2.4 Researching social influences on participation and interest in science

A significant body of research suggests that young people's interest in science diminishes in secondary school (Osborne and Dillon, 2008) and that there is a lack of gender and ethnic diversity within the scientific community (Medin and Bang, 2014). Archer et al. (2015) call for an increase and widening of science participation as an issue of social justice. This section considers the literature regarding the way that children's race/ethnicity, class and gender have an impact on their interest in science.

Archer et al. (2012) interviewed 92 primary school children (aged 10 and 11) and their parents in England, and found that ethnicity affected science interests and aspirations. Families with the strongest science interests and orientations were most likely to be white or South Asian. International studies have also found differences in science interest by race; for example, in a North American study, Aschbacher et al. (2010)

found that Latino and Asian parents were more likely to support science career choices than white or African American parents. In the study by Archer et al. (2013) described above, social class also affected science aspirations. Middle class families were more likely to possess science-specific cultural capital (which Archer et al. (2015:928) describe as 'science capital'), and provide their children with science resources, extra-curricular science activities and embed science-related interests in everyday family life.

Western society bestows science with masculine attributes– objective, reasoning and the domination of nature (Harding, 1996) and according to Buck et al. (2008), girls feel disconnected from the professional life and stereotypical images of scientists. Although primary age boys and girls both enjoy and achieve in science, many girls decide that it is 'not girly', therefore not for them (Archer et al., 2013:178). In the ASPIRES study, which explored children's science aspirations (age 10-14), working class girls were least likely to want a career in science, instead expressing an interest in traditionally gendered careers such as the caring professions and glamorous jobs such as fashion designer, hairdresser or celebrity (Archer et al., 2013). The researchers speculate that this is due to pressure to perform a hyper-hetero-sexualised version of femininity that focuses on appearance and romance.

In a three-year study, Alexander et al. (2012) interviewed parents of 4-year-olds and found that boys were more likely to be reported as having an interest in science than girls. Parents provided boys with science opportunities whether they expressed an interest in science or not. If girls expressed an interest in science, only then did parents respond by increasing science opportunities for their daughters and expressed a desire to overcome stereotypes involving women and science. Alexander et al. (2012:764) describe parents' role in children's development of interest in science as 'pivotal'.

Mujtaba and Reiss (2014:2995) conducted a large-scale survey of over 5000 15-year-olds in the UK, also mention the importance of parental support:

> Some girls who do not intend to participate in physics post-16 are switched off physics not only by their physics environment at school but

also by issues outside school, given that girls as a group report receiving less encouragement than boys to study physics post-16.

As these examples illustrate, research suggests that science interest dwindles, particularly in certain groups, and the following section considers initiatives aiming to address this.

### 2.4.1 Initiatives aimed at increasing interest in science

Jack and Lin (2014) propose a formula for *igniting* interest in science, predicated on novelty, involvement and meaningfulness. They acknowledge the role of social factors; for example, what is meaningful (personally relevant) to one pupil may not be meaningful to another, yet they claim that attention to these three elements will result in children's attitude to science shifting from a negative to positive interest. Archer (2019:presentation) also uses a flame analogy, in which fuel is the child's 'socialised dispositions and science-related economic and cultural resources', air is the 'space of positions and position-taking' and the spark is a 'teaching moment or science encounter'. She proposes that if all three conditions are met, the outcome is a burning flame, analogous to children's engagement.

However, Dawson et al. (2019) capture the sense of futility of some science initiatives in their description of a school trip to a science museum and how the activity of taking selfies in the museum summed up the young people's lack of connection with the world of white, male, privileged scientists that were represented in the content of the exhibitions. The urban youth in Dawson et al.'s study chose to reject looking at the exhibits and instead, used their mobile phones to photograph themselves, identifying themselves as in opposition to an identity of being interested in science.

Some studies have focused their interventions on younger children. For example, Mantzicopoulos et al. (2009) conducted interviews with 123 children aged 5 years old in two schools who implemented an enquiry approach through 17 lessons (on scientific inquiry, living things and forces) and compared this to 70 children in two control schools. On three occasions across a school year, they carried out semi-structured interviews through puppets, explaining that this technique encouraged children to

share their socially derived understanding, rather than repeating what they have been told.

Mantzicopoulos et al. (2009: 346) asked a series of questions such as:

> "Do you have science in your school?" and, "You know, I am not there when you do science but I am really interested in what you do. Would you tell me and (Puppet 1) and (Puppet 2) so that we can learn about the sorts of things that happen in science?"

They conclude that children's meaningful participation in a conceptually coherent science programme resulted in these children becoming more knowledgeable about what counts as science than those in the control group and more likely to view themselves as science learners. Mantzicopoulos et al. (2009) aimed to breakdown children's naïve view that science is dangerous or magical and carried out by crazy haired male scientists. However, their Scientific Literacy Project seemed to focus on inducting children into 'the ways of knowing and practices of school science' (Driver, 1994:11), rather than encouraging children to develop their own lines of enquiry that are meaningful to them, taking a broader definition of the nature of science (see section 1.4).

In contrast, Richards et al. (2013) focus on identity rather than curriculum content and report on the personal epistemology and science identity of a case study child, Estevan, who is 12 years old. They analysed video footage of science classroom interactions between Estevan and his teacher, Mrs K, as well as interviewing both parties. Estevan talks about how Mrs K 'brought back' his feeling toward science, 'like you found your favourite toy' that 'you lost when you were a little kid' (Conlin et al., 2015:19). The authors attribute Estevan's interest in science, not with a specific topic or pedagogy, but because he identified himself as a lover of challenges, who wanted to work things out for himself. Their study considers the connections that exist between children's interests, cultural backgrounds, lived experiences and identities, and recommends 'looking deeper into what connects individuals to science before prescribing how to engage students in science' (Richards et al., 2013:337).

## 2.5 Implications of the literature for my research questions

Reviewing the literature clarifies that a defining feature of interest is content specificity and raises questions about how best to operationalise the concept of interest, which is not a property of an object or in the mind of a child, but in the relationship between a child and their social context. Interpreting children's interests from a sociocultural perspective provides additional layers of depth to analysis, compared to a psychological interpretation that focuses on the individual. A sociocultural reading of children's observable play explores the significance of children's choices and the deeper lines of inquiry they symbolise in relation to social interactions, identities and community practice (Andrews and Wang, 2017).

Referring back to my original research questions, described in section 1.2, the first question asks how children's interests develop, whereas, a more appropriate question concerns how their interests are expressed. This question raises the difficult challenge of *seeing* children's interests and directs me to generate data with children in multiple ways, rather than only asking their parents about their interests. The second research question concerns the type of interactions that support interest development. Again, this review of the literature highlights that we need to ask a deeper question about the development of children's interests, if we accept sociocultural accounts that focus on identity, such as Richards et al. (2013).

Therefore, the research questions of this study are:

1. *How do children express their interest in science between the ages of 5 and 7?*
2. *What is the relationship between young children's identities and their expression of interest in science?*

A literature review has provided me with a structure to explore widely before focusing in on what is most relevant. I realise that if I want to *research* children's interests, rather than describe them, I need to theorise how they are expressed. Children express themselves through their actions, emotions and interactions, in other words, their social practice; so what is needed is a practice theory of interest, in order to interpret how children express themselves as being interested in science. I expand on these ideas in the next chapter.

# Chapter 3 Theoretical Framework

## 3.1 Introduction

This chapter explains the theoretical framework that I have chosen to apply in this study, building on the ideas presented in the literature review. Before doing so, I disentangle two interrelated terms that are often conflated in the literature: interest and curiosity. After critically examining definitions and discussing overlap between these concepts, I clarify the relationship between them and how they fit into a theoretical framework that recognises them as socially constructed.

The remainder of this chapter presents a *practice theory of interest development*, which draws on the ideas of identity in practice (Holland et al., 1998) and funds of knowledge (González et al., 2006), in order to explain how expressions of interest in science are part of children's identities. The implications of this for my methodology are discussed in Chapter 4.

## 3.2 Disentangling interest and curiosity

People talk in everyday conversation about being interested or curious, drawing on an intuitive understanding of what these words mean, based on personal experience. This kind of everyday use of concepts can create challenges for research, since each researcher and participant constructs their ideas in a personal sense (Valsiner, 1992). Interest and curiosity are inconsistently conceptualised in research and often used synonymously (Kashdan et al., 2004; Silvia, 2006; Grossnickle, 2016). However, this study treats the terms curiosity and interest as two separate constructs with a certain degree of conceptual overlap. In Chapter 2, I discussed how interest is conceptualised, so I begin this section with definitions of curiosity and curious behaviour.

Curiosity is frequently defined as a need for knowledge or new sensory experiences that leads to exploration (Grossnickle, 2016). Studies have shown that curiosity is not specific in the same way that interest is, and children can be curious in a wide range of situations where there is novelty value, a desire to explore the unknown, or to alleviate boredom (Kashdan et al., 2004). Children can exhibit their curiosity through seeking behaviour, which takes different forms, such as moving towards an unknown object,

articulating their transient wonderment or trying to find out how something works, discover facts, explanations etc. (Luce and Hsi, 2015). Schmitt and Lahroodi (2008:125) claim that people can enjoy being curious for its own sake; however, Litman (2008:397) reports that some children feel anxious, frustrated or angry due to them having an intense need for specific and relevant knowledge in order to reduce uncertainty.

As with the concept of interest, curiosity splits the research community broadly into those who adopt a psychological perspective and those who adopt a sociocultural perspective. Many cognitive psychologists see curiosity as intra-individual, essentialist and innate, so that children are labelled as having high trait or low trait curiosity (Reio et al., 2006). The alternative sociocultural view is that curiosity is linked to social interactions, because children learn through communication with other members of their community (Hedges and Cooper, 2016) and express their curiosity differently across contexts, shaped by previous experiences (Luce and Hsi, 2015).

According to Rogoff (2003), children may vary in how much they express curiosity depending on the cultural value attributed to curiosity-related behaviour. If children's curiosity is measured by how many questions they ask, then this measure works well in a culture where questioning is encouraged. However, not all cultures encourage questioning and in some societies, children are expected to work things out for themselves, rather than ask questions (Paradise and Rogoff, 2009). In addition, curiosity may be more culturally acceptable in one context than another, so that asserting one's curiosity can be a political struggle (Phillips, 2014). In other words, curiosity exhibited by children in school may be nurtured as acceptable, but when children ask questions that challenge authority or religion, they may be reprimanded. In this thesis, I challenge studies such as Kashdan and Roberts (2004), which claim that exploratory behaviour can be interpreted as caused by inborn high or low levels of curiosity. Instead, I follow sociocultural approaches, and adopt the stance that children's expressions of curiosity vary in different contexts and at different times, depending on social communication, prior experiences and cultural expectations.

If children express their curiosity through exploratory behaviour, how does this differ from interest? The difference in how I have conceptualised the two terms is that

interest is a relationship with a specific object of interest, whereas curiosity is a more general response. In this way, curiosity can be a precursor or trigger for interest. However, one does not automatically follow the other, because what children are curious or interested in is affected by their identity in a social, cultural and historical context and this is the key point. The novelty value of a learning situation, referred to by some authors as 'interestingness' (Krapp et al. 1992:5), does not *cause* curiosity or interest in children; these phenomena occur in the relationship between the child and the object of interest, rather than existing in the object itself.

The four-phase model of interest development (Hidi and Renninger, 2006:111) uses the term 'situational interest' to describe children's behaviour in response to novel experiences, in a similar way to how I have conceptualised curiosity. In Chapter 1, I referred to initiatives that aim to 'make science interesting' (Ofsted, 2013:26). However, because of the existence of power relations and complex dimensions in the subjectivity of social actors (Ortner, 2006), I question the oversimplified notion that through the interestingness of engaging activities, we can convert children's curiosity in science into a long-term interest.

## 3.3 The role of identity in interest development

As discussed in Chapter 2, children's interests are very closely connected with their identity. The concept of identity is part of a large body of scholarly work – theoretical frameworks and empirical research – that includes self-concept, self-esteem, self-efficacy, etc. (Leary and Tangney, 2011). This section focuses specifically on the key ideas and literature regarding identity that are relevant to interest development. I will explain how I have operationalised identity and its centrality to interest development, before weaving ideas about self-authoring (Holland et al., 1998) into a *practice theory of interest development* in section 3.4.

James (1890) and Mead (1934) provide a useful framework for conceptualising self in two ways – the self as subject 'I' and the self as object 'me'. Self-concept is our s*elf as object*, derived from social interactions with others and their response to us (Leary and Tangney, 2011). Cooley (1902:179) describes this as the 'looking-glass self' – how we

imagine others see us, what judgements they make of us and how this makes us feel. Our self-concept develops from observing our own and others' reactions during repeated social interactions and involves self-reflection and reflexive thinking (Lieberman, 2007). One way to conceptualise this is as a cognitive schema of stored information and symbolic meanings that we use as a framework to interpret our experiences (Stryker and Burke, 2000). Social structures impact on self-concept and self-concepts impact on social behaviour and social structures. According to Hallowell (1955), self-awareness and self-reflexivity are universal human characteristics, yet other aspects of selves, which seem natural, are culturally shaped and context-dependent. Thus, a sociocultural perspective emphasises social participation, relationships with others, the context of activities and historical change (Scribner, 1997). Holland et al. (1998:51) describe the way we have abstracted everyday life into a narrative of how events unfold as socially and culturally constructed 'figured worlds', and emphasise the importance of social positioning in our interactions with others. Thus, Holland et al. (1998:26) argue that 'selves are socially constructed through the mediation of powerful discourses'.

To explore the role of narrative further, Holland et al. (1998) draw on Bakhtin's (1981) concept of self-authoring to describe the complex way that we dynamically construct our identities, continually addressed by the world, through languages and beliefs (historical and cultural), which we answer in an ongoing storying of our place in the world (Holquist, 1990). Within figured worlds, children's identities are expressed through what they say and do, the resources that they activate, the ways in which they position themselves in relation to others while taking particular roles, and how they are positioned, recognised and storied by others:

> Our communications with one another not only convey messages but also always make claims about who we are relative to one another… when we speak we afford positions to one another. (Holland et al., 1998:26)

The processes of authoring are complex and children act 'as social producers and as social products' (Holland et al., 1998:42). Identity *in process* describes the recursive nature of authoring, recognition, and meaning making across time and context, so that

the tools used to author oneself can be used repeatedly, and over time, and can become tools of change and self-control (Holland et al., 1998).

Unlike traditional psychological studies that view identity as an essentialist personal attribute, I treat identities in this study as 'stories about a person' (Sfard and Prusak, 2005:14) within a context. Identities are the ways in which children construct themselves and are constructed by others as they 'adapt to author themselves in the moment' (Holland and Lave, 2009:4); individuals can simultaneously hold and identify with multiple identities (Lawler, 2008). Personal, shared, actual (current) and designated (imagined/future) identities are one way to classify different types of multiple identities (Sfard and Prusak, 2005).

If identity is the 'central means by which selves, and the sets of actions they organize, form and re-form over personal lifetimes' (Holland et al., 1998:270), then *being interested* is one of the actions that comes out of and feeds into the process of forming and re-forming identities. Our individual and group identities emerge from our social relationships, roles, values, goals and group membership. Viewing people as active agents, we have the agency to enact identities in specific contexts, as Lemke (2008:18) clarifies:

> We act differently with children and with peers, in formal situations and informal ones… who we are, who we portray ourselves as being, who we are constructed as being changes.

To summarise, in this study, I treat multiple identities and interests as co-constructed, so that children's interests are part of their actual and designated identities.

## 3.4 A practice theory of interest development

In this section, I present a theoretical framework of interest in social practice, drawing on Holland et al.'s (1998) conceptualisation of identity in practice. What I mean by this is that interests and identities are constructed in the doing of an activity within a historical and sociocultural context. Therefore, I treat interests and identities as situated in the 'individual-in-social-action' (Park, 2015:3). I have used the phrase *a practice theory of interest development* to describe a process that acknowledges the

close relationship between identities and interests. References to Holland et al.'s (1998) conceptualisation of self-authoring, figured worlds and practice theories run throughout the discussion below and are pertinent across all three sub-sections.

### 3.4.1 Interests are situated

Children's interests can be viewed as situated in a social context, which the children themselves are part of, because they negotiate the practices and values of the contexts (Walker et al., 2004). Therefore, I do not conceptualise interest development as an internal, linear process, as described in psychological models of interest development, such as the four-phase model (Hidi and Renninger, 2006). Instead, the information/sensation seeking behaviour associated with curiosity, often referred to as the trigger for situational interest (Rotgans and Schmidt, 2017), may lead to an individual interest for some children, but not others, because of children's participatory learning and cultural expectations, consistent with a view of interest development as social in nature.

Traditional psychologists view interest and curiosity as properties of an individual – an internal state that is *influenced* by external factors. Alternatively, the approach applied in my study, based on sociocultural theories, is that interest is a social phenomenon, co-constructed alongside identity, in a community, with its values and goals. From this viewpoint, individual interests do not develop outside the social meanings and identities that make up the sociocultural context.

Valsiner (1997) describes the co-construction of children's interests as canalisation, where people, consistent with cultural values, interact with children and channel their activities in certain ways (see section 2.2). Valsiner (1997) draws on Vygotskian (1978) social constructivism to conceptualise children's interests as developing through social interaction. Meanings, values, norms and goals all have social origins and purposes, and provide the context in which children's interests develop, as they participate in cultural practices.

Once children have chosen to explore an activity, the interaction may feel rewarding with positive emotional and cognitive feedback - seeing thoughts and emotions as part of a person's subjective lived experience or 'perezhivanie' (Vygotsky, cited in Veresov

and Fleer, 2016:1). Alternatively, the experience may not be congruent with children's self-authoring, (that is to say, the narratives children hear and tell about themselves), nor be compatible with their values and goals. These goals may be personal, shared or imposed normative goals. Some interests become highly valued as an integral part of a child's identities. Young people who identify with a particular social group may act in ways that are stereotypical for that group, including their choice of interests, in order to signal their collective identity (Hofer, 2010).

By viewing interests as situated, I argue that when children self-author as being interested in science they make use of community practices, beliefs and funds of knowledge (González et al., 2006) in order to enact their interest. González et al. (2006) define funds of knowledge as the knowledge individuals' accumulate from their first hand experiences with their family and community. According to Moll et al. (1992), funds of knowledge and skills, historically accumulated and culturally developed, are essential for household and individual well-being. They argue that community is a strength and resource of prior experience for learners to build on and interpret new information. As children become enculturated into communities of practice, their interests can be an expression of 'intent community participation', for example, enacting adult occupations and care-related parenting behaviour (Paradise and Rogoff, 2009:104).

Esteban-Guitart and Moll (2014:31) use the phrase 'funds of identity' to describe when children actively use their funds of knowledge to define themselves. They elaborate that children use 'historically accumulated, culturally developed and socially distributed resources' for 'self-definition, self-expression and self-understanding'. According to Esteban-Guitart and Moll (2014:31), to understand children's identities (and interests) requires an understanding of the 'funds of practices, beliefs, knowledge and ideas that people make use of'. Funds of identity are resources for making identities and self-definitions, dependent on lived experiences, which are products of collective storytelling. In this way, funds of identity is a useful concept to explain the connection between figured worlds, funds of knowledge and children expressions of interest in science.

### 3.4.2 Interests are positioned

The idea of 'culture in practice' captures the collective ability to take imaginary worlds seriously, where identities are embodied, objectified and positioned so that symbolisation of identities can be used to direct behaviour of oneself and others (Holland et al. 1998:278). In this way, identities and interests are positioned due to relational power, status or expectations of privilege (Foucault, 1980) within figured worlds (Holland et al. 1998). Foucault (1980:98) claims that power is not static and that 'the individual which power has constituted is at the same time its vehicle'. We exist within a culture in practice, so that, according to Bakhtin (1981), if we are alive, then we are engaged in answering what is directed at us and we author the meaning of actions.

Practice theories foreground the importance of activity in the creation and perpetuation of social structures (Nicolini, 2012), whilst still leaving space for individual agency – the capacity to act independently within constraints and adapt to new circumstances, referred to by Holland et al. (1998) as improvisation. For example, children exhibit agency as they choose activities and objects of interest that resist a dominant narrative of what they should or should not find interesting.

### 3.4.3 Interests emerge in response to discourses

The space for authoring is a cultural space and culture is highly politicised (Ortner, 2006). In Bourdieu's (1978) notion of *habitus*, structural power shapes people's dispositions to act, so that they accept the dominance of a system without being made to do so. This relates to a practice theory of interest in science, because practice theory states that social subjects are produced through practice in the world and the world itself is produced through practice (Ortner, 2006). Taking a view that interest occurs in practice challenges current initiatives, which assume that exposing children to exciting practical experiments or meeting STEM ambassadors will *make* them more interested in science. This is because children do not encounter science experiences on an even playing field; instead, they arrive with particular habitus, which underpins their expectations of themselves in the world of science.

## 3.5 Chapter summary

To summarise the theoretical framework I have presented in this chapter, a practice theory of interest development assumes that there is a two way interaction between identity and interest - what children are interested in becomes part of an identifying narrative (Sfard and Prusak, 2005) and their individual/collective identities contribute to what children may be interested in. In addition, several studies report a bidirectional relationship between children and their parents, where a child's interest can stimulate their parents' behaviour and vice versa, so that interest in a particular topic can co-evolve as family members mutually reinforce an interest (Pattison et al., 2016, Andrews and Wang, 2017). A continuum of interest development is non-linear, complex, dynamic, contextually situated and rich with meaning, linked to the formation of multiple identities (Walker et al., 2004). Interpreting children's interest development through the lens of figured worlds, drawing on funds of knowledge (González, et al., 2006), acknowledges children's personal and cultural identities, and includes the symbolic significance of their interests, in relation to shared community experiences and social practices.

The following chapter considers the philosophical position that I have adopted in order to study interest and identity as socially constructed phenomena using the Mosaic approach. I explicitly state how my epistemology and ontology have developed since beginning this study; reflecting on my subjectivity.

# Chapter 4 Methodology

## 4.1 Introduction

This chapter sets out the methodology of this study, explaining how it is consistent with the ontology and epistemology of my theoretical framework, a practice theory of interest. Working with this theoretical lens to investigate the phenomena of interest in science, I justify why the Mosaic approach (Clark and Moss, 2011) was an appropriate instrument to generate data. The key principles of the Mosaic approach are pertinent to this chapter; see Chapter 5 for further details of the participatory data generation techniques used in this study.

I have established in Chapter 3 my rationale for conceptualising interest and identity as a socially constructed phenomena. A practice theory of interest recognises social situatedness and the complexity of practice, which is why I have used a methodology that encompasses multiple methods and sources of data. Since everything we do is intrinsically social and all the data generated in this study is co-constructed, the methodology of my qualitative study, using the Mosaic approach, is not about 'a chance to extract one 'truth' but as opportunities for creating meanings' (Clark, 2017:18).

I begin the chapter by reflecting on my own epistemological shift towards a qualitative, interpretive methodology. Then I explain how my research questions relate to what I believe it is possible to discover. Next, I reflect on my subjectivity and the challenges of presenting an insider's perspective. This chapter leads directly into Chapter 5, which discusses the design of the research plan, data generation strategies and ethical considerations.

## 4.2 Epistemological shift

During the two years of data generation, I refined the research methods I used through dialogue with participants and reflection. My approach to data analysis also developed as I increasingly engaged with theory. Changes in my epistemology have been accompanied by shifts in my beliefs about the certainty of knowledge. This section identifies and describes these changes in order to clarify my current thinking and

explain the origins of challenges I have encountered in being and becoming a researcher.

Before starting this doctorate, I had an idea in mind that I would invite young children to complete a series of *experiments* and study their responses in order to see if they were interested in science. I thought that I could measure their level of interest by observing their effort and persistence in completing specific science related activities. By repeating similar activities over an extended period, I would be able to measure whether children's interest in science changes, as they grow older. This quantitative study would give me definite answers about the level of individual children's interests and motivation. In hindsight, my initial research questions (see section 1.2) were naïve and research method unrealistic. The roots of the implausibility of my nascent study were epistemological – I was asking research questions and proposing to collect data appropriate for a positivist rather than an interpretivist study, because I was assuming that children's interests are something that I could objectively measure.

Once I had spent time in an early years setting, observing young children interacting with their environment in a natural (non-experimental) situation, I realised that observing whether children were interested in science was not as straightforward as I had imagined. For example, I observed a group of five children crowded around the water tray making 'potions', choosing to give their time, effort and persistence to this activity. They added various real and imaginary ingredients to their concoctions and two children vied for leadership of the game. As an observer, I could identify lots of science in the children's activity (in regards to investigating the properties of materials), but I could also speculate that the motivation for their game centred on forming friendships and rehearsing adult roles, rather than being interested in science. This example showed me how difficult it is to interpret children's imaginary play. In addition to observations, I realised that I needed to communicate with children about their interests, memories and ambitions, in order to discover more about the way they storied their interests within and beyond the classroom.

The focus of my research moved away from positivist measurements and quantitative data, towards interpretivist description and qualitative multi-modal data, in order to explore the complexity of children's interests in depth (Pressick-Kilburn et al., 2005). In

addition, my approach to data *collection from* participants, shifted to data *generation with* participants (Clark, 2017). However, I caught myself apologising, implicitly and explicitly, for this shift away from positivism in my early supervision meetings, and writing - as if I thought my project had to include facts, measurable outcomes, correlations and statistical verification. For example, I found it difficult to move beyond triangulation and inter-rater agreement as ways to confirm reliability and validity, instead of holding on to a constructivist ontology that multiple realities exist (Varpio et al., 2017).

I feel that carrying out qualitative research creates tension within me. One of the sources of this tension originates with my undergraduate Botany/Zoology degree, completed over 30 years ago. My dissertation on leaf miners (a type of caterpillar) drew the following conclusions:

1. The percentage of honeysuckle leaves mined increases with height and leaf size (Fig.1).
2. Leaf miner pupae size increases with mine area (Spearman rank correlation coefficient 0.571 to $p<0.01$ significance) and is independent of mine complexity.

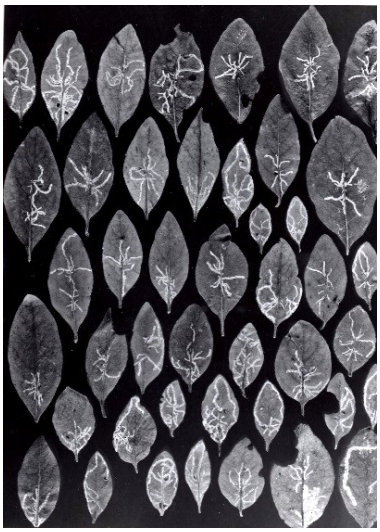


*Figure 1 Leaf miner data collection from 1987*

The certainty of these conclusions is in stark contrast to the tentative findings of my current study. Clearly, my methodology when researching leaf miners cannot be transferred to researching children. Looking back on this fundamentally different approach to my undergraduate research helped me to understand why I have found implementing a new methodology a 'painful and risky activity' (De Haan, 2011:25). In the past six years, I have undergone an apprenticeship in social science research and I have learnt about where I situate myself as a researcher ontologically and epistemologically. I have felt this location shift during my studies and with it, the focus

of my research questions. The principles of the Mosaic approach have supported this epistemological shift because they emphasise the open-ended nature of qualitative enquiry (Clark, 2017), as explained further in the following section.

## 4.3 The Mosaic approach

My methodology is based on Clark and Moss's (2011) Mosaic approach, a framework for listening to children's perspectives on their lives, which acknowledges adults and children as co-constructors of knowledge and understanding. Originally developed in 2001, Clark and Moss specifically designed the approach for research with young children (under five years old); consequently, it does not rely on written words, which young children would find difficult to access. The approach can be used with children who do not use language to communicate and includes a range of methods such as observation, interview, photography, role-play, drawing and mapping, through which children are able to express themselves (Clark and Moss, 2011). Data generation begins with relationships – the researcher establishes a relationship with children – in order to explore children's relationship with the world.

Once a relationship has been established between researcher and participants, the researcher has the responsibility to listen with sensitivity to the hundreds of codes and symbols used by children to communicate (Hawkes, 2017). The Mosaic approach is intended to be flexible and open-ended, as opposed to prescribed, and so a researcher can become *tuned in* to children's preferred ways to communicate, allowing children to take the lead in generating data (Clark and Moss, 2011).

The methodology of the Mosaic approach is based on the following four principles, in which young children are viewed as:

- 'experts in their own lives'
- skillful communicators
- rights holders
- meaning makers (Clark and Moss, 2005:5)

These principles are inspired by the child-centred Te Whāriki early childhood curriculum (Ministry of Education, 2016) and 'pedagogical documentation' of Reggio Emilia preschools (Rinaldi, 2006:17), and embody the key ideas of the new sociology of childhood of agency and participation (James and Prout, 2015). Reggio philosophy views children as competent, active citizens, able to communicate and produce change in the systems they are involved in (family and society) (Rinaldi, 2001). Clark and Moss (2011) acknowledge the influence of the democratic pedagogy of Reggio Emilia preschools in the design of the Mosaic approach, as described by Carlina Rinaldi, the Director of Early Childhood Education:

> The emphasis of our educational approach is placed not so much upon the child in an abstract sense, but on each child in relation to other children, teachers, parents, his or her own history, and the societal and cultural surroundings (Rinaldi, 1993:105).

The Mosaic approach considers sociocultural knowledge set within a community and assumes that children bring knowledge and understanding with them to the events in which they participate (that children are 'experts in their own lives' (Langsted, 1994:8)). Young children may have intuitive knowledge that they cannot express explicitly as they use this knowledge unconsciously (Aubrey et al., 2000). It is the researcher's responsibility to interpret children's words and actions to portray their lived experience (Clark, 2017). In this study, I have collaborated with participants (children, parents and school staff) and involved them in data generation and interpretation, in order to access their understanding and give them agency in the research. In keeping with Article 12 of the United Convention on Rights of the Child (United Nations, 1989), I have carried out research *with* children, rather than *on* them and I have made time to listen deeply to children – 'within this time assumptions can dissipate, multiple truths can be revealed and the child's rights can be upheld' (Hawkes, 2017:22).

## 4.4 Critically reflecting on methodology and research questions

This section considers how I have situated my approach within the field of qualitative research and the underlying assumptions and challenges that relate to the conceptual focus of the study and the young age of my participants. I have problematised my methodology in order to examine my conceptual assumptions and prompt me to consider new ways of thinking about my area of research (Alvesson and Sandberg, 2013).

Duffy and Bowe (2014:1) provide a striking metaphor for the consequences of how a researcher sees a phenomenon: 'Those who believe the Earth is flat write questions that probe its flatness and edges, so they can learn more about flat Earth properties'. Applying this metaphor to my study, my aim is not to ask a single type of research question that only probes the surface of children's interests in science. Instead, how research questions are asked and how the resultant data is analysed needs to provide space for a multi-layered interpretation of children's interests (Hedges and Cooper, 2016). This leads me to question: What do I think it is possible to know about children's interests and what can be researched about them? How have my own preconceptions influenced my research questions and research method?

Qualitative research is based on the assumptions that reality is socially constructed, that variables are complex and difficult to measure, and that findings are contextualised, interpreted and contribute to understanding of researcher and participants' perspectives (Lincoln and Guba, 1985). My ontology and epistemology regarding the concept of interest development maintains that there is a social reality. Therefore, I chose to undertake a qualitative study and to describe my findings in the interpretative tradition (Maxwell, 2012).

When thinking about what is possible to research in this study, one starting point is to consider what it is *not* possible to know about children's expressions of interest in science. Participants' words and images can be interpreted, but the reasons for their actions are personal to them. Participants may have many interests, but when asked to show or recall what they are interested in, they may not have wanted to tell me, or I might not have asked quite the right question to prompt them. As an adult, I do not

think in the same way as a five-year old child – as discussed in section 4.6. I am not part of the same community as children and cannot draw on the same funds of knowledge (González et al., 2006) as they do. In addition, participants and I have personal understanding of 'interest' and 'science'. The use of these concepts may vary between participants and make interpretation of their words and actions challenging.

Returning to my question about what it is possible to research about children's interest in science, I argue that through the methodology of the Mosaic approach, using multiple methods, I can generate data that accesses children's practice regarding their interest in science. It is possible to interpret this data through the lens of a practice theory of interest, in order to understand more about the relationship between children's expressions of interest in science and their identities.

## 4.5 Situational subjectivity

Having clarified the ontological basis of my research and the decisions I have made in terms of methodology and method, I now describe the multiple layers of subjectivity and interpretation, which I needed to consider in this study. For example, children provide subjective descriptions of their interests, in which they are also aware of the audience for their words. Adults' observations of children are filtered by what they choose to see or hear, their interpretation of children's behaviour, and their conceptualisation of curiosity and interest, and this is inevitably true of my own research (see Chapter 3). Other elements of subjectivity arise from the questions I have chosen to ask, the focus of my lines of inquiry and the interpretation of data. I must acknowledge that my own beliefs about interest in science will influence every facet of my research, since I view my research through the filter of my past experiences and memories, adding meaning, accentuating some parts and ignoring others (Lincoln and Guba, 1990).

In terms of positionality, not only do I have an enduring interest in science, and nature in particular, that I have studied to degree level, but I am also a lecturer in science education and a passionate advocate for the importance of science as a core subject in the primary National Curriculum (DfE, 2013). I have a strong emotional attachment to

my area of research and this will influence where I decide to attribute value in my findings. In order to provide a forum to acknowledge subjectivity and reflect on any bias, I have discussed research plans, data generation and interpretation with my peers (Swain, 2017). I have done this by frequently presenting my work at seminars and conferences, so that my methodology and research questions can be discussed openly, in order to clarify my position. See Chapter 6 for details of how I involved my colleagues in data analysis and interpretation.

In addition to considering the layers of subjectivity inherent in the data generated in this study. I have analysed my subjectivity in further depth through a systematic audit, in order to draw to the surface the subjectivity implicit in my research (Peshkin, 1988). The purpose of this analysis is to expose my subjectivity to the reader by making it explicit.

Researchers' emotional responses can be indicators of subjectivity (Pope, 2007), so I have analysed my description of each visit to school, which is contained in my research diary. I looked for expressions of emotion (my participants and mine), such as, positive and negative feelings, and highlighted when they occurred, noting language that gives emphasis to a description e.g. 'unfortunately' or 'very'. As I read each entry, I reflected on what my thoughts and emotions were at the time of writing the diary and added memos. In addition, I asked a colleague to read my research diary, highlight any emotions and make comment on any subjectivity she perceived. We then discussed and compared our annotations in order to identify two themes.

Following Peshkin (1988:18), I synthesised the subjectivity analysis into *'Is'*, which Peshkin describes as 'situational subjectivity', generated by the particular conditions of a research site and researcher. The two *Is* described below are a product of my interactions with participants and school environment. In other words, the *Is* are bound up in this particular project and I would unearth different characteristics of subjectivity if I audited a different study I had carried out.

1. **The Trusted-Friend I**. Simply put, I like children and enjoy their company, so I am glad that the children have befriended me and they behave as if they are pleased to see me when I visit. My colleague also identified this emotional

attachment to my participants in my diary. The following extract is from my last visit to School B:

> I feel sad and nostalgic as I approach the school. It's lunchtime and the children are playing outside, they run up to the fencing shouting "Zoe, Zoe, Zoe!" They are very excited and full of wonder about the world.
>
> (Research diary entry, School B)

My relationship with the children is not just about them liking me, but also that they trust me, as exemplified by this diary entry:

> Then Hakim said he wanted to show me his recorder and asked if I would film him playing his recorder. I found this really touching, that Hakim wanted to share this with me.
>
> (Research diary entry, School B)

I recognise that the *Trusted-friend I* is important to me as a researcher, because it makes me feel that my research is not an imposition and that the children are willing participants, who enjoy my visits and want to share with me. It also allows me to acknowledge how much I have cherished the whole process of being in school and spending time with the children.

2. **The Idealist I**. The process of highlighting my research diary has made me realise how strongly I support the principles of free-flow play (Bruce, 2001). I believe that children should have the opportunity to immerse themselves in what they are doing at school and give it their sustained attention. In my diary entries, I approve of children exercising free will and free choice to play and explore inside and outside (especially outside). I disapprove of children not having access to outdoor play, for example, I write, 'it was a nice day, but no children were outside' (Research diary entry, School B). I also disapprove of young children following a timetable of rigid lessons and whole class teaching, as illustrated by my use of the term 'very' in the following extract:

> Hoped to observe children for 2 hours, but again the teacher had planned a very structured morning and I had to wait until playtime to talk to and observe children.
>
> (Research diary entry, School B)

According to Pope (2007), it is common for teacher researchers to evaluate the pedagogy they witness and Peshkin (1988:18) calls this his 'Pedagogical-Meliorist I'.

I am ideologically against the excessive emphasis on phonics, literacy and numeracy that I perceive as imposed on young children's education by current Department for Education policies. A pedagogy of rote learning and passively listening to the teacher is anathema to me. My attitude reveals a philosophical belief about what childhood should be – a time to be curious and excited about learning itself. In addition, there is a pragmatic reason why I prefer it when children are engaged in free-flow play during my visits, rather than sat at tables directed by the teacher. During continuous provision, I have the chance to observe what children choose to spend their time doing inside and outside, and they are free to chat with me and take photographs. Therefore, I see free-flow play as the ideal conditions for me to generate data with children. For example, the following extract demonstrates when a child has time to sustain his engagement with construction materials:

> Hakim is working independently trying to make a model out of Meccano – he was trying to use the pictures of completed models included in the instructions – the kit was aimed at children age 8+ and looked complicated, but this did not put him off.
>
> (Research diary entry, School B)

I highlighted a number of extracts of my research diary that I initially classified as 'Thwarted I'. I realised that the times when I was disappointed I could not talk to children due to whole class teaching, are not a separate subjective

characteristic, but part of the *Idealist I* described in the section above. My colleague also identified the times when I was frustrated during my visits.

*Trusted-Friend I* and *Idealist I* are filters that I perceive my data through, and by recognising them and being explicit about their presence, I hope to avoid interpreting my own sentiments as data (Pope, 2007). Instead, my fondness for my participants and pedagogical values are an integral part of my reflexive interpretation of data (see Chapter 7).

## 4.6 Children are experts in their own lives

As mentioned in section 4.3, the first principle of the Mosaic approach (Clark and Moss, 2011) is that children are 'experts in their own lives' (Langsted, 1994:8). By clearly stating this from the outset, the authors intend that when using the Mosaic approach, adults should focus on understanding more about children's views and acknowledge that children have a 'unique perspective' on the details of their everyday lives (Clark, 2017:20).

In carrying out qualitative research, I am part of the research process, but it is difficult for me to be an insider in my study, as I am an adult and cannot think like a five-year-old. The issue of insider and outsider perceptions is referred to as emic and etic (Berry, 1989). Emic descriptions make sense to insiders within a culture or social group and are based on the understanding of concepts that insiders share. Etic descriptions attempt to communicate to outsiders of the culture or social group some aspects of the insiders' logic and concepts (Young, 2005). Another way to describe these two perspectives, used by Moss (2014), is Other and Same. Moss cautions that if we translate children's vocabulary into our own, then we impose our ideas onto what was said, changing the intended meaning. In addition, participants do not only use their own words to communicate their ideas, they are also heteroglossic, and appropriate the words of others as their own (Holland et al., 1998).

Throughout the process of qualitative research, I have participated in the research, but as an adult, I am an outsider to the young participants, as I cannot think and feel like a five-year-old or experience the world through their eyes. As far as possible, I have

given an emic description to represent the children's lived experience, recognising that any attempt by an adult to interpret a child's world will be limited. My aim is to represent children's expressions of interest in science and understand how these relate to children's identities, but I cannot conduct the research *from* the children's perspective.

## 4.7 Chapter summary

The theoretical framework for this study is based on ideas about the relationship between identity and interest, underpinned by theories of funds of knowledge (González et al., 2006) and identity in practice (Holland et al., 1998). This framing conceptualises interest development as taking place in a sociocultural context. I am part of the research process, and in this chapter, I have considered the methodological implications of my stance on interest as social practice.

At the heart of this study, is the paradigm of a culturally and socially constructed world. To use a science analogy, society is like gravity, it is not possible for humans to live outside of its effects. This is why I have adopted a practice theory of interest and used the Mosaic approach as a data generation tool, to take the time to listen to the 'hundred languages' of children (Rinaldi, 2001:51), facilitating the co-construction of knowledge and understanding.

I deliberately do not use the term *influence* to describe how parents, peers etc. interact with children's interests. The reason for this is that influence implies separation and direction, so that the actions of one person lead to a response by another. Instead, I use the term *co-construction* to mean that children and their community negotiate the meanings of actions, words and objects. This is why observation as a research method is insufficient, as gauging children's interests through such measures as choice of activity (as used by Renninger, 1992) can lead to specious interpretations that 'trivialise' children's interests (Hedges and Cooper, 2016:305).

My research questions focus on socially constructed subjective experiences and an epistemology that recognises children's perspectives as central to understanding their

own lives. Consistent with this epistemology, I have used the Mosaic approach as my research methodology, in order to generate a range of data and explore how children self-author as someone interested in science through their practice. The following chapter provides a detailed explanation of the research plan, research methods, and ethical considerations of this study.

# Chapter 5 Working with the Mosaic approach

## 5.1 Introduction

This is a qualitative study of young children's interest in science, which emphasises interest as closely connected to identity in practice (Holland et al., 1998). As such, it poses challenges with respect to data generation techniques and ethical considerations that are specific to the young age of participants. In this chapter, I provide details of the pilot phase of the study, followed by my research design; how I selected two schools and eight children; the purpose of monthly visits to school; and the different types of data generated during each visit. There then follows a description of each data generation technique, discussing challenges and limitations. The final part of this chapter looks at the ethical issues that arose during the study.

## 5.2 Piloting data generation techniques

In the six months prior to starting the main study, I piloted observing children in five different primary schools, talking to them about their interests and asking them questions. The schools were ones with which I had personal contacts, having spent many years working with primary school teachers. I asked the teachers about how they organised their curriculum and provision. Whilst how the school day was organised varied from school to school, the underpinning philosophy of early years education – to support children in free-flow play (Bruce, 2001) – was consistent across all five schools (see Chapter 1 for further explanation of early years pedagogy). In all the schools I visited, Key Stage 1 children had a more formal structure to their day of discrete lessons.

As a starting point for designing an interview schedule for children, I based my initial questions on research by Nolen (2007). Her project asked children questions about reading; I adapted it to ask children about science instead:

1. Tell me about science lessons this year.
    a. What do/don't you like about it?
    b. What's fun about it?
    c. What kind of things have you done?

2. Do you do any science outside of school/at home?
    a. What kinds of things have you done?
3. What do you think science is?

(based on Nolen, 2007)

I trialled asking these questions to a focus group of four children in every year from Reception to Year 6 in one of the pilot schools. I also asked the children for their views about the questions themselves. The outcome of this trial was that I developed a range of ways to ask children about their interests in general, rather than focusing my questions around science (see Appendix 8). This is because children did not have a clear grasp of science as a concept and the younger children often told me they did not know what it meant (Crompton, 2013). In addition, if children only think of school science when asked to comment on science, rather than a broader definition of science (see section 1.4), then they could potentially not tell me about an interest related to science, because they did not consider the interest to be science.

During the pilot phase, I trialled interviewing children in groups. However, children can be influenced by what they hear other children say, and if they interrupt each other, some children may be prevented from finishing their points (Griffin et al., 2016). It can also narrow conversation down; for example, during one conversation about what the children thought science was, one child used the word 'potions', the other children followed suit and also talked about potions rather than contributing new ideas. I also trialled asking my questions through a puppet in order to reduce the asymmetrical relationship between adult and child (Naylor et al., 2007). The puppet I used was of a girl; she introduced herself to children and began asking them questions. Rather than answering, the children asked her questions instead, then got their own puppets and role-played making friends with mine. In puppeteer style, the children changed their voices when speaking through their puppets and the responses they gave were their imagined puppets' answers to questions rather than their own, so that the puppets added another filter to the conversation rather than aiding communication.

As well as refining my interview questions for children, I also trialled asking questions to teachers and support staff during the pilot phase, about whether they thought that children showed any particular interests, to see what criteria school staff applied when

storying a child as a person with an interest in an aspect of science. In their study of children's science interests, Leibham et al. (2013) conducted bimonthly telephone or e-mail contacts with parents and asked questions about their children's preferred play activities and interests. They asked three questions to identify children's early interests:

> 1. What does your child prefer to do during free play time?
> 2. If your child had one hour to do anything, what would they prefer to do?
> 3. Does your child seem to have a focused interest (and what is it in)?
>
> (Leibham et al., 2013:579)

During the pilot, I used these questions as the basis for my interviews and questionnaires with staff and parents. Whilst Leibham et al.'s questions proved appropriate for a written questionnaire (see Appendix 7), I developed more probing interview questions for staff and parents as the study progressed and these are summarised in Appendix 9. The next section describes the design of the main study.

## 5.3 Research design

My starting point was that children's interest development is a complex social phenomenon that occurs within a context. Therefore, I elected to conduct a multiple case study, as defined by Simons (2009:21):

> An in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a 'real life' context.

My research plan spanned two years, and the 'multiple perspectives' mentioned in the quotation above are the views of children, their parents, and school staff, generated using polyvocal techniques based on the Mosaic approach (Clark and Moss, 2011). Thomas (2011:512) proposes that case studies comprise of two elements:

> (1) The subject of the study, which is the case itself, and (2) the object, which is the analytical frame or theory through which the subject is viewed and which the subject explicates.

The subjects of the case studies are three of the eight children that participated in my study and the object is the practice theory of interest, through which I viewed the storying of children's interest development in context – see Chapter 6 for further details.

The appeal of case studies are that they can capture the complexity of human behaviour and allow researchers to make inferences (Cohen et al., 2017). However, some consider the strength of a case study to be its weakness, since its exploration of a specific situation in depth means that it can be difficult to replicate or generalise findings from (Shaughnessy et al., 2003). My intention has not been to generalise; instead I see case study research as providing me with a focus for in-depth exploration, applying a theoretical framework, rather than limiting the scope of the enquiry (Yin, 2018).

The study took place from January 2014 to December 2015, and included 17 monthly visits to two schools (in some months there were no visits, for example, August and September). In total, I made six visits during the children's Reception year, nine visits in Year 1 and two visits in Year 2. In the first visit, I did not generate any data; instead, I introduced myself to staff and parents and gave them the information sheets and consent forms (Appendices 4 and 5). In the second visit, I gained verbal assent from children whose parents had given their written consent (Appendix 6) and spent the afternoon indoors and outdoors interacting with children and staff, allowing time for me to get to know the setting and for participants to feel more comfortable in my presence, as recommended in the Mosaic approach (Clark, 2017). In visits three and four, I asked staff to describe what they thought children were interested in at home and at school. In addition, I informally reconfirmed children's verbal assent and unobtrusively observed children's activities and practice.

I asked the class teachers to provide additional information about the interests of the eight children via email, which was the teachers' preferred method of communication (see Appendix 9). By the seventh visit, I selected four children in each school to follow into Year 1 and the beginning of Year 2. I based my selection on initial data generated with parents, staff and children, see section 5.5. Details of the dates and data generated during each visit are in the research plan (Appendix 2).

I was fortunate that all eight children took part in the study for the full two years. However, sometimes children were absent on the day of my visits due to illness, or visits were cancelled and gaps were caused by the school calendar. The longest gap in data generation was four months (from June to October), which means the data set is somewhat fragmented. Such gaps seem inevitable in a study that involves schools.

Each visit lasted at least two hours and I observed, made field notes and digitally audio-recorded children's actions and conversations during activities. I encouraged children to choose how they wished to communicate with me, following the principles of the Mosaic approach that children are 'skilful communicators' (Clark and Moss, 2005:5). The diagram below illustrates the pieces of the mosaic and different ways that I worked with children to generate data during each visit.

<table>
<tr><td>Child X's art work</td><td>Observation</td><td>Child X interview</td><td></td></tr>
<tr><td>Parent interview</td><td colspan="2">Child X</td><td>Child X's photographs</td></tr>
<tr><td>Research journal</td><td>Child X's written work</td><td>Child X's 3-D models</td><td>Staff interview</td></tr>
</table>

*Figure 2 Building up a mosaic for Child X*

Clark (2017) stresses that each child's mosaic is as different as children themselves, hence why there is an empty box in Figure 2, giving space for improvisation. For example, in addition to the methods listed above, some children chose to record videos and some talked about their *My Hopes and Dreams* booklets (see section 5.6.4). The children selected the tools they wanted to use to communicate their ideas from the choices I offered them – photographs, drawing or talking. I observed children during my visits, and asked some children if they would like to answer questions each time I visited. I showed the children that I was recording their answers and they had the choice whether they wanted to be interviewed individually or with a friend. Children were free to decline to be interviewed, for example, if they were engrossed in a task, as participation must be voluntary (see section 5.7 for further discussion of ethical issues). I gained information from parents and school staff on five occasions,

using semi-structured interviews and short questionnaires, in order to find out what the adults' views were of children's interests. I gave adults the option to answer questions orally (digitally recorded) or provide a written response - handwritten or via e-mail. I also kept field notes and reflected on my experiences of the data generation process in a research journal.

I refined and adapted multimodal strategies in response to feedback from participants and opportunities that arose as the study progressed. The focus of some of my questions shifted over time, because of changes in pedagogy and curriculum as children moved from a Reception class and Early Years Foundation Stage curriculum to Key Stage 1 and National Curriculum subjects (see Chapter 1 for more information). For example, in the second year of the study I asked children about what their favourite lesson was in school and what they thought science was. See Appendix 8 for a list of potential interview questions.

## 5.4 Selection of schools

Of the five pilot schools, I selected two schools for my study. The reason for choosing two schools was to concentrate my time on generating rich data rather than spreading my attention across a number of schools, which could result in less depth to the analysis (Creswell, 2013). An additional reason for generating data in two schools rather than one, was in case one of the schools withdrew their consent during the project, as they were free to do at any point. I selected the two schools in which the staff showed the most interest in the project, based on my e-mail conversations with the Headteachers and Reception teachers, as well as conversations with other staff. The other schools I visited were agreeable to working with me, but did not appear particularly interested in my chosen area of research.

### 5.4.1 School A

School A is a larger than average primary school on the outskirts of a city, in an area of social and economic advantage where few families are eligible for free school meals. The proportion of children with a statement of special educational needs is average and most pupils are of White British heritage (Ofsted, 2017). Ofsted report that it is a

good school where 'pupils achieve well and make good progress' (Ofsted, 2017:1). Reception classes in School A are organised around the principles of free-flow play. All 60 children in two reception classes have free choice where to play across both classrooms and the outdoor provision for the majority of the day. Five staff work with these children – two teachers and three teaching assistants. Each day starts and ends with 15 minutes carpet time for singing, stories and show-and-tell. There are 15 minutes adult-directed inputs during the day in mixed ability groups of three or four children for phonics, literacy and numeracy. Each class has a weekly PE lesson. Science is not taught as a separate subject, but through the areas of provision that children have access to during free-flow play.

In contrast, the two Year 1 classes are taught separately and children sit in ability groups all morning for adult-directed instruction on literacy and numeracy that includes one-to-one support, group work and whole class teaching. Most afternoons are spent on topic work in mixed ability groups; this is sometimes designated as a science lesson, depending on the topic. During Year 1, children have some free choice and opportunity for child-led learning when the teacher is providing guidance to a specific group of children.

### 5.4.2 School B

School B is a Free School and opened in September 2013 as a Science Academy. Science is highlighted on the school's website, which states that; 'We firmly believe in the importance of science as a foundation for all areas of learning'. (School B, 2017:online). There are currently four year groups of children at the school. At the start of the project, there were 20 children in the Reception class with one teacher and two teaching assistants. The school is in temporary accommodation in an inner city area of high social and economic disadvantage. Areas of provision, especially outdoors, are very limited due to the temporary accommodation. Six Reception children travel 10 miles each day in a minibus to attend the school. Whilst not a faith school, it has a Sikh ethos and the majority of children are of Indian heritage. A new Principal was appointed in September 2014 and Ofsted reported the school *Requires Improvement* in

June 2015. With such close links to the local community, parents often come into school and some volunteer for part of the day.

The Reception classroom is set out in a typical manner for an early years setting with various areas of provision, such as a reading area, water tray etc. Features of the school that illustrate its emphasis on science are a significant number of non-fiction books in the reading area about space travel, animal encyclopaedia etc.; a large science area of provision; and the language of enquiry, for example, 'observe', 'predict' on classroom display boards. The school also has regular science based visits, such as, a trip to Tropical Life, as well as visitors, for example from a STEM ambassador. A typical day in Reception at School B includes short adult-directed inputs in ability groups of six children for phonics, literacy and numeracy, and carpet time after lunch and before the end of the day for show-and-tell, circle time or a story. The rest of the time, children participated in free-flow play; with a rota of times when groups of children were invited to play outdoors, if they wanted to (the outdoor space is too small for all the children to use at once).

As with School A, School B has a timetabled curriculum for Year 1. Children spend the mornings sitting in ability groups for mathematics, phonics and English. The afternoon timetable comprises topic work, in mixed ability groups, and includes a science lesson every week. The school follows the International Primary Curriculum, so all subjects are linked to cross-curricular topics (Fieldwork Education, 2014). Children have free choice during Breakfast Club and once a week in Golden Time on Friday afternoon.

School A and School B are different in many ways – especially their size, the socio-economic profile of their location and the heritage of pupils. School A is well established, whereas School B opened four years ago and only has four classes. At School A, staff seemed to be interested in my project, but I was a very small part of a large busy school and I rarely saw the Headteacher. On the other hand, School B is a science academy and staff frequently approached me to discuss what they were doing to raise the profile of science for children, parents and the local community. The Headteacher of School B often made a point of engaging me in conversation about my research.

Although School A and School B are in contrasting locations, both schools organised the delivery of the curriculum in a similar way. In Reception, children spend the majority of their school days learning through free-flow play, whereas Key stage 1 children spend most of their time in structured lessons with a focus on literacy and numeracy. Neither schools' Ofsted report mentioned anything about the science provision at each school; judgements only referred to standards in English and mathematics. Therefore, I am not surprised that both schools prioritise the nationally tested subjects.

## 5.5 Selection of children

This research follows eight children from two different schools in a 2-year study. The age range of the children at the start of the project was between 4.7 and 5.3 years old (average age 5.1) and between 6.5 and 7.2 years old (average age 7) at the end of the study. Four children attended School A and four children attended School B (see Appendix 3 for pen portraits of the eight children).

At the start of the project, the parents of eight children in School B gave their consent, six boys and two girls. In School A, 12 parents gave their consent, with a total of six boys and six girls. Appendix 4 is the information sheet I gave to parents and Appendix 5 is the consent form they signed. I gained verbal assent from all the children (the script for this is Appendix 6) and I gave their parents a questionnaire to complete (see Appendix 7). I decided to reduce the number of children involved in the study at School A to the same number as School B, as it was impractical for me to observe and talk to 12 children. I chose eight children at School A based on conversations with the children, Reception teachers and support staff. We selected children who we felt would be comfortable talking to a researcher and engaging in the study (Merewether, 2014). For example, we did not choose a girl who answered 'I don't know' to all my questions, as I interpreted her responses as indicating that she was not giving her assent to be a participant (see section 5.7).

After the final visit to Reception, I transcribed interview data and categorised children's photographs, drawings, observations, interview transcripts and written

responses from questionnaires. I discussed and agreed with staff which four children would continue the study in each school. I selected children who appeared to express a variety of interests, based on my initial observations and contributions from the school staff and parents' questionnaires. I anticipated that some children's interests might change and develop between the age of 5 and 7 years old, so I did not just choose children who exhibited a specific interest in science related activities. I reconfirmed these children's assent to be involved in the study, as well as asking parents if their interests were the same or had changed since the start of the project.

According to Wellington (2015), the design of a case study is a funnel, where the researcher casts their net widely at the start of the project and as focus develops the funnel narrows. The wider sample can then provide the background for the study of fewer cases. In my project, I began with 16 children and after six visits reduced this number to eight children who expressed a range of different interests, such as, football, animals, computer games and creative arts (painting and drawing). I did this in order to devote sufficient time to generating data in a variety of ways with each child, rather than spreading myself too thinly. Before commencing data analysis, I reduced numbers further to three case studies by identifying those three children who most strongly expressed an interest in an aspect of science, in order to analyse their case records in depth to write case studies. Chapter 6 explains the detail of this process.

## 5.6 Data generation techniques

For the Mosaic approach to be a participatory research tool, it must allow young children to *co-construct* knowledge and understanding (see section 4.3 for details of the methodological principles of the Mosaic approach). In this study, I strived to be a reflexive researcher, aware of the limitations of the Mosaic approach and open to receiving input from participants (children and adults) about how best to generate data, rather than adhering inflexibly to a predetermined research plan. Participation can be considered at four levels (based on the categories developed by Holland et al., 2010). I would categorise my study as Level 2, as I have gathered children's views through child-friendly forms of communication, such as, drawings and photography. However, the design of the study is under my control and, one could argue, relies on

children's 'schooled docility' for their cooperation (Gallacher and Gallagher, 2008:506). In the following sections I explain the four main multimodal strategies used.

### 5.6.1 Observations

Being a non-participant observer can be problematic in an early years setting as a detached adult may seem strange to children, who are used to adults in their setting being friendly and helpful (Cowie et al., 2014). Therefore, I elected to be a participant observer, making sure, as far as I could, that my observations were not intrusive and did not encroach on participants' personal space (Wellington, 2015). I was also sensitive to non-verbal signs as to whether children felt at ease, or not, about taking part in the study (Mayne et al., 2016). However, observing children presents an unavoidable challenge - the relationship between researcher and participant is asymmetrical, because it is a relationship between an adult and a young child. Not only are adults physically bigger than children, but in children's experience adults are usually in charge and tell them what to do (Ebrahim, 2010). If children see the researcher as a teacher, this can also affect their behaviour. I deliberately set out to not be viewed as a teacher by the children through my choice of dress, behaviour and the way I spoke to them (Wellington, 2015). Ebrahim (2010:294) suggests the ideal role is a 'non-threatening person who asks ignorant questions'.

From experience, I developed the following strategies when observing young children:

- To be approachable and friendly, asking children and staff to call me by my first name, so young children are less likely to think that I have any authority over them.
- To ask questions in a way that implies that I am the learner and children are the knowledge holders (Merewether, 2014).
- Not to influence or direct children's choice of activities, so that I can observe them behaving naturally (as far as possible).
- To be attuned to subtle signals that children do not wish to be observed – for example, turning away from me, whispering to each other or hiding out of sight. If this occurred, I would move away from the children behaving in this way and respect their privacy.

### 5.6.2 Interviews and questionnaires with adults

I provided parents with an information sheet and asked them to complete a questionnaire (with the option that they could email me or telephone me instead) on two occasions during the project, at the start and after the first year (see Appendix 7). Parents elected to complete a handwritten questionnaire and I received these for all eight children. Towards the end of the study, I endeavoured to speak to the children's parents by timing my visits with the end of the school day and parents' evening. This strategy enabled me to speak to five out of the eight parents. Face to face, I asked more varied and in depth questions than I could do in the questionnaire, improvising in response to the parents comments (see Appendix 9).

During my visits, I found it relatively easy to spend time talking to teaching assistants about individual children, but I could not spend the same length of time talking to the teachers, as they were often busy. Instead, I collected summary information about children's interests via emails from teachers at the start and end of each academic year (see Appendix 9 for the questions I emailed to teachers). Working in initial teacher education, my experience has been that email tends to be teachers' preferred form of communication, as they can deal with the task at a time convenient to them and without interruption. It is often difficult to speak to a teacher via telephone, during break time or a lesson. Hence, email communication seemed pragmatic at the time, although in practice it provided only limited data. For example, one child's teacher commented in an email after my final visit of the summer term 'He likes to make things at home (or his parents like him to make things at home)' (Extract from Hakim's Year 2 teacher). In hindsight, I wish this had been a conversation, so that I could have explored this comment further.

### 5.6.3 Interviews with children

I tried to be sensitive in my approach interviewing children and to avoid formality, instead aiming for the interview to be conducted in a conversational style. Having found group interviews and the use of puppets unsuccessful during the pilot (see section 5.2), I interviewed children one-to-one or sometimes as a pair, whilst they were going about their day-to-day activities, audio recording our conversations so I

could transcribe them accurately. I asked children about what they were interested in or enjoyed doing at school and at home, using similar questions to those I asked in the adult interview and rephrasing them if children were not sure what I meant. However, there are subtle changes in meaning caused by using different words. When I asked the children, 'What are you interested in?', some of the children found it difficult to answer this question and they shrugged their shoulders, saying that they did not understand what I meant. I usually rephrased the question and asked, 'What do you enjoy/like doing?' (as used in the Mosaic approach interview schedules (Clark, 2017:171-175)). This is not quite the same question; in everyday speech *interested* often means *attracted to*, whereas *enjoy* has a more explicit reference to a positive affective response (Dohn, 2013). Children have their own understanding of the concepts *like* and *enjoy* and what they decide to tell me about will have personal meaning to them.

To find out more about children's past, present and future interests, I asked them about what they were interested in right now, what sort of things they had been doing at home – for example, what book they were reading or toys they played with, and what they would like to learn more about in the future. I improvised during my interviews with children, following the points they made and trying to redirect the conversation when necessary (see Appendix 8). I asked one question repeatedly, because it seemed accessible to children in that they could always answer it:

> If you had an hour spare when you got home from school, before teatime what would you like to do? (Children's interview question)

This question puts children's activity in a clear, concrete timeframe and implies an element of free choice. It also contains the assumption that children will express their interests through their practice. I did not ask the children specifically about science until the second year of the study, when I knew they had been exposed to science as a school lesson, based on my experiences during the pilot.

When participants are interviewed they cannot respond anonymously; they are aware of their audience and may modify their comments accordingly. This means that a limitation of interviews is that participants may anticipate the researcher's motives

and tell them what they think they want to hear. Children are subject to this potential pressure because they are not free agents; they act within cultural, societal and institutional boundaries (Andresen et al., 2010). This bias may be accentuated when children respond to questions posed by adults about something as 'discursively mysterious and powerful as science' (Jensen, 2014:1).

Audio-recording conversations seemed to affect both child and adult participants behaviour, but in different ways. For example, when two of the children noticed that the sound levels rose and fell on the iPad display during a recording, this fascinated them and they began shouting 'Hellooooo!' and watched the sound level change to red for maximum volume. Our conversation that day was punctuated by their interjections. The voice recorder had the opposite effect on one of the teaching assistants. I asked her if I could interview her and explained that I would like to record the conversation, as it would be quicker and more accurate than taking notes. As I brandished the voice recorder, she said 'Oh, well…' and stepped away from me slightly, indicating that the thought of being recorded made her nervous. I explained that the recording was just for me and would be transcribed, rather than played to an audience and she consented. Listening to the recording of our conversation, I can hear in the tone of her voice, how nervous the physical act of recording her words made her feel. The effect of the voice recorder epitomises the observer effect, in that the act of recording a conversation changed it (Wellington, 2015).

In my future practice, in terms of the practicalities of audio-recording conversations in a noisy classroom, I would use a clip-on microphone, in order to capture participants' voices more clearly (Merewether, 2014). I would also explore the technique of shoulder-to-shoulder research (Griffin et al., 2016), which minimises direct eye contact in order to help children feel more comfortable about saying what they want to say, rather than what they think I want to hear.

### 5.6.3 Children as photographers

I invited children to photograph what they were interested in at school using an iPad, so that they could see their photographs immediately. I elected to accompany children when they took their photographs rather than leave them to do this unaccompanied,

because the conversations that occurred during the act of taking photographs can be as important as the images produced (Einarsdóttir, 2007; Stephenson, 2009). Therefore, I audio-recorded this multimodal strategy and reviewed the photographs with the children, asking them to describe what their photographs were about and how they felt about the objects or activities they captured. Children photographed their environment both inside and outside school, walking around with the iPad looking for particular objects such as a specific book, construction materials or image on a display.

The types of questions I asked children during this process included:

- What would you like to take pictures of? Why?
- Is there anything here that you'd like to take a picture of?
- Why did you choose to take a photo of XXX?
- Do you remember that we took some pictures? *(pointing at photographs)* Do you know why you took these? (Children's interview questions, see Appendix 8)

Some children had very little to say when viewing their own photographs, except that they remembered taking them, and I did not put too much emphasis on this verbal commentary, since I wanted the photographs to provide an alternative means for young children to express themselves (Clark and Moss, 2011).

Children's photographs may appear to bypass the challenges of verbal communication and provide a simple record of objects and events that they were interested in on the day of my visit to school. However, the reasons behind children's photographs could be personal and have affective meaning, or be bound up in their beliefs about their place in the world, their perception of me and speculation about why I have suggested they take photographs (Rose, 2016). According to Bagnoli (2009:548) images are more effective at describing the 'ineffable' and can make the ordinary extraordinary. This applies not just to the choice of subject of the photograph, but also the way children decide to compose and frame their photographs (Britsch, 2017).

The iPad could also video events as an alternative to photography, so during my fourth visit to School A, I invited two children to use the video function rather than photograph objects and events so that the data generated was not static. However,

rather than look around themselves for objects or events to video, the children excitedly filmed each other dancing and doing cartwheels and immediately replayed the videos of their performances. The medium of video encouraged the children to perform and this is a common reaction when children know they are being filmed (Cowie et al., 2014). During my final visit to School B, one child requested that I video him playing the recorder – this was the only time a child gave me the iPad to capture data rather than doing it for themselves and I found this a touching request (see section 4.5).

### 5.6.4 Children's drawings and written work

During my visits to school, I frequently encountered children busy drawing, painting or making something. When this occurred, I would sit alongside children and ask them to talk about they were doing or making. When I gave children the iPad to choose something to photograph, they would often photograph their artwork, both what they were in the process of making and finished work around the classroom and on display. In addition, if I spotted any artwork around the classroom belonging to one of the eight children involved in the study, I asked permission from the teacher and children to take a photograph of it. For example, on my fifth visit to School B, the children had completed a piece of work with a picture of themselves doing something and a sentence written underneath about what they like (see Figure 3 for an example from Hakim). I was interested to see what the children had chosen to draw and write about, so I photographed their pictures and asked children further questions about them.

*Figure 3 Hakim's picture, Visit 5, in June of Reception*

During a visit to School A, just a few weeks before the children finished their time in Year 1, the teacher showed me children's *My Hopes and Dreams* booklets. With entries spanning two years, from the start of Reception to the end of Year 1, these booklets contained separate entries from teachers, parents and children, about what children's strengths were, what their hobbies and interests were, what they wanted to achieve over the coming year and what their dream job was. School A's prospectus explains that the purpose of My Hopes and Dreams lessons are 'to develop aspirations in our pupils' (School A, 2018).

Comments in this school record booklet were written with the audiences of children, parents and teachers in mind, and are discussed further in Chapter 7. The children's entries contained responses scribed by an adult, so I read out these questions to children in a conversational style, to see how they answered them verbally to a different audience, and transcribed this dialogue to include in the data. Tracy (2019:238) refers to these types of conversations as 'member reflections… valuable not as a measure of validity, but as a space for additional insight and credibility'. I also asked the children from School B the same questions:

- I am really good at…
- My hobbies/clubs I belong to/interests of mine are…
- If I could get help with one thing it would be…
- When I am older, I would like to be able to…
- When I am an adult, my dream job would be…

(Children's questions from *My Hope and Dreams* booklet)

Field observations, photographs and interviews tend to focus on the immediate school environment (Griffin et al., 2016), whereas discussing children's *My Hopes and Dreams* booklets gave a future orientated focus to our conversation, and space for children to talk about what they would like to do and what job they would like to have in the future.

## 5.7 Ethical considerations

In this section, I will explain how I conducted my research in accordance with principles outlined in Manchester Metropolitan University's Ethical Framework (Research Ethics and Governance, 2016), and took into account specific issues that relate to the ethics of researching young children. The British Educational Research Association (BERA, 2018) set out principles that should guide anyone undertaking educational research. To structure my analysis of ethical issues, I will consider three of these principles.

### 5.7.1 Consent

This gives participants the right to make their own decisions on the basis of their values and preferences, without coercion. To make informed decisions about whether to take part or not, research participants need to understand the full purpose of the research study and what will be expected of them, the time commitment and what will happen to data at the end of the study (Research Ethics and Governance, 2016). This autonomy is necessary for 'informed consent'. In other words, participants choose whether to take part in research or not and fully understand the implications of their participation.

There are a number of difficulties in obtaining informed consent that are specific to research of vulnerable members of society, including young children. The BERA guidelines (2018) caution that such participants may not fully comprehend what they are agreeing to or may feel pressured to agree to participate. To research children under the age of 16 it is necessary to obtain proxy consent from a parent, guardian or other legal representative. These adults are gatekeepers who provide access to participants and assumed rather than informed consent for the research to take place (Richard and Bélange, 2018). There is a hierarchy of gatekeepers when research takes place in a school, starting with the Headteacher. Once the Headteacher has given consent to a project, the teachers and parents may feel obligated to consent as well - either wanting to please or not wishing to offend the Headteacher (Homan, 2001).

As participants in research, young children may not fully appreciate what giving their consent means in practice. They may not understand or believe that they can withdraw from the research, even if this has been explained to them (Parsons et al.,

2016). Some researchers use the term *assent* instead of consent to describe the cooperation they seek from children (Flewitt, 2005). According to Alderson and Morrow (2006), researchers should ensure that children actively understand and agree to participate when they give their assent, rather than passively accepting or not refusing to take part in research. When I gained assent from children, I explained that I was a student at the university and showed them how the voice recorder worked, so that they could give their verbal consent (Appendix 6 is the script I used for this conversation). When discussing consent with participants and gatekeepers, I also made it very clear what my role would and would not be during the study, for example, Wellington (2015) cautions that Headteachers may think they can use the researcher as a spy in the classroom.

### 5.7.2 Harm arising from participation in research

Some types of educational research are considered to be higher risk for a number of reasons, including if children are under 8 years old (Wyse, et al., 2016). My participants' ages ranged from 4 years 8 months to 5 years 3 months at the start of the project, so I completed a full ethical approval form (Research Ethics and Governance, 2016). Participants must be made aware of any risks or discomforts that may occur during a research project before consent is sought. BERA guidelines (2018) advise that the health and safety of participants must be protected and identifies harm, such as physical, psychological or financial, that must be both clearly identified and managed. Minimal levels of risk and harm can be defined as no greater than what the participant would encounter in normal everyday life (Fisher, 2005). Unobtrusive observation of children in everyday situations can be considered to be low risk (BERA, 2018).

Educational research may cause teachers and children harm in subtle and indirect ways; for example, interviews could use up valuable teaching and learning time (Richard and Bélange, 2018). Researchers could potentially cause harm to a community by misrepresenting the views and opinions of a group. Young children express their thinking in unconventional ways, so it is difficult for adults to represent children's thinking accurately (Harcourt and Conroy, 2005) (see section 4.6).

### 5.7.3 Consequences of research

It is the responsibility of researchers to report their findings honestly and transparently (Wellington, 2015). Research participants should be made aware, at the start of a research project, what the potential benefits will be for themselves and to others (BERA, 2018). Such benefits may be indirect or long term, for example, the research contributes to future policy or practice (Cohen et al., 2017).

### 5.7.4 Micro-ethics in practice

Micro-ethics refers to ethics in practice, those 'ethically important moments' that occur during research and are in addition to the procedural ethics captured by institutional ethical approval (Guillemin and Gillam, 2004:262). A conversation with one of the case study children, Hakim (see section 7.3), illustrates a micro-ethical moment:

> Zoe: Anything else you wanted to tell me about?
> Hakim: Do you know what happened to Paris? Guess what happened in Paris?
> Zoe: What happened?
> Hakim: They were shooting and attacking and bombs on people and they destroyed Disney Land and they killed a hundred people.
> Zoe: They killed a hundred people. That's very sad isn't it.
> Hakim: They made a big hole inside the ground and put all the people in there. They puts lots of bombs everywhere and 205 people died.
>
> (Visit 15, in October of Year 2)

How did I feel and how did I react to this disclosure? Children's redirection of the research agenda can often be motivated by wanting to make a connection with the researcher (Chesworth, 2018). I experienced this with Hakim when he talked about the deaths – I felt a connection between us that we were both upset by such terrible things happening in the world. At the same time, I felt myself grappling with the ethics of what I *should do* in response to Hakim's comments and anxious as a researcher about making sure I took the appropriate actions.

Hakim's description of death and violence created a dilemma for me. Should I continue with the interview as if nothing out of the ordinary had been said, or abandon it? Our conversation took place in December. From my previous visit, I knew that Hakim had been to Disneyland Paris during the summer holidays, so I guessed that when the terrorist attack occurred in November he had discussed it with his parents, as he seemed to want to tell me about it, rather than ask me to explain anything. In the end, I chose to respond with empathy and allow Hakim to move on from this topic when he was ready.

### 5.7.5 Ethical implications for my study

I applied the principle of participant autonomy to my research by gaining informed consent from all the gatekeepers and participants involved in my project (Research Ethics and Governance, 2016). I renegotiated this consent on a regular basis throughout the research process to allow gatekeepers and participants the opportunity to choose freely if they wanted to remain in the project or withdraw.

I sought assent from children in a way that was appropriate for their age; I talked about what I was doing and why, with concrete examples and language they were familiar with (see Appendix 6). I asked children's permission, invited them to communicate their agreement in a number of ways and checked they comprehended what they were agreeing to (Parson's et al., 2016). Mindful of 'schooled docility' (Gallacher and Gallagher, 2008:506), I repeatedly reassured children that they could choose to engage with me or stop taking part at any time.

In terms of potential harm, I assessed that my research presented minimal risk of harm. I used pseudonyms for children's names and obscured faces in photographs to protect the anonymity of participants. I also replaced the names of locations with pseudonyms. I have not carried out any activities with children that are different to their usual classroom activities and I have not selected an experimental or control group of children to treat differently. There is a slight risk that I take up valuable time from children and staff in my conversations with them. I managed this risk by keeping a record of how much time I spent with each individual participant to ensure this was not excessive.

In terms of benefits from my research, I involved staff in the data generation process. I presented my research at national and international conferences. In the future, I plan to disseminate my findings to the wider research community in publications and develop the ideas emerging from this thesis through further research.

## 5.8 Chapter summary

In this chapter, I have justified my choice of data generation tools, based on the Mosaic approach, and discussed the limitations of each method. A general criticism of data generation techniques is that they are in danger of being 'locked into the 'here-and-now' of participants perceptions' (Somekh and Lewin, 2011:56). To counter this, I included interview questions that explored participants' past, present and future, in order to look beyond the present for why things have come to be; the influence of past events; and future aspirations (see reference to *My Hopes and Dreams* in section 5.6.4). Another limitation of focusing on the 'here-and-now', is that by its nature, the Mosaic approach appears to be biased towards the physical environment that children experience directly through their senses and this is what they photograph, talk about, walk around or draw. However, several children talked about their interest in computer games. For example, Hakim told me that he had been playing Minecraft (a first-person video game) – but how could Hakim choose something to photograph in the classroom that related to this creative technology? Are photographs of material objects the most appropriate way to capture interest in a virtual world? Hakim's interest in Minecraft is discussed further in section 7.3. In the next chapter, I explain the process of data analysis and the role of theory in this.

# Chapter 6 Data Analysis

## 6.1 Introduction

In this chapter, I describe how I categorised all the data in order to identify three children for holistic in-depth case study analysis through the lens of a practice theory of interest. Case studies retain connections between participants and context, essential for a sociocultural approach to analysis, focusing on the way children self-author, and are authored by others, as interested in science.
During this study, I visited two schools on 17 occasions across two years and generated a wide variety of data. Sixteen children were initially involved in the project, decreasing to eight children by the end of the study. Categorising the Mosaic of data for each child reduced this number further, to arrive at three case studies, thus narrowing the funnel (Wellington, 2015).

While the initial categorising and summarising of the data made it ostensibly more manageable, it did not have the benefits I had anticipated. As Simons (2009) notes, the inductive process of ordering and comparing categories to identify patterns and connections carries a danger that the researcher loses sight of the holistic nature of the data. In this chapter, I reflect on this issue and the role that my use of the qualitative data analysis software package NVivo (QSR, 2014) played in this. In the final part of the chapter, I explain the process of holistic analysis of the three children's case records, which produced the case studies in Chapter 7.

## 6.2 Organising the data

During my study, I observed and made field notes, audio recorded conversations with adults and gave children a choice of ways to communicate, for example, through talking, drawing or taking photographs. I stored children's digital photographs in folders for each school visit, identifying the child who had taken the photograph in the file name. I transcribed all interviews with children and adults, and stored them in the same way. I typed up the field notes for each visit into a research diary. The final data set comprised of 49 interviews with children, 16 questionnaires and 5 interviews with

parents, 16 questionnaires and 8 interviews with school staff, 180 children's photographs, 2 children's videos, 12 children's drawings, 5 school record books and a research diary. Table 1 provides a summary of the data relating to each child (see Appendix 2 for the timeline of when data was generated).

| Child | Research diary entries | Child interview | Parent interview/ questionn-aire | Teacher interview/ questionn-aire | Child's photo-graphs | Child's drawings | Other |
|---|---|---|---|---|---|---|---|
| Isla | 11 | 7 | 3 | 3 | 24 | 2 | My Hopes and Dreams 13 entries |
| Robert | 12 | 7 | 3 | 3 | 35 | 0 | My Hopes and Dreams 12 entries 1 video |
| Beth | 9 | 5 | 2 | 3 | 7 | 2 | My Hopes and Dreams 12 entries |
| Jake | 12 | 6 | 3 | 3 | 54 | 2 | My Hopes and Dreams 12 entries 1 video |
| Amita | 14 | 6 | 2 | 3 | 16 | 2 | |
| Hakim | 12 | 6 | 2 | 3 | 17 | 2 | School record book 4 entries 1 video |
| Sunil | 14 | 6 | 3 | 3 | 12 | 1 | |
| Bilal | 14 | 6 | 3 | 3 | 15 | 2 | |

*Table 1 Types of data generated for each child*

In order to manage this large data set, I researched the types of data bases used in similar studies and selected the qualitative data analysis software NVivo (QSR, 2014), based on its flexibility and functionality. I created a database using NVivo, inputting all the multimedia data and storing it in folders of types of data for each child. The following section explains the process of classifying the data.

## 6.3 Initial categorisation of data and identification of the case studies

I began the process of categorising data in the first year of data generation. Since the study concerned children's interest in science, my first step was to look at *what* they expressed an interest in, in order to identify occasions when the specific subject of their interest related to science; without this initial filter, I would be casting the net too widely. In order to do this, I developed a working definition of science based on my understanding of both science as a school subject and a broader definition of science as multidisciplinary (see Chapter 1). I then used this to classify my observations of children's activities, photographs, what they talked about and what parents and teachers said they were interested in. My task was not to look for moments when the children, their parents or teachers spoke about them doing 'science' using this term, since my pilot study had shown that 5-year-olds are often not sure what the word means. Instead, it was to look at each separate piece of datum and decide if this counted as science or not. Where does science end and not-science begin? The boundaries between science and not-science are fuzzy – science pervades so many things, on so many levels, that one could argue that everything is science.
As an example, Beth spent one lunchtime using a skipping rope to play horses with her friends. One girl would run around the playground pretending to be the horse, holding the skipping rope so that a second girl could run along behind her holding the ends of the rope as if they were reins. Perhaps Beth was expressing her interest in science through this activity, because the horse is an animal (and Beth says that she likes animals) and the skipping rope needed to have the right tensile strength to act as the reins. Yet I discounted this as a tenuous connection. As the observer, I made a decision about this data beyond what is possible to judge from reading a description. As someone familiar with Beth's practice from several visits to school, I could see that this activity was one of many make-believe games Beth and her friends would play during lunchtime and it was about friendship and the joy of running around, rather than an expression of interest in animals and pets.

I developed a list of science categories, based on observations of children's actions, their images and drawings, as well as the words of children and adults, rather than

curriculum statements. As an example of the difference between school science and a broader view of science, engineering appears in this list, whereas it is not mentioned in the National Curriculum. I use the term engineering to describe children's activity using construction materials, such as Lego, to build and test structures. It also represents an interest in design and problem solving (Brophy, et al., 2008). The final list is as follows:

1. Natural world, plants, animals including humans
    a) Nature, environment and seasonal change
    b) Plants and gardening
    c) Animals and pets
    d) Human body
2. Materials and engineering
    a) Properties of materials
    b) Changing materials
    c) Construction
3. Scientific enquiry, investigating and testing ideas
    a) Asking questions and predicting
    b) Making observations and/or measurements
    c) Recording and interpreting data

These categories are not exclusive; the data include many examples of children conducting their own independent investigations related to particular scientific concepts, and in these cases, I categorised the data in multiple ways. For example, Beth's parents described what she liked to do at home as, 'She enjoys feeding the birds in the garden and using her binoculars to see if they are eating the food'. I categorised this as 1a, 1c, 3a and 3b, and this was reflected in NVivo's facility for multiple coding of data.

I then discussed these categories with a colleague whose field of research was science education and we independently and collaboratively coded the data for one child in order to refine the categories. We discussed the similarities and differences in our coding, helping me to articulate my interpretation of each category. I audio recorded our conversation so that I could transcribe and review it. We talked in depth about

whether children's practice was or was not indicative of an interest in science and this proved useful in clarifying the application of categories. The following extract from our conversation illustrates the difficulties in deciding if children's activities might suggest an interest in science or not.

> Colleague: So going through it, I was confident about categorising the natural world and construction and properties of materials, apart from where I highlighted painting. Now painting was the one for me that I felt there was often enough to justify being coded, but what it came under I'm not sure, I didn't know why he was painting, and someone said he was interested in construction and houses, so I categorised it under the construction theme, but I can't confidently say that I think that's where it should be.
>
> Zoe: He likes painting and often chooses to paint. I think that's not science, it's creative arts and expression, so maybe the question is, what is he painting a picture of?
>
> (Discussion during initial phase of categorising data)

Categorisation brought a layer of order to the data and focused my attention on children's expressions of interest in science in particular. As I coded each item, I noticed that children exhibited multiple interests and some of these varied over time. All eight children chose to engage in activities, talk about, or photograph objects and events that I have categorised as science at some point during the two years of the study. The categories were helpful for identifying children who consistently and repeatedly spoke about and photographed something that I categorised as science. However, I did not intend to code the data in order to convert qualitative data into quantitative data. Indeed, coding and simplifying data, tidying it into neat tables and diagrams, caused it to lose its complexity and messiness (Bernauer et al., 2013). I identify with MacLure's observation that:

> Successively higher-order coding 'condemns' relationships to the taxonomic style of class, order, genus, species, where differences are subsumed, data are allotted specific places and complexity is reduced. (MacLure, 2013:168)

The complex relationship between children's interests, identities and social context was completely absent from the initial coding I carried out using NVivo, which focussed on my own categorisation of behaviours indicative of children's interests in science/non-science, rather than the children's framing of their activities as science.

## 6.4 Moving away from NVivo

NVivo's designers make many claims about its usefulness to qualitative research, for example, that the software enhances rigour by enabling researchers to record decisions made during data analysis and providing that can be used to check that they have not emphasised rare findings and ignored repeated patterns to suit a particular argument, helping to guard against confirmation bias (Krefting, 1991). NVivo can also perform a coding comparison query and uses coloured highlighting to show where different coders agree or disagree. The software designers state that this allows the user to quantify inter-rater reliability (QSR, 2014). This can be a seductive process, for if researchers discover they concur with 95% of their coding, they have demonstrated stability of the coding rather than reliability (Morse, 2015). Since quantifying and reliability are terms more commonly associated with the natural sciences, I did not run a coding comparison query, as this function of NVivo is more congruent with a positivist approach to research (Varpio et al., 2017). However, what needs to be considered carefully and thoroughly is how the codes were arrived at and what assumptions might be behind a particular choice of code. For example, the categories of science I developed derived from the data, but included the language I am familiar with from the National Curriculum (DfE, 2014), such as, '3. Scientific enquiry'. I found my conversations with a colleague during data analysis, helped me to remain sensitive to where my own perceptions of science influenced how I spoke to children during interviews and how I interpreted the activities that children engaged in.

Indeed, Zhao et al. (2016) question why qualitative researchers seek such quantitative representations of their data at all; since qualitative data represents subjective experience, is it appropriate to analyse it in this way? Researchers must bear in mind that QDAS is often a commercial product and the claims its designers make should be viewed as marketing tools rather than methodologically neutral statements (Zhao et al., 2016). Coding results in slicing data into fragments, separating it from context, whereas children's interest in science needs to be understood in terms of their practice, manifested through actions that take place within a context.

In rejecting the quantifying features of NVivo in favour of holistic data analysis, I also rejected triangulation, which is often viewed as a means of verifying data (Tracy, 2019), but was not my purpose when generating data through different methods. Instead, I have applied an alternative approach, known as crystallisation. According to Ellingson (2009:10), crystallisation embraces multiple ways of knowing and views 'knowledge as situated, partial, constructed, multiple, embodied, and enmeshed in power relations'. This approach fits well with my theoretical framework of interest development as socially constructed with identity. Crystallisation is situated contextually and enhances thoroughness because multiple data sources provide comprehensiveness rather than convergence (Ellingson, 2009). It also embraces understanding as complex and partial: 'rather than apologizing for this partiality as a limitation, scholars using crystallization can celebrate multiple points of view of a phenomenon' (Ellingson, 2009:22).

NVivo enabled me to organise the whole data set and filter it, in order to select four children who expressed a strong interest in science through their practice (what they chose to photograph, talk about or do, and what they and their parents said they did). In this sense, the initial phase of categorisation served a basic purpose. The four children I identified were Isla, Hakim, Robert and Beth. Unfortunately, Beth was absent on three occasions when I visited school due to illness and her data set was incomplete, so I decided not to pursue her as a case study. Of the four remaining children, Amita, Bilal, Jake and Sunil all expressed strong interests in subjects other than science. For example, Sunil told me he liked to watch, take part in and read about sport, especially football and wrestling. He played football, went to football matches

with his father, and chose to photograph his football boots and football trophy. He also expressed an interest in Marvel Superheroes, which he photographed and role-played in school. His parents described his good hand-eye coordination, interest in sport and 'Marvel stuff' in their written and verbal conversations with me. Sunil's only mention of science, and activities I categorised as science, was when I asked him what he liked doing at school. If the study had been about children's interests more widely, I could have potentially written seven case studies, but the focus of my study on science determined my choice of case studies.

## 6.5 Towards a practice account of children's interests

Having selected three children to write case studies about, based on *what* they appeared to be interested in, the process of data analysis could begin by addressing my research question about *how* they expressed their interest in science, and the relationship between their identities and interests. To do this, instead of categorising data item by item on a computer screen, I analysed the entire case record for one child, Hakim, by printing out physical copies of images and re-listening to audio files alongside their transcriptions. Printed images and text crossed the 'tactile-digital divide' (Gilbert, 2002:215) assisting with the process of looking at the whole, whilst simultaneously searching for the detail. I used inductive strategies such as grouping and juxtaposing Hakim's images and words to look for connections, as well as deductive strategies by applying theory, such as looking for when children self-authored, in other words, as part of their identifying narrative, what did they say and do to express themselves as *someone interested in...*.

As with the initial classification, I involved a colleague in theoretical and holistic analysis. Instead of a researcher from the field of science education, this time I worked with one of my supervisors, an experienced researcher from the field of early childhood and visual methodologies. This gave me the opportunity to develop a more nuanced interpretation of the data based on children's funds of knowledge (González et al., 2006) and a practice theory of interest derived from Holland et al.'s (1998) ideas about socially constructed figured worlds and identity in practice (see Chapter 3).

Working with a practice theory of interest led me to pay close attention to the context in which data appeared, for example, the audience for participants' spoken and written words. Rather than focus on what children appeared to be interested in, I focused on *how* children storied themselves and how they were storied by others. For example, in the following extract, I could see in Hakim's words how he storied himself as 'grown up':

> Zoe: What toys do you play with at home?
> Hakim: I don't play with nothing. I've got a big grown up bike.
> (Interview with Hakim, Visit 3, in April of Reception)

A year after this interview, when I asked Hakim if he was doing any painting and he replied, 'That's all boring for me now', this phrase stood out, because Hakim storied himself as leaving childish activities behind him. In addition, I analysed the comments from his parents and teachers, noticing phrases that suggested positionality and the presence of discourses which make particular positions available (Holland et al., 1998). For example, I noticed in the extract below, how Hakim's mother positioned him as a *helpful* child, who was interested in adult activities.

> Hakim takes great interest in watching and helping his dad and grandad. Rather than playing with his toys, he takes great interest in gardening, mowing the lawn, growing fruit and vegetables, washing the car, cooking and baking.
> (Entry in school record book by Hakim's mother, in January of Reception)

Hakim's mother used the word 'great' to emphasise her description and stories Hakim as wanting to participate in domestic chores. My research diary also records instances when he is helping the adults to tidy up. Hakim's interest in adult activities and self-authoring as 'grown up' could stem from his funds of knowledge of participating in family life and perhaps a discourse held by his family that this is what children should be doing, rather than playing with toys. Drawing on a theoretical framework that views interest development as situated in a social, historical and cultural context and through holistic analysis, I noticed in Hakim's photographs and words about how he expressed

his interest in science and his identifying narrative. I also noticed when his mother described him using language that defined him in particular ways that were '*reifying*, *endorsable* and *significant*' (Sfard and Prusak, 2005:16).

I went through the same process analysing the case record for Isla. Close analysis of every pronoun, adjective, turn of phrase and suggestion in Isla's case record revealed many examples of how she storied herself as someone with a particular interest in wildlife and nature. For example, in the extract below, she talks about what 'we' do, in order to indicate her affiliation to her family. She also names different animals and speculates that a fox killed a swan, to self-author as a person who is knowledgeable about UK wildlife.

> Isla: Yes, when we were at the canal, me and mummy, and we saw a swan that had died and a heron.
> Zoe: The heron and the swan had died?
> Isla: No, I saw the heron when we were walking, then there's a bridge and then a big massive bit of water and we saw the swan in there and it was dead, so I think a fox has been to kill it.
>
> (Extract of Interview with Isla, Visit 9, in January of Year 1)

Esteban-Guitart and Moll (2014:31) use the phrase 'funds of identity' to describe when children actively use their funds of knowledge to define themselves and this is what Isla does through her social practice – what she chooses to read, do, talk about, draw and photograph – that she is a person who is interested in nature. This narrative has been encouraged by her parents who state that it will make her 'a better and more balanced person'. During the analysis of data generated by and about Isla, I noticed how the key adults in Isla's life, her mother, father and teachers responded to discourses, and storied her in different ways, positioning her as the caring child and the good student.

Table 2 is an extract of my interview with Isla's father, highlighted for where it indicates he is drawing on the *funds of knowledge* of family practice and where Isla's interests are *situated* in a social, cultural and historical context. I have also highlighted

words and phrases that suggest Isla's identities and interests are *positional,* in that they are associated with structural power relations, and that they have developed in response to *discourses*. See Appendix 10 for an analysis of a larger sample of Isla's data.

| **Extract of interview with Isla's Dad** | **Commentary** | **Practice theory of interest interpretation** |
|---|---|---|
| *Zoe: What would you say those interests are?*<br><br>Isla's Dad: Well quite a few things, but in particular we have tried to get her into wildlife.<br><br>*Zoe: Why is that?*<br><br>Isla's Dad: We think it'll make her a better and more balanced person and she'll have a better understanding of the world.<br><br>*Zoe: She's told me about quite a few of her trips.*<br><br>Isla's Dad: Yes, a lot of our visits do involve wildlife places.<br><br>*Zoe: Do you think she had that interest anyway or do you think that you've influenced her?*<br><br>Isla's Dad: Ermm, she's always been prone to it. I'm also a keen runner and I have brought her to events and she has shown no interest what so ever, so obviously she must hold some interest herself. | Dad does not quite answer the question I ask, instead he tells me that he and his wife have encouraged Isla to 'get into' wildlife.<br><br>I use the phrase 'quite a few' and Dad replaces this with 'a lot of' when he replies to add emphasis.<br><br>Dad talks about what Isla is doing with reifying language about her having essential characteristics. The adverb 'always' stresses the enduring nature of her interest (Sfard and Prusak, 2005). | Dad uses 'we' to make it clear he shares his actions and views with Mum and that they are inducting Isla into their family values (funds of knowledge). Dad's responses suggest **positioning** due to a structural power relation.<br><br>*A better person is into wildlife* – this is the **discourse** he ascribes to. He is drawing on a cultural resource about stewardship of the world, which is a predominantly Western anthropocentric view. Dad represents this as a family collective identity and funds of knowledge for Isla, as a way of thinking about the world.<br><br>Isla's self-authoring as someone interested in nature is **situated** in her family practice.<br><br>Dad narrativises Isla's possession by using the word 'hold' and emphasises that this is undeniable by prefacing his statement with 'obviously'. |

| **Highlighted in data** | **Colour** |
|---|---|
| Situated | XXXXXXXXXXXXXX |
| Positional | |
| Discourses | XXXXXXXXXXXXXX |
| Funds of knowledge | XXXXXXXXXXXXXX |

*Table 2 Extract of interview with Isla's father – with highlighting and commentary*

The final case study, which is of Robert's practice, provides a third analysis of a child's case record, noticing different aspects (compared to Hakim and Isla) of the relationship between Robert's identifying narrative and self-authoring as someone interested in science, viewed through the theoretical lens of a practice theory of interest (see Chapter 7).

## 6.6 Chapter summary

Conceptualising expressions of interest as part of children's identities and practice, with a sociocultural ontology and epistemology of social, multiple realities, opened my eyes to a way of looking at the data to notice subtlety and nuance, rather than using qualitative data analysis software to reduce children's expressions of interests into tally charts. This is not to say that NVivo prevented a nuanced interpretation, and used otherwise, it could have potentially done this, however, a holistic analysis involving close scrutiny of the data allowed for a three-way conversation between theory, data and researcher, in which the data provoked new thoughts (MacLure, 2013). The outcome of my data analysis is not to find one truth about children's interests or seek an objective reality (Denzin, 2012), but the opportunity to explore different participants' perspectives through the theoretical lens of a practice theory of interest. My interpretation of data acknowledges the complexity of the phenomenon of interest development, rather than attempting to converge on a 'truth' (Varpio et al., 2017).

# Chapter 7 Case Studies

## 7.1 Introduction

My position in regard to the phenomenon of children's interest in science is based on a *practice theory of interest* derived from Holland et al.'s (1998) concepts of socially constructed figured worlds and identity in practice (see Chapter 3). My research questions focus on how children express their interest in science and the co-construction of children's identities and interests. In this chapter, I address the research questions through three case studies, exploring the ways in which each child self-authors, and the ways in which they are storied by others.

A practice theory of interest adopts a sociocultural perspective which holds that children's interests develop and are expressed as part of their identities. Building on Holland et al.'s (1998) concept of identity in practice and González, et al.'s (2006) funds of knowledge, a practice theory of interest maintains that children's interests cannot be studied in isolation from their fluid and constantly forming identities, and are *situated* in a social, cultural and historical context. Such interests and identities are linked to power and status (Foucault, 1980); they are *positional*, often developed and enacted in accordance with major structural divisions in society. Interests also emerge in response to *discourses*, in the context of the cultural worlds in which we engage and I utilise the concept of funds of knowledge to explore the symbolic meaning of children's expressions of interest.

The case studies in this chapter illustrate that children self-author within school and home contexts, where they draw on particular discourses, values and cultural models to position themselves as interested in science in different ways. Through the case studies, I examine the complex relationship between children's interests and identities, noticing how their practice is embedded in classroom culture in school and family practice at home[2].

[2] See Appendix 10 for an example of how I analysed the data generated by, and about, Isla through the theoretical lens of a practice theory of interest.

The first case study focuses on Isla, who self-authors as someone interested in nature, situated in the context of her family's values and shared practice. This differs to how she is authored at school as a *good student*. The second case study explores Hakim's shifting interests across the two years of the project and the way he stories himself as a person for whom growing up, and the practices of his family and community, are important. Finally, the third case study focuses on Robert, who self-authors – and is authored by others – as someone interested in the creative possibilities of construction materials at home and at school.

## 7.2 Isla

In Isla's case study, I first present evidence of how she self-authors as someone who is interested in nature and is also positioned as such by her parents. I then turn to how she authors herself and is authored by teachers and her mother as a *good student* at school. These different narratives of Isla illustrate the point made in section 3.3 that who we portray ourselves to be, and who others construct us to be, changes in different contexts (Lemke, 2008). Focusing on the two contexts of home and school, the following analysis explores how Isla constructs herself using the resources available to her, and how she is authored by others in terms of her interests. The analysis highlights the workings of discourses and positioning in figured worlds (Holland et al., 1998).

### 7.2.1 The storying of Isla at home: 'I love foxes!'

The situated interest discussed in this section is Isla's authoring of herself as someone interested in the natural world, especially animals, which she expressed in her conversations with me about her choice of photographs of living things (or representations of living things) during my visits to school. She described keeping guinea pigs, fish and hens, collecting eggs, feeding foxes and visiting farms. During one of my early visits to School A, Isla arranged some model animals into a display and chose to photograph them. The sequence of photographs in Figure 4 show the careful way she placed the animals in relation to each other and composed each image. In the central photograph, starfish, pelican and turtle occupy the first row, with whales and sharks behind them in an ordered arrangement.

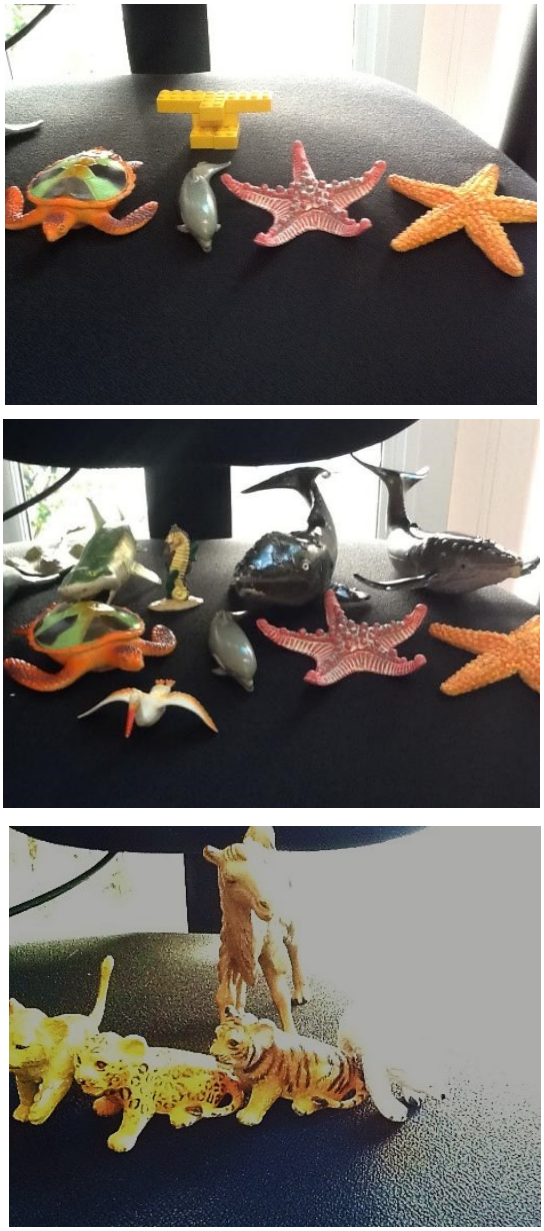


*Figure 4 Isla's photograph, Visit 7, in October of Year 1*

Zoe: So, can you tell me why you like the sea creatures?

Isla: Because I like the dolphins.

Zoe: Anything else?

Isla: And the starfish.

Zoe: So why did you choose them today?

Isla: Because I like them, and I like the whale.

Zoe: And what about outside of school, are you interested in them outside of school?

Isla: Yes, I used to have a fish at home but it died.

Zoe: And do you have any other pets?

Isla: I used to have guinea pigs too but they died, and we're going to get the garden done, and we're going to get chickens. We're getting a gate so they can't escape.

Zoe: So what else are you interested in?

Isla: Urmm, animals.

Zoe: What kind of animals?

Isla: I like ginger goats.

Zoe: Where have you seen them?

Isla: At the farm.

Zoe: And did you feed them?

Isla: Yes, and I've fed foxes before, with my mum and dad. You can just put your hand out and they feed out your hand.

(Interview with Isla, Visit 7, in October of Year 1)

In our conversation, I asked about why Isla likes the sea creatures, before asking what she is interested in, because, during previous visits, she had struggled to answer the question 'What are you interested in?' (see section 4.4). Isla repeatedly gave short responses about why she 'likes' the sea creatures – 'I like them…', 'because I like them'. However, she provided much more detail when talking about what she is interested in outside of school, telling me in a matter-of-fact way about the short lives of her previous pets and her family's intentions to keep chickens in the future. Using the plural pronoun 'we', Isla authored herself as a member of a family with shared plans and activities, such as feeding foxes with her mum and dad.

In my visit two months later, Isla expressed her interest in animals, and foxes in particular, using a powerful emotional term 'love':

Isla: I like Ryan's new puppets, because he got all the marbles in his jar and that means he got the puppets.

Zoe: Why do you like them? What are they?

Isla: One's a fox, one's a squirrel, one's a rabbit, one's a badger.

Zoe: And why do you like them?

Isla: Because it has a fox in them and I love foxes! They are my favourite wild animal.

Zoe: And do you like wild animals?

Isla: Yes, when we were at the canal, me and mummy, and we saw a swan that had died and a heron.

Zoe: The heron and the swan had died?

Isla: No, I saw the heron when we were walking, then there's a bridge and then a big massive bit of water and we saw the swan in there and it was dead, so I think a fox has been to kill it.

Zoe: Yes, maybe. That's very sad isn't it? And have you got any pets at home?

Isla: I'm going to get two and they're both chickens, but they're not *boy* chickens because we don't want boy chickens, because they're going to wake us up at four in the morning, (chuckling) I already know that.

(Interview with Isla, Visit 9, in January of Year 1)

Isla self-authored as someone who *knows* about wild animals, telling me in detail about the chickens and the dead swan. Sfard and Prusak (2005:18) state that 'identities are products of discursive diffusion – of our proclivity to recycle strips of things said by others even if we are unaware of these texts' origins'. One of the phrases Isla used, 'they're going to wake us up at four in the morning', sounds to me like something her parents would say. Perhaps, she made her parents' words her own and subsumed them into her narrative and stressed her ownership of this information by saying, 'I already know that'. As Holland et al. (1998) state, drawing on Bakhtin (1981), we are always heteroglossic, drawing on the words of others, which we imbue with our own intentions.

Isla tells me how her parents keep pets and visit the countryside, and that she feeds the animals and 'loves foxes'. This is a narrative of interest as enacted in practice, of

Isla family engagement with nature. Three months later, we see ongoing evidence of Isla's authoring as someone interested in nature and animals, with her family. Our conversation took place in the school grounds, where Isla had chosen to photograph snowdrops in flower (Fig.5):

*Figure 5 Isla's photograph, Visit 11, in February of Year 1*

Zoe: So, do you remember last time we talked, you said that you'd just been to the Medical Museum. Have you been anywhere else recently? Any other visits?

Isla: Yes, loads of times I went to Newby Hall Farm.

Zoe: I love Newby Hall Farm. What did you do?

Isla: I saw some sheep, and I've been to another farm. I've been to lots of farms.

Zoe: And what book are you reading at the moment?

Isla: I don't have a reading book at the moment.

Zoe: What about at home, are you reading any books that are your family's books at home?

Isla: Yes, I've got, I found… there are loads of books about animals and it says the African Plains.

Zoe: So what animals live on the African Plains?

Isla: I've got a book called Laughing Giraffe and in the book they have a competition. No that's in the Running Rhino, I think they have a competition.

(Interview with Isla, Visit 11, in February of Year 1)

In our conversation, Isla uses the words 'lots' and 'loads' to emphasise her descriptions of her life at home and how much it concerns animals. Applying the practice theory of interest development, we can see that Isla self-authored as someone interested in nature, situated in the context of her family's values and shared practice.

In my visit to school during the summer term of Year 1, Isla chose to take a closely cropped photograph of foliage and flowers in the playground (Fig.6), focusing on the seasonal summer vegetation in the same way as her previous photograph (Fig. 5) captured the first signs of spring.

*Figure 6 Isla's photograph, Visit 14, in July of Year 1*

In our conversation, I asked for an update on the chickens and we talked about some of the subjects Isla studies at school:

Zoe: Any news on the chickens?

Isla: They've laid an egg.

Zoe: You didn't have them last time we talked. How many have you got?

Isla: We've got two, one's called Buttercup and the other is called Bluebell, and there are these little bits that you can walk on inside the house.

Zoe: Cool, so tell me about the eggs?

Isla: Cos, there are these little things with holes in them and they have laid the egg under, so we need to clean it and we can't eat it because it is cracked.

Zoe: So have you eaten any of the eggs?

Isla: Yes, I've eaten loads.

Zoe: Brilliant. So, I was just wondering, now you're in year 1, what subjects you like at school. Do you like maths?

Isla: Yes.

Zoe: What about literacy, reading and writing?

Isla: Yes, I like literacy, because when I'm in numeracy, there's not much of my friends in numeracy, but when I'm in literacy there are loads.

Zoe: I see, so what about science, do you like science?

Isla: Yes... I don't think we're doing any science at the moment.

Zoe: What kind of stuff do you generally do in science?

Isla: What is science?

Zoe: I'm asking you.

Isla: I forget.

Zoe: Don't worry. Any books that you're reading? What do you like reading about?

Isla: One's about a dog, and it's a puppy and there's a little girl called Nina and she doesn't like the puppy because it sniffs so much, so she called it Sniffy, but then she likes it at the end because she had a little teddy… (Isla interrupts herself) Oh look, there's a rabbit!

Zoe: Is that a rabbit, oh yes.

Isla: Can you see that little thing hopping away?

(Interview with Isla, Visit 14, in July of Year 1)

As with the dialogue from Visit 7, there is a contrast between how Isla talks about school and home. The chickens are important to Isla and she uses the term 'we' to indicate a shared activity. Her excitement in seeing the rabbit (which is hard for me to

capture in a transcript), mirrors the passionate way she talked about foxes. She uses the word 'loads' again to emphasise her points. My questions about school subjects elicited contradictory responses. Isla answers 'yes' she likes literacy, numeracy and science, even though she goes on to say that she prefers literacy, because she can be with her friends and she is not sure what science is. Her compliance is a feature of her 'schooled docility' (Gallacher and Gallagher, 2008:506), in that she is expected to like every subject and wants to give the correct answer when being interviewed by an adult (see section 5.6).

During one of my visits in Year 2, I spoke to Isla's father when he came to collect his daughter at the end of the school day:

> Zoe: What would you say that Isla's interests are?
> Dad: Well, quite a few things, but in particular, we have tried to get her into wildlife.
> Zoe: Why is that?
> Dad: We think it'll make her a better and more balanced person and she'll have a better understanding of the world.
> Zoe: She told me about quite a few of her trips.
> Dad: Yes, a lot of our visits do involve wildlife places.
> Zoe: Do you think she had that interest anyway or do you think that you've influenced her?
> Dad: Ermm, she's always been prone to it, because I'm also a keen runner and I have brought her to events and she has shown no interest whatsoever, so obviously she must hold some interest herself.
> Zoe: Thank you very much, because, I've spoken to Isla, but you're a piece of the puzzle in terms of thinking about where do her interests come from.
> Dad: Well we don't push her, but we do encourage her.
>
> (Interview with Isla's father, Visit 15, in October of Year 2)

Isla's father uses the pronoun 'we' to include Isla's mother in a joint decision to encourage Isla to be interested in wildlife to 'make' her become 'a better… person'. He does not see their actions as something to hide; instead, he seems to be telling me that

this is good parenting. His words draw on a discourse of ideals regarding our behaviour towards, and value of, the natural world (Bonnett, 2007).

Isla's self-authoring as someone who is interested in nature includes her actions of feeding foxes, keeping chickens, naming and ordering animals. The symbolism of these actions is a caring attitude to nature. Isla's father says that he hopes that by encouraging Isla to be interested in nature it would make her 'a better and more balanced person'. Such comments capture a particular orientation towards the non-human world of stewardship, which is a culturally specific anthropocentric view (Marshall, 2015).

The evidence from interviews, observations and photographs suggests that Isla and her family are storying a collective identity 'unified by a family resemblance' (Sfard and Prusak, 2005:17). When I asked her father where he thought Isla's interest in nature came from, he spoke of Isla's interest using language that implied it is an essential characteristic that has always been there, rather than something she is currently doing. Sfard and Prusak (2005:17) categorise this way of talking about someone as a story of a 'third-person identity', an identifying story about Isla, told by her father, to me. The father's storytelling reifies Isla in his use of the phrase 'she's always been prone to it', emphasising Isla's intrinsic *state* – 'she must hold some interest herself' – and stressing the enduring nature of her actions (Sfard and Prusak, 2005).

Applying a practice theory of interest development to the next vignette reveals as much about me as it does about Isla and the way we may be constructing and positioning each other. On this occasion, I spent playtime with Isla outdoors. Figure 7 is a photograph of a tree that Isla chose to take and the conversation we had about the tree.

*Figure 7 Isla's photograph, Visit 17, in December of Year 2*

> Zoe: You took a picture of the tree, why did you want to take a picture of the tree?
> Isla: Because it's really old. It's a really, really, really old conker tree. It was there when I was in Reception.
> Zoe: Is it a conker tree?
> Isla: Yes, but it's lost all its leaves now, so it doesn't have any conkers on it.
>
> (Interview with Isla, Visit 17, in December of Year 2)

I started the conversation by asking Isla about her photograph, in order to find out more about why she photographed the tree. Isla authored herself as having a particular interest in the tree and confidently explained the seasonal changes leading up to how the tree looks in December. As with her description of visiting farms, she used language to emphasise her words, 'It's… really, really, really old'. At the time, I was impressed that Isla could correctly name the species of tree, since it is much harder to identify trees in winter, and her detailed description attests to her long-term

interest in the tree. In terms of positions, I emphasised the tree in my question, positioning myself as someone interested in trees, and she answered in a way that authored herself as a child with a similar interest.

### 7.2.2 The storying of Isla at school: 'A lovely girl'

This section considers data about Isla's storying of her interests and the way she is storied by others at school. Isla's self-authoring at school includes a prominent figure, her friend Alfie. The following mosaic of three sources of data, generated during one visit, illustrates her friendship with Alfie:

> Isla and Alfie are playing snakes and ladders – this is drawn onto the playground and they are using an imaginary dice to take it in turns to move across the board.
>
> (Research diary, Visit 10, in January of Year 1)


*Figure 8 Isla's photograph, Visit 10, in January of Year 1*

> Zoe: What would you like to study when you're older, what would you like to learn?
> Isla: I want to learn, I want to be a teacher and so does Alfie. We're going to do it in this class and class 6.
>
> (Interview with Isla, Visit 10, in January of Year 1)

In this exchange and in her photograph (Fig.8), Alfie appeared unbidden. Isla answered a question that I did not ask, telling me how she aligned herself with Alfie in terms of their shared future careers. During every visit to school, I observed Alfie and Isla playing together, often role-playing being a teacher and pupil. They seemed to express a shared actual identity of being good friends and a future designated identity to both be teachers when they grow up (Sfard and Prusak, 2005), and they enacted their friendship and rehearsed their adult careers (Chesworth, 2016). Through her practice, Isla self-authored as someone who is a good student, interested in being and becoming a teacher.

The following conversation with Isla's Year 1 teacher revealed the way her teacher views Isla:

> Zoe: The question is, I've been following Isla over the year and have asked her what she enjoys doing and it's really just from your perspective, what do you think that she is interested in and do you think that it has changed over the year?
> Teacher: To me, Isla is one of these girls that has got a real interest in lots of different things, and she's just really… Oh gosh, I don't know if there's anything that springs to mind that is something in particular. She's really good at her literacy and she loves her writing, but I think that she is one of these children that is keen, she absorbs everything really.
> Zoe: So, she enjoys learning?
> Teacher: Yes, she enjoys the learning of whatever we are doing; she's always one that is totally engaged with everything, which is really good.
> Zoe: So, in terms of her talking about hobbies or stuff that she does outside of school, is there anything that stands out?
> Teacher: I'm not really sure what she does outside of school, to be honest, so I couldn't really say about that, so… yes.
> Zoe: Yes, it's interesting isn't it.
> Teacher: Yes, she's quite quiet actually, that's the thing with her isn't it? And she's got this very close relationship with Alfie, and that's gone right

through from Reception, that really close friendship. That's not to say that she's not good at making friendships with others, because she is.
Zoe: Has she told you what she and Alfie want to do when they grow up?
Teacher: No, are they going to get married?
Zoe: They're going to both become teachers at this school.
Teacher: How lovely. Well Alfie dressed as a teacher for Aspiration Day, but Isla was away, so it would have been interesting to see if she would have come dressed as a teacher as well. Do you want to have a look at what they have written?
Zoe: Yes please, that would be great. Thank you.

(Interview with Teacher, Visit 14, in July of Year 1)

When I asked the teacher about Isla's hobbies, she responds by telling me that she does not know and that Isla is 'quite quiet', associating why she does not know with Isla's quietness and her very close friendship with Alfie. She then goes on to suggest that children should be good at making friendships with others. She describes Isla as 'one of these girls', placing her clearly as a member of a gendered group, before going on to describe Isla's 'love' of writing (the same choice of language that Isla used to describe her feelings about foxes). She uses the adverbs 'really', 'very', 'totally' to emphasise her storying of Isla. Having framed Isla as 'one of these girls', she goes on to reframe (and anonymise) her as 'one of these children', narrativising Isla as a good student, making it clear that she approves of Isla's 'schooled' (Baynham, 2004:286) learning disposition by saying, 'She's always one that is totally engaged with everything, which is really good'. She also says that Isla 'is keen', transforming her behaviour at school into an essential and permanent characteristic, 'turning properties of actions into properties of actors' (Sfard and Prusak, 2005:16).

The Year 1 teacher showed me Isla's *My Hopes and Dreams* booklet, which is a document kept in school and added to each year (see section 5.6.4). It contained entries from teachers, parents and Isla herself. The teachers' entries from Reception and Year 1 used similar language to the Year 1 teacher's verbal description of Isla as a child who tried very hard, focusing on literacy skills:

> *I think your strengths are…* You are a lovely girl with a real eagerness to learn. You are kind and thoughtful and a good friend to others. You are always trying your best.
> *I think I can help you improve…* I can help you gain confidence and take your learning to its next stage. I can help you to use your phonics in your reading and writing.
>
> (Isla's Reception teacher, *My Hopes and Dreams,* entry 6)

> *I think your strengths are…* Isla you are always happy and never have a bad word to say about anyone. You enjoy school and you are keen to do well.
> *I think I can help you improve…* I hope we can work together to develop your literacy skills and improve your handwriting so that it is smaller and easier to read.
>
> (Isla's Year 2 teacher, *My Hopes and Dreams,* entry 13)

Isla's mother described a very different version of Isla at home as 'very chatty', compared to the 'quiet' girl described by her teacher:

> *What makes my child special?* Isla is a really friendly, kind and thoughtful girl, she is very chatty and always makes me laugh.
> *What do I think my child is good at?* Drawing and writing, both of which she really enjoys.
>
> (Isla's parents, *My Hopes and Dreams,* entry 12)

Her mother uses the same phrase as the Reception teacher to describe Isla, 'kind and thoughtful', perhaps because the context of a school record book commanded particular language and ways of describing children with both teacher and parent aware of each other as the audience for the comments. Parents and school staff seem to be aligning Isla's behaviour with expected behaviour for a girl. The language of the entries about Isla is rather saccharine: 'a lovely girl', 'happy', 'never a bad word to say about anyone'. It appears that Isla is authored by the adults in terms of a gender at school, with implicit assumptions about what are appropriate ways to behave as a girl,

highlighting themes of kindness, literacy skills and care for others' feelings (Millard and Bhojwani, 2012). Isla's entry, which has been scribed for her by a member of school staff, continued the focus on literacy and Isla endorses the story that she is a good student:

> *What do I like doing best at school?* Playing in the shared area and going outside.
> *Why?* I like to draw in the shared area. I like running around outside.
> *What do I like the least at school?* I can't think of anything.
> *If I could get help with one thing it would be…* reading and the tricky words. I can't spell them.
> *By the end of this year I would like to be able to…* have got loads of house points and be good at taking away. I also want to always write my name neatly.
>
> (Isla, *My Hopes and Dreams,* entry 8)

In her entry, Isla uses the word 'always' to stress her desire for neat handwriting. Her words are an example of a 'first-person identity', an identifying story told by herself, which Sfard and Prusak (2005:17) claim is an ongoing inner conversation and 'likely to have the most immediate impact on our actions'.

In contrast to Isla's Year 1 teacher's comments about her being 'one of these girls', Isla's Year 2 teacher described her in the following ways, in an email to me, sent 4 months after my last visit to school:

> *What does she enjoy doing?* Drawing, art and reading books. Isla enjoys school especially anything creative. She likes playing animal games outside and loves to run around and skip.
>
> *Does she have any special interests that she talks about?* Isla likes animals, she has chickens and likes looking after them. She enjoys the company of others and likes to do what her friends are doing.
>
> Email from Year 2 Teacher, in April of Year 2

In this private communication, the authoring of Isla is very different to the public view of Isla that the Year 2 teacher records in her *My Hopes and Dreams* booklet (see entry 13 on p.104). This analysis of Isla's self-authoring as someone interested in nature highlights a significant point about children's perceived interests. In this case, there was a mismatch between what the adults and Isla are choosing to emphasise when describing her interests at school compared to at home. This is particularly evident in her *My Hopes and Dreams* booklet, which focused on the attributes of a good student and celebrated 'schooled' (Baynham, 2004:286) learning dispositions. Across 13 entries, there were multiple references to literacy, some to numeracy, but none to science or nature. Isla's interest in nature was absent from a document that claimed to be about *her* aspirations.

### 7.2.3 Summary of Isla's case study

Drawing on Holland et al.'s (1998) theory of identity in practice enables an examination of how Isla self-authors, and how her identity in the past, present, and possible futures, is informed by the encounters she has 'addressing and responding to others while enacting cultural activities under conditions of political-economic and cultural-historical conjuncture' (Holland and Lave, 2009:3). At school, Isla, her family and teachers actively respond to discourses in which literacy skills and studious behaviour are valued as part of potentially gendered expectations.

Isla's self-authoring appears to be related to a narrative that a 'better person' is someone interested in nature (in the words of her father) and a 'lovely girl', who is 'kind and thoughtful' (in the words of her teachers and mother). This raises a question: Where does science fit in with Isla's performance of being a girl at school? She has the opportunity to author an interest in science and nature outside of school, whereas in school, literacy skills seem to dominate. I will return to the issues raised by this case study in the discussion in Chapter 8.

## 7.3 Hakim

This case study analyses changes in the ways in which Hakim expresses and narrates his interests, in terms of how he self-authors and is authored by others over time. He

stories himself as a child for whom the practices of his family and community are important. His science-related activities changed from Reception to Year 1 and towards the end of the study, Hakim reflects on the actions of his younger self. The ways that Hakim stories himself as leaving childish activities behind him runs as a theme through this case study.

### 7.3.1 The storying of Hakim at home: 'Grown up'

During an early visit to School B, I watched Hakim intently painting several pictures of houses. His finished pictures were laid out, one above the other, on the drying rack and there were several on display around the classroom. Most of his paintings were of houses and the photographs he took during my visit were of his pictures (Fig.9).

*Figure 9 Hakim's photographs, Visit 3, in April of Reception*

Zoe: So, tell me what kind of things do you enjoy doing at school?

Hakim: Painting and running in the playground.

Zoe: Anything else?

Hakim: Going on the bikes and climbing.

Zoe: What is it you like about being outside?

Hakim: Because it's my favourite.

Zoe: What do you like doing at home?

Hakim: More painting.

Zoe: You paint at home, yes, and what toys do you like playing with?

Hakim: I don't play with nothing. I've got a big grown up bike.

Zoe: Fantastic, and what do you like learning about?

Hakim: Fishes.

Zoe: Go on, tell me about fishes.

Hakim: To dive. I went to an aquarium last time and then I got some fishes.

Zoe: And how many fishes have you got at home?

Hakim: I've got more than a hundred fishes. I've got a big fish tank and I've got some food for them and I'm going to buy a dog.

Zoe: You're going to have a dog as well as fish?

Hakim: I'm going to sell my fish tank and get a dog.

(Interview with Hakim, Visit 2, in April of Reception)

Hakim expressed his interest in painting through his choice of photographs and in his two references to liking painting in this interview. Hakim told me that he liked learning about 'fishes', and both fish and dogs appeared multiple times in our future conversations. In addition, in several of his comments he positioned himself as 'grown up'. He said that he: did not play with his toys; had a 'big grown up bike'; and that he was planning to 'sell his fish tank and get a dog'. In the parents' questionnaire, his mother wrote:

1. *What does your child prefer to do during free play time?*

Hakim loves playing out on his bike, or likes doing role-play with his sister (shops, going on holiday, lawn mowing).

2. *If your child had 1 hour to do anything, what would he prefer to do?*

Hakim would prefer to be doing something with his dad in the garden, helping mend things or joinery.

(Initial parents' questionnaire for Hakim)

His mother storied Hakim as interested in doing things with his family, especially helping his father with adult activities. She also writes about his role-play of adults roles with his sister. In a school record book about Hakim, his mother provided her views on his strengths and interests when he started school:

*Child's strengths:* Hakim is artistic, always ready to get the craft materials out at home (drawing, painting, sticking). He is very helpful, always ready to join in and help me with anything I am doing. Hakim enjoys counting and making big estimations to millions and billions, he attempts to count to 100 and is doing well.

*Child's interests:* Hakim is very interested in construction and building things. His dad is a joiner. Hakim takes great interest in watching and helping his dad and grandad. Rather than playing with his toys, he takes great interest in gardening, mowing the lawn, growing fruit and vegetables, washing the car, cooking and baking. Hakim recently has been interested in experimenting – with ice, different materials, seeing which is stronger.

(Entry in school record book by Hakim's mother, in January of Reception)

It is notable that his mother begins her description of Hakim with a strong statement which attributes an essential characteristic to her son – 'Hakim is artistic'. Elsewhere, she repeats the words 'great interest' to emphasise her points about Hakim's general nature, underlining her comments about what her son likes to do at home by using words like 'very', 'always' and 'anything'. As with Isla's mother's entries in her *My Hopes and Dreams* booklet, Hakim's mother mentioned his academic progress (perhaps aware of the audience for her comment). She stresses that Hakim does not play with his toys, storying him as a child who prefers 'helping his dad or grandad' around the house and garden. According to Sfard and Prusak (2005:16), identity can be defined as 'narratives about individuals that are *reifying*, *endorsable* and *significant'*. Here, his mother's language reifies Hakim as a particular type of child. This identifying narrative is endorsed by Hakim, in other words, it is a story he tells about himself that reflects his mother's storying of him, particularly his self-positioning in terms of his membership of his family. Entries in my research diary included observations of Hakim building a house out of Lego, riding bikes and helping the adults to tidy up, which echo his mother's description of the activities he did at home.

Two weeks after Hakim started at school B, there is an entry in his school record book by his teacher, accompanied by the photograph in Figure 10.

> Hakim was using the wooden blocks in the outside area and was sat down. I asked him what he was making and he told me, 'It's a house. This is my workshop. My tools are here. It's not finished, I need to drill some holes and plaster the walls'. A little while later, he called me over and said 'It is finished. I have drilled the wall and done the plaster'.
>
> (Entry in school record book by Hakim's teacher, in January of Reception)

*Figure 10 Photograph in school record book of Hakim, in January of Reception*

The teacher's photograph (Fig.10) captured the moment when Hakim had finished building his house and was perched inside it. The construction of the house itself was elaborate, using planks and boxes of many different sizes and shapes. The school record book entry reflected Hakim's storying of himself as grown up, recording his use of words that are related to his father's profession as a joiner: 'workshop', 'tools', 'drill' and 'plaster'. The house is the subject of his paintings and construction, as well as the location for his imaginary play. Applying the practice theory of interest development, we can see that Hakim self-authors as someone interested in construction, especially building houses, and that this narrative of self is situated in the context of his family's shared activities, particularly his father's work.

A month later, I noted what Hakim was busy doing in my research diary:

> Hakim is working independently trying to make a model out of Meccano – he is trying to use the pictures of completed models included in the instructions – the kit is aimed at children age 8+ and looks complicated but this does not put him off.
>
> The Teaching Assistant asks children if they would like to plant some seeds. Hakim, Sunil and Bilal choose to do this. Hakim tells the teaching assistant that he has planted seeds before and that the seeds will grow roots and grow into plants.
>
> (Research Diary, Visit 4, in May of Reception)

My description of Hakim struggling with an activity intended for older children implies that I admired his perseverance, that the difficult model 'did not put him off'. When Hakim said that he had planted seeds before and knows that seeds 'grow into plants', he again positioned himself as having real world knowledge. My observations during this visit continued with the following entry:

> Hakim and Dharam are playing in the water area. They fill a large container with water, then push a smaller, empty container into the water and are delighted that all the water is displaced and spills out. They repeat this several times, so that they know what will happen and anticipate it with delight.
>
> (Research Diary, Visit 4, in May of Reception)

In this observation, the children were experimenting, carrying out a repetitive investigation regarding the capacity of different containers. Hakim's mother had also mentioned his interest in experimenting in the school record book and in the second parents' questionnaire (see below):

> 1. *What does your child prefer to do during free time?*
>
>    Hakim rarely will ever pick any of his toys to play with. He will always prefer to be making models out of boxes. A recent interest he has is water rockets, he's researching how he wants to make one.

2. *Does your child seem to have a focused interest (and what is it in)?*
   I think craft and art is his main interest. He also likes experimenting, freezing things, playdoh, water, paints, glue, mixing them together.
   (Second parents' questionnaire for Hakim)

As in her earlier entry in the school record book, Hakim's mother frames her son as someone who takes an active part in his interests by describing how he is 'making', 'researching', 'experimenting' and 'mixing'.

### 7.3.2 A virtual interest in science: 'I'm building my own house and I'm having dogs in it'

In the following year, I observed Hakim making potions, riding bikes and playing football. Hakim took the photographs in Figure 11 and I interviewed him about them at the end of the summer term of Year 1.


*Figure 11 Hakim's photographs, Visit 14, in July of Year 1*

Zoe: Have you got it, fantastic, great picture, so why the map and the globe?

Hakim: Because they match together.

Zoe: Yes they do, so why do you like the map and the globe?

Hakim: Because you can look at all the different parts of the world.

Zoe: Yes, anything else you like?

Hakim: The days.

Zoe: Yes, go ahead, you want to stand back, have you got them all in?

Hakim: Yes. I can say all of the days of the week in Punjabi.

Zoe: Can you? Very good. So, tell me, what do you enjoy doing at the moment. What do you like?

Hakim: Lots. Minecraft.

Zoe: Anything else, playing outside?

Hakim: No. Do you know where I do Minecraft?

Zoe: No.

Hakim: At home. Do you know what I'm building now?

Zoe: What are you building?

Hakim: I'm building my own house and I'm having dogs in it.

Zoe: On Minecraft?

Hakim: Yes.

Zoe: Cool, and what about in your garden, do you like being in your garden?

Hakim: No.

Zoe: Growing any plants?

Hakim: No, too hilly.

Zoe: Are you cooking?

Hakim: No.

Zoe: Are you doing any painting?

Hakim: No. That's all boring for me now.

(Interview with Hakim, Visit 14, in July of Year 1)

Hakim's choice of subjects to photograph presented a storying of self as having an interest in the world, which links to his ability to say the days of the week in Punjabi, positioning himself further as someone who is of Indian and Sikh heritage. He then took over the conversation from me and became the person asking the questions, perhaps because I did not follow up on his mention of the computer game Minecraft[3];

[3] Minecraft (released in 2011) is a popular game with primary age children in which players build constructions out of textured cubes that have different properties (Hobbs et al., 2017).

instead, I had tried to move on to a new topic, following my own agenda. He told me about the house he had constructed virtually on Minecraft and his plan for having dogs, which mirrored his plan to get a dog in the real world. After checking I had understood him correctly, I steered the conversation back to what I wanted to ask him. He rejected my suggestions in quick succession, stating his lack of interest in painting and using the telling phrase, 'that's all boring for me now'.

Analysing this brief phrase in detail, 'that's all' suggests he is talking about all of my previous questions - gardening, cooking and painting, and 'boring' is a definitive choice of words to describe his lack of interest. 'For me now' situates Hakim in the present, at six years old, reflecting on what he used to like doing when he was five years old, and distancing himself from his younger self. In the same way as when he was five years old, he asserted, 'I don't play with nothing. I've got a big grown up bike', Hakim's interest in Minecraft could be another example of how he is storying himself as growing up.

Three months later, we discussed his trip to Paris[4]:

> Zoe: So listen, in Show and Tell you talked about your trip to Paris. Why did you want to tell everyone about it?
> Hakim: Because I liked it.
> Zoe: What did you do?
> Hakim: I went swimming, and on a boat, and up the Eiffel Tower.
> Zoe: That sounds like a great trip. So thinking about what you're doing at the moment in school. What are you enjoying in school?
> Hakim: Ermmm… nothing.
> Zoe: Nothing? So what about at home. Do you remember we've talked before about your pets?
> Hakim: Pets?
> Zoe: Have you got any dogs or cats, or fish?

[4] See section 5.7.4, where I discuss an unexpected conversation about Paris.

Hakim: Yes, just one now. When I go into my own room, I'm going to have two goldfish this big. (Hakim spreads his arms wide to show the size of a large goldfish)

Zoe: And how big is the tank going to be?

Hakim: As big as this desk

Zoe: Yes, as big as this desk.

Hakim: And another half.

Zoe: Now Hakim, if we had some visitors from France, and I was going to introduce you to them…

Hakim: Where?

Zoe: If we had some visitors who came to visit the school from France…

Hakim: But I can't speak French.

Zoe: Its ok, they speak English. So I say, "Hello visitors, let me introduce you to Hakim, he's one of the pupils at this school, and he is…"So what would I say, how would I describe you? (Hakim looks puzzled) What's the thing you like doing the most? "Hakim is…" what would I say?

Hakim: Playing on my iPad.

(Interview with Hakim, Visit 15, in October of Year 2)

Whilst Hakim may have stopped painting, he continued to be interested in keeping fish, something he had mentioned in his first conversation with me. What seems significant for him in this interview is that he told me he will soon have a room of his *own* (another symbol of growing up) in which to keep the fish. When I attempted to get him to describe himself to a visitor, he was quick to point out that he cannot speak French, demonstrating his worldliness in knowing that visitors from France would speak another language. His final response indicated how important the iPad is to him. His parents and his teacher also told me that in Year 2 he enjoyed 'playing on his iPad'.

### 7.3.4 Summary of Hakim's case study

Whilst I have divided the case study of Hakim into two sections, the theme of him self-authoring as 'grown up' runs through both of them, as do his expressions of interest in fish, dogs and building houses. Applying the tenets of the practice theory of interest,

Hakim's interests and identities are situated in family life, and the adult undertakings of mowing the lawn, cooking and joinery are things that Hakim actively participates in (Chapter 8 discusses this in more detail). The community that he sees himself as part of is the Sikh community and he talks about India, 'our God' and speaking Punjabi in a way that suggest these things are important in his narrative of self. Hakim's interests are positional, in that his parents story him as a child who would rather make things and help the adults than play with his toys. Hakim's interest in Minecraft is strongly associated to the value he places on playing on his iPad, perhaps due to peer culture since Minecraft is a popular game. He has changed his practice, in terms of how he expresses his interests, from painting to gaming, but building houses is a persistent subject of his interest from the physical to the virtual world.

## 7.4 Robert

Robert stood out in my visits to School A as a child who self-authored as someone very interested in construction materials. His practice of building many different 3D structures spanned home and school.

### 7.4.1 Robert's self-authoring: 'I like making things'

My field notes about Robert record many occasions when he is intently creating 2-D and 3-D objects, giving these objects his sustained attention. The following exchange around Figure 12 provides an example of one of these objects and the imaginative properties that Robert gave it.

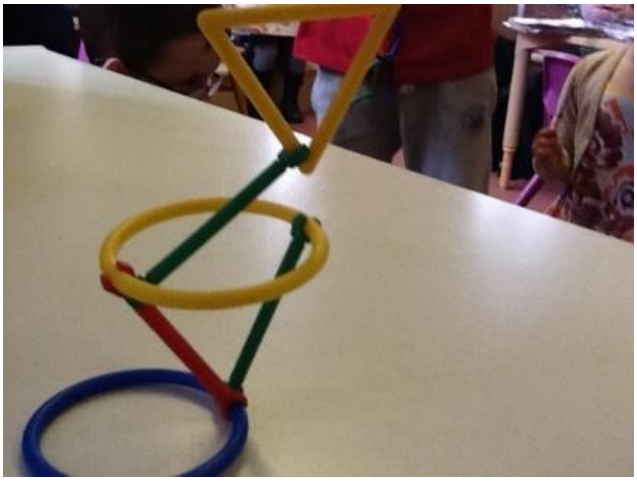


*Figure 12 Robert's photograph, Visit 3, in April of Reception*

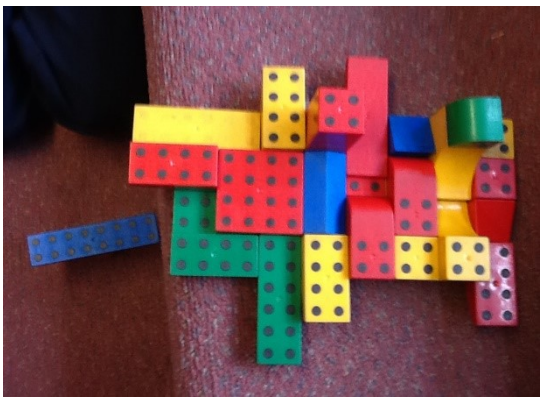
> Zoe: So, what have you made?
>
> Robert: A laser.
>
> Zoe: A laser, cool. What does it do?
>
> Robert: It makes things disappear and takes photos and it can fly around.
>
> Zoe: Great. So, what do you like learning about?
>
> Robert: I like making things.
>
> Zoe: You like making things, but what do you like learning about?
>
> Robert: I don't know.
>
> (Interview with Robert, Visit 3, in April of Reception)

Robert used the technical word 'laser' and described what his creation can do. This response was in sharp contrast to his answer to my next question about learning, which silenced him. He self-authored as someone who likes learning about making things, and so he had no answer to my question, which separated making things from learning. During each of my visits to Reception, where there were many opportunities for children to choose their activities, Robert was usually engrossed in making something. Notes from my next visit provide a second example:

> Robert is playing with the magnetic construction kit. Theo is also playing there. Sometimes the boys interact and other times they work on their

own, they continue the task for 30 minutes, then show me the 'skate park' they have made and Robert takes photos of it. He tells me he has Megablocks and Lego at home, which he likes to play with.

(Research Diary, Visit 4, in May of Reception)



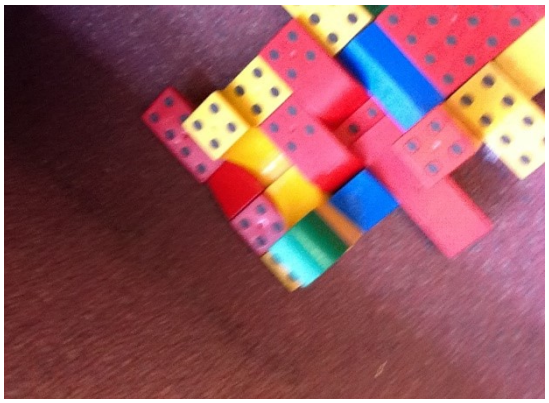


*Figure 13 Robert's photographs, Visit 4, in May of Reception*

As with the 'laser' (Fig.12), the 'skate park' (Fig.13) is another named structure Robert has built with abstract construction materials, and Robert explains that this is what he does at school and at home (in his description he mentions Megablocks, which are the equivalent of Lego for younger children).

His mother also authored him as a child who 'likes to build' in her responses to the parents' questionnaire:

1. *What does your child prefer to do during free play time?*

Robert likes to build and role-play with small world characters. He does like to watch TV but we limit this. Robert likes playing indoors mostly, but enjoys the outdoors once he is out.

2. *If your child had 1 hour to do anything, what would he prefer to do?*

He would play with his toys – could be anything, whatever he has out, or read a magazine.

3. *Does your child seem to have a focused interest (and what is it in)?*

He loves Octonauts (on CBBs) and loves to play with his Octonaut toys, making up his own stories and read the Octonaut magazine or fact file book.

(Initial parents' questionnaire for Robert)

Robert's mother uses 'we' to describe how she and his father control his time spent watching television – this is something a parent might say to a teacher to indicate performance of expected parenting behaviour; the same is perhaps true of her comment about the outdoors. In her opening phrase, 'Robert likes to build' she prioritised this particular activity.

As with our conversation about the skate park, Robert also mentioned Lego and making things in his *My Hopes and Dreams* booklet:

> *What do I like doing best at school?* I like the Lego, making things and skating fast.
> *Why?* I like Lego because I like building things. I like making magnetic things as they stick together and never break.
> *What do I like least about school?* I don't like musical instruments.
> *Why?* Because they are very noisy and I have to cover my ears.
>
> (Robert's entry, My Hopes and Dreams, entry 4)

Both Robert and his mother present making or building things as a timeless identifying narrative about Robert, with an emphasis on the process of making rather than the product. In the following entry in Robert's *My Hopes and Dreams* booklet, his mother writes:

> *What makes my child special?* He is imaginative and caring.
>
> *What do I think my child is good at?* Being creative, he is also quite independent. He is eager to learn and loves to read.
>
> (Robert's parents, My Hopes and Dreams, entry 5)

Robert's mother uses exactly the same phrase as Isla's mother does 'eager to learn'. In the *My Hopes and Dreams* booklets, it appears that parents tend to write stock phrases about attributes of a good student that teachers might want to hear, and from

this point of view the school record book represents a schooled version of their child. Robert's mother described him as 'imaginative', 'creative', 'quite independent' and 'caring' and in doing so, she turns his actions into attributes, authoring him with these characteristics (Sfard and Prusak, 2005).

Robert's photographs taken in March of Year 1 (Fig.14) are of three different types of construction materials. The Super Acrobats are what he was in the middle of building when I arrived in school, and the box of castle components and Lego tray were elsewhere in the open plan classroom. I started our conversation by asking him about his choice of subjects to photograph; his responses further illustrate his self-authoring as a child who likes to make things.


*Figure 14 Robert's photographs, Visit 12, in March of Year 1*

Zoe: So what was your favourite thing to photograph?

Robert: The castle.

Zoe: And why the castle?

Robert: Because you can build any castle you want out of it.

Zoe: And do you like castles?

Robert: Yes.

Zoe: And what about Lego, what can you build out of Lego?

Robert: You can build spaceships, you can build… (distracted by activity in the classroom) and in the K'Nex you can make whatever you want in the K'Nex.

Zoe: In the K'Nex, yes that's right. So what else have you made apart from a spaceship? What are you making at home?

Robert: I've made a Lego Movie garbage cruncher and a Lego Movie ice cream squirter and gun. The guns are lollies and the squirting thing can transform into the ice cream thing as well as the squirting.

(Interview with Robert, Visit 12, in March of Year 1)

Robert describes the properties of the Lego Movie models he has made at home and explained that he likes the castle and K'Nex[5], because 'you can make whatever you want'. He stories himself enthusiastically as a child who knows the endless possibilities for building by repeating the phrase 'you can'.

The following exchange occurred during my final visit to Year 2:

> Zoe: So, what is your favourite lesson at school?
>
> Robert: Maths.
>
> Zoe: Why's that?
>
> Robert: Because you do lots of number sentences and I'm really good at number sentences like those (*points to the wall*).
>
> Zoe: And what about science, do you like science?
>
> Robert: Yes, a bit.
>
> Zoe: So what do you think science is?
>
> Robert: Well, I'll say it was moving stuff like pushing and pulling, they are the big two groups, then there are smaller groups like winding and spinning.
>
> Zoe: Yes, so that's what you've been learning about at the moment, about forces, but more generally what's science? What would a scientist be doing?
>
> Robert: Well… (he pauses), I have been doing some science at home. I've been trying to make a Bob's Best that no one's been able to eat.
>
> Zoe: Bob's Best?
>
> Robert: Bob is my nickname.
>
> Zoe: I see. So no one else…?
>
> Robert: Can eat it, cos it's made out of salt, pepper, cinnamon and nutmeg.
>
> Zoe: You're making food that nobody else can eat?
>
> Robert: Yes, it's a kind of sauce that you put on that's supposed to be from Mars.
>
> Zoe: Wow, very good. So do you want to find out any more about science?

[5] K'Nex is a construction toy, designed for 5-12 year olds, which consists of interlocking plastic rods, connectors, wheels, and other components that can be used to build a wide variety of 3D models and machines (Gordon, 2016).

Robert: Well the next stage of science is to mix some liquids together.

Zoe: What liquids are you going to mix?

Robert: Soap and my own shampoo and my Dad's bubble bath and my little sister's bubble bath and my potion will make it all bubbly, so you can't see underwater, except for with goggles.

Zoe: Brilliant.

(Interview with Robert, Visit 15, in October of Year 2)

In this exchange, Robert provides a detailed description of what he thinks science is, positioning himself as something of a scientist in his response, 'I have been doing some science at home' when I asked about what a scientist would be doing. His account of making 'Bob's Best' – using his own name – associating his extra-terrestrial inedible sauce with science, demonstrates a sense of ownership and an authoring of self as experimenter. My response, 'Wow, very good', makes it clear to Robert that I approve of his concoction, and he carries on talking about how his experimenting is progressing from mixing solids to mixing liquids. His phrase 'the next stage of science' sounds rather authoritative, like something an adult might say.

In an email to me, at the end of Year 2, Robert's teacher provides further information about what she sees his interests as:

*What does he enjoy doing?* Robert enjoys playing imaginative games with other boys and girls in the class. He also sometimes enjoys spending time on his own.

*Does he have any special interests that he talks about?* Robert is interested in Lego and builds a lot of Lego at home. His Learning Log homework on 'Creativity' shared his interest of Lego; he had used his imagination to create his own models, which he then named. Robert also enjoys reading and finding out new information.

Email from Year 2 Teacher

His teacher uses the terms ‘imaginative’, ‘imagination’ and ‘create’ to story what type of child Robert is and again the process of building is emphasised, rather than what was built. In Reception, Robert played with Lego and other construction materials during free-flow play. Now he is in Year 2, he has written about his Lego building for a homework task, giving him the opportunity to link his practice at home with school.

### 7.4.1 Summary of Robert’s case study

Robert self-authors as someone who is interested in building 3D structures. His narrative of self, and his storying by others, presents a consistent image of a child whose identifying characteristic is of a person interested in construction (and particularly Lego), which it would seem that he has opportunity to express seamlessly at home and at school.

## 7.5 A funds of knowledge reading of the case studies

This final section of the chapter draws some threads together from the analysis of each child’s data, to show how the case studies illustrate contrasting funds of knowledge (González et al., 2006). The concept of funds of knowledge is a useful way to foreground the importance of context, in order to view interests as situated in children’s participation in everyday experiences, family activities and cultural practices (Hedges and Cooper, 2016). Children draw on funds of knowledge located in their family and community, and their actions can be perceived as symbolic of deeper interests (Chesworth, 2016).

My first observation is about the presence of implicit cultural and family values in the way parents storied their children’s interests. When asked what their children would do, given an hour of spare time, Hakim’s mother described him helping mend things with his father, whereas Robert’s mother wrote that he would play with his toys and Isla’s mother described Isla dressing up or playing board games. It would seem that the mothers are drawing on particular funds of knowledge when describing their children’s practice. Isla and Robert’s mothers refer to toys and games, whereas Hakim’s mother refers to participation in domestic activity and helping the adults. The case studies also reveal different discourses about the cultural construction of childhood (Wood, 2013),

whether it is a time to play with age-appropriate toys (in the case of Isla and Robert) or contribute to adult endeavours (in the case of Hakim).

Another interesting contrast is in how Robert and Hakim's practice of building things and expressions of interest in construction materials, such as Lego, might at first appearance seem to be similar practice. However, for Robert, the process of building structures is as important as the product, and the appeal of construction materials is that 'you can make whatever you want'. In contrast, Hakim's purpose when using construction materials was often to build houses and emulate his father's profession, which he role-plays by saying, 'It's a house. This is my workshop. My tools are here'.

The third observation is a comparison of how Isla and Robert write about themselves and their aspirations in their *My Hopes and Dreams* booklets (bearing in mind that their comments are scribed for them in a school record book, which lends itself to schooled ways of describing children). The final entry in Robert's *My Hopes and Dreams* booklet, which is written on his behalf at the end of Year 1, is in stark contrast to that written on Isla's behalf (see Table 3).

| **Question in *My Hopes and Dreams* booklet** | **Isla's responses** | **Robert's responses** |
|---|---|---|
| *I said that by the end of this year I hoped to be able to…* | get lots of house points and always write my name neatly. | get started on my bike by myself. |
| *Did this happen?* | I think I got loads of house points and I sometimes write my name neatly. Sometimes it's a bit big. | Yes, I can get on my bike on my own and ride it on the road. |
| *What would you like to do by this time next year?* | Read better and be better at doing big sums. | I would like to do some wheelies. |
| *Is your dream job still the same?* | No, now I want to be a teacher. | Yes, because I just love Octonauts. |

*Table 3 Comparison of two children's entries in My Hopes and Dreams booklets*

Isla self-authors as a *good student* in her entries by focusing on improving her handwriting and mathematics, wanting to get house points and being a teacher when she is older (the previous year, her dream job was to look after animals). On the other hand, none of Robert's responses are about looking studious; instead he confirms that his dream job is the same as it was the previous year (which was to collect Octonauts,

something his mother says he has a focused interest in). Isla's self-authoring appears to be more constrained in a school record book than Robert's is.

Through these case studies, I have portrayed the practices, identities and interests of three individual children. The case studies demonstrate that the way the three children self-author as interested in science is connected to the values and experiences of the community to which they belong. In the next and final chapter of this thesis, I bring together the key findings from the data analysis to address my research questions.

# Chapter 8 Discussion and Findings

## 8.1 Introduction

In this final chapter, I respond to the two research questions I introduced in Chapter 1, recapping on my stance with regards to the conceptualisation of interest in science, justifying why it should be understood through children's practice, and explaining what this tells us about the relationship between interests and identities. I argue against viewing children's interest in science as an essential characteristic that can be sparked in a predictable way by a fascinating science activity, on the grounds that children's interests are co-constructed with their identities, which are in turn co-constructed with significant others and based in culturally developed practices, beliefs and resources.

Following a discussion of theory and the outcomes of data analysis, I consider the limitations of this study, evaluate the multi-method approach that I used for data generation and make suggestions for future research. The chapter concludes with what I have learnt about myself as a researcher, key findings and the implications of the findings of this study for practitioners and the educational research community.

## 8.2 Addressing the research questions

As I argued in Chapter 3, if identity is the 'central means by which selves, and the sets of actions they organise, form and re-form over personal lifetimes' (Holland et al., 1998:271), then *being interested* is one of the actions that comes out of and feeds into the process of forming and re-forming identities. Therefore, the responses to my research questions are connected, since expressions of interest are part of children's self-authoring.

My first research question interrogated the ways in which children express their interest in science. Utilising ideas about funds of knowledge (González et al., 2006), this study has examined the symbolic meaning of children's interests, concluding that interest in science is situated within cultural practice. The second research question concerns the relationship between children's identities and interest in science. Focusing on concepts of self-authoring and (self-) positioning, my analysis presents

evidence that interest in science is a part of children's narratives of self, which are supplemented with storying by their parents and teachers.

### 8.2.1 Question 1. How do children express their interest in science between the ages of 5 and 7?

My conceptualisation of interest in this study is that it is a 'slippery concept' (Kintsch, 1992:xiii), analogous to the concept of energy. In the same way that physicists talk about only being able to see the effects of energy transfers, rather than energy itself, *pure* interest cannot be seen with certainty, but expressions of interest can be observed and invite interpretation. This interpretation cannot be definite, because children's expressions of interest are personal responses to the world based on previous experiences; therefore the epistemological stance that I have taken is that there is no single truth. Interest in science needs to be understood in terms of practice and this manifests itself through actions, but it is also the case that actions take place within contexts, to which children have to respond.

How can we understand the nature of children's expressions of interest if it is such a slippery concept? In this thesis, I have used the Mosaic approach (Clarke and Moss, 2011) as a methodology that generates different kinds of data with which to understand the story that a child may be trying to present. As the three case studies in Chapter 7 illustrate, children are not uniform; each individual child has different prior experiences and brings their own individual 'history in person' to a context (Holland and Lave, 2001:3). Hence, my theoretical approach focuses on a practice theory of interest. This has proved to be particularly helpful for exploring how children position themselves and are positioned and storied by others. Considering children's funds of knowledge enables a focus on the connections between the home and the child, and the symbolic meaning of their interests. I have looked beneath what children say they are interested in, in order to recognise the complexity of the cultural products and resources that children use to make self-definitions (Esteban-Guitart and Moll, 2014). For instance, the available identities in Isla's home are very different to those in Hakim's home. Isla's parents talk about Isla in a way that stories her as a child who cares for nature and enjoys feeding foxes, and Hakim's parents story him as a helpful child, who joins in with the tasks adults are doing, such as mending things.

Thus, my response to Research Question 1 is that children do not express their interest in science in isolation. Their practice and actions are resourced by the historically accumulated funds of identity on which they draw, and by their socially distributed home experiences (Esteban-Guitart and Moll, 2014). In school, teachers and parents appear to constrain some children through the expectation that they perform the 'schooled' (Baynham, 2004:286) learning dispositions of a good student, which often mean a focus on literacy and numeracy, rather than science. For instance, in the case study children's school record books, references to reading, writing and counting dominate the entries. Children's *My Hopes and Dreams* booklets do not seem to be about the child's aspirations; instead, entries are about *other people's* hopes and dreams about them, constrained by the way that the booklet lives in school, so that parents and teachers can only write what is available to them, which is a narrative of a schooled version of the child.

### 8.2.2 Question 2. What is the relationship between young children's identities and their expression of interest in science?

From a sociocultural perspective, identities are products of collective storytelling (Sfard and Prusak, 2005), rather than essential characteristics of the person. Children's expressions of interest in science are a part of their identity, and in this sense, are a component of their social practice, taking place in an intimate and social landscape (Holland et al., 1998). My analysis of the case studies in Chapter 7 raises the question – who is telling the story and what are they choosing to emphasise?

Analysis of the data, through the lens of a practice theory of interest, reveals the way that children and their parents tell stories in figured worlds (Holland et al., 1998). Parents story their children by describing their interests as essential components of their characters. Isla's father says about her interest in wildlife, that 'she's always been prone to it'; Hakim's mother writes; 'Hakim is artistic' and Robert's mother describes him as 'creative'. Isla's storying of herself to me is that she is someone who is very interested in animals and her father stories Isla as the kind of person who values wildlife and nature, against a background discourse of the importance of caring about the world.

Isla's self-authoring as being knowledgeable and interested in nature seems to be, for the most part, overlooked in school. The analysis of Isla's case record carries an intimation of the impact of discourses of gender. At school, Isla is storied by her teacher as 'one of those girls', who is 'quite quiet' and enjoys learning. While it is not possible to make strong claims about the role of gender discourses on the basis of three case studies, these findings suggest that this is something that warrants further study (see section 8.5).

Thus, my response to Research Question 2 is that children's expressions of interest in science are part of their self-authoring. Children use cultural signs and tools to story themselves and be storied by others, deeply embedded in family and school practices. However, the format of school appears to be constraining because it focuses on schooled learning dispositions, so that certain stories cannot be told.

## 8.3 The contribution of this work to our conceptualisation of development of interest in science

Whether children are, or are not, interested in science is of major concern to the science education community, due to evidence that interest wanes in older children, so that they do not pursue science subjects in further education or as a career (Potvin and Hasni, 2014). 'Make science interesting' has been a plea from government bodies (Ofsted, 2013:26) and a significant number of research studies are based on converting situational interest into individual interest (based on the four-phase model of interest development (Hidi and Renninger, 2006)).

Some initiatives that aim to promote children's engagement in science take a *cause and effect* approach that assumes that exposing children to science activities will trigger and sustain their interest in science (Jack and Lin, 2014). However, the analysis in this thesis shows that something in the environment cannot *demand* children's attention. Rather, being interested is an expression of children's self-authoring in a sociocultural context. Hence, I argue that we cannot *make* children interested in something. A linear model of interest development, such as Hidi and Renninger's (2006) four-phase model, suggests that the child progresses through predictable

phases. However, such a model does not account for the way that children's actions take place within social structures (Holland et al., 1998). Starting with the *interestingness* of a situation is looking at the concept of interest from the wrong direction. When children author identities, including what they are interested in, they perform combinations of behaviour and speech perceived as appropriate, using their histories as resources for these performances (Johnson et al., 2011).

Using children's questions as an example to illustrate the point, if one child in a group asks lots of questions when introduced to a novel science activity, this could be interpreted as that child having a greater intrinsic interest in science than the other children do. However, foregrounding identity provides an alternative interpretation, that the child has taken up a positional identity, based on prior experiences and cultural expectations, as someone who asks questions. It may be that another child in the group finds the science activity very interesting and does not ask any questions. In other words, interests, as part of children's identities, are perceived, enacted and represented within cultural worlds (Holland et al., 1998). Therefore, my argument is that we cannot talk about interest in science without considering cultural models of childhood and the importance of family practices. The implication for the science education community is to view development of interest in science as embedded in children's practice and be mindful of the way children's self-authoring is potentially being positioned or constrained by historical, cultural and social contexts.

## 8.4 Evaluation of the study and limitations

In this section, I evaluate the thoroughness of this study, identify limitations and make suggestions for improvements.

### 8.4.1. Conscious reflexivity

I have employed 'conscious reflexivity' (Lincoln and Guba, 1990:54) and reflected on my own personal experiences and my relationship with the school context and participants. I paid conscious attention to how my beliefs and history have shaped my study and how I have been shaped by it (Lichtman, 2013). I have been self-critical and acknowledged that the process of reporting a case study is intensely personal (Tracy,

2019). I have reflexively analysed data, consciously acknowledging the experiences and values that I bring and considered how these could bias my interpretation (Creswell, 2013). For example, I notice my proclivity for science analogies throughout this thesis, such as, references to a flat Earth, a vacuum, gravity and energy. In making my subjectivity explicit, I provide an audit trail so that even if the reader does not agree with the methodological decisions, theoretical framework and interpretations that I have made, they can follow the reasoning behind these decisions.

I have produced three case studies in response to my research questions, and analysed them through the lens of a practice theory of interest, rather than attempting to generalise from them (Gioia et al., 2013). I have written a 'thick, complex interpretation' (Denzin, 2012:84) of data with sufficient detail and clarity about the context of my project and my findings that other researchers can consider if the assertions that I make are relevant to the context that they are studying.

### 8.4.2 Limitations caused by the school-bound nature of the study

The data generated in my study are school bound, because all data, from parents, staff and children, were generated on school premises. I would like to have also spent time in children's family homes, for two main reasons. Firstly, the visits would have given children the opportunity to take photographs or give me a tour of the things that they enjoy and find interesting to do in and around their home, rather than just describing them to me, because talking to me whilst in school adds an additional filter to their story. For example, visiting Isla's household would give her the chance to show me the animal books she reads and her family's chickens. Robert's home contains all of his construction projects and 'Bob's Best' experiments, and Hakim could show me his plans to make water rockets and his virtual creations on Minecraft. This would have provided a more complex picture of children's self-authoring and provided an opportunity for me to see if they author differently at home and at school, and how they draw on artefacts at home.

Secondly, it would have given me the opportunity to spend time with children's parents, as I only had written communication with some of them. I did not meet Isla's mother face-to-face, because her father collected her from school, and I did not get

the chance to meet Hakim's parents, as he travelled to and from school by minibus. Conversations with parents in the family home could have potentially allowed space for them to talk in a different way about their children's expressions of interest, since carrying out the research at school appeared to constrain what they said in response to the parents' questionnaire. This would have added additional information to my data about the funds of knowledge that connect school, home and community (González et al., 2006). Talking on participants' home territory, rather than at school, may have also helped reduce the power imbalance between participants and researcher.

By spending time in the children's home, I could have further explored the differences in funds of knowledge and cultural constructions of childhood to which I refer to in response to Research Question 1. As described by Esteban-Guitart and Moll (2014), time immersed in the family home would have added depth to my narrative, and given me the opportunity to learn more about the lived experience and accumulated sociocultural knowledge of a household, in order to have a greater understanding of children's funds of identity.

### 8.4.3 Evaluation of my research plan

In addition to visiting children's homes, if I was to do this study again, I would have reduced the number of children taking part more rapidly; on reflection, starting with 16 children across two schools spread my resources and time too thinly – in terms of generating rich data – in the first six visits of the project. Quickly reducing the number of participants to three children at each school would have given me more time to spend with each child, enabling me to find out more about how they self-authored and are authored by their parents/teachers, and so contributing further to responding to Research Question 2.

In hindsight, if I could have spent longer generating data with each child, I would have been able to broaden my range of polyvocal tools to include more arts-based techniques, for example, self-portraits, providing a focus for reflective conversations and additional ways for children to communicate about their practice. This links to a

limitation of my study, that on occasions I rushed the data generation process. Reflecting on the transcripts of my conversations with children, I sometimes wish that I could have slowed myself down. There were several occasions when I moved onto the next question rather than giving children the space to expand on their answer. Talking to children during playtime, or when the rest of the class were doing something else, meant that interviews were sometimes time limited. I wanted to get the maximum from our dialogue, but in doing so, I rushed past points, when it would have been better to linger. In addition, sometimes the questions that I asked focused on assessing science subject knowledge: for example, when Isla talked about why she photographed a particular tree I asked her, 'Is it a conker tree?' and when she said that she had read a book about the animals on the African Plains I asked her, 'So what animals live on the African Plains?' My desire to assess Isla's subject knowledge is reminiscent of how I might question children as a teacher – a habit that I need to unlearn by being more aware that I am doing it.

### 8.4.4 Evaluation of the Mosaic approach

A multi-method approach to data generation worked well in accessing how children's storied their interests as part of their identity. However, a fundamental challenge in following the Mosaic approach (Clark and Moss, 2011), which is also one of its strengths, is that it advocates using multiple data generation strategies, including allowing children to communicate through non-linguistic media such as photographs. This is in the spirit of the Reggio Emilia philosophy that emphasises 'the hundred languages' of children (Rinaldi, 2001:51). Yet, as previously discussed in section 5.6.3, this sometimes left the task of analysing and interpreting the intentions of the child photographer to me. The Mosaic approach is intended to facilitate the co-construction of knowledge and understanding between participant and researcher, yet constructing knowledge with 5-year-olds brings the challenge of accessing an insider's perspective.

Reflecting on my personal experience of the Mosaic approach, I found that its use tends to lead to description of a case. In many studies that utilise this approach the case is the early years setting and the purpose of the study is to give children a right to respond about their experiences in the setting, and to enable adults to review their

current practice and implement change (Clarke, 2017). In many cases, it has 'proved to be a really practical tool' (Moss, 2017:9). It is this emphasis on practicality that I found made it somewhat atheoretical. I could not have progressed very far with data analysis without developing a practice theory of interest. Reading the work of Holland et al. (1998), Sfard and Prusak (2005), González et al. (2006) and Ortner (2006) enabled me to look beneath surface observation, categorisation and description, to engagement with theory and interpretation of self-authoring, positionality and discourses from a sociocultural perspective.

## 8.5 Suggestions for future study

In this thesis, I have developed a practice theory of interest that draws together ideas about figured worlds and funds of knowledge. I have also questioned the deficit model that seems to be implied in some initiatives aimed at encouraging under-represented groups into STEM subjects and careers. A potential area for future study would be to approach a STEM initiative from a different direction by starting with children's funds of identity (Esteban-Guitart and Moll, 2014). Working in collaboration with a school, the study would embrace children's funds of knowledge and build on them in school, rather than try to *fix* a lack of interest in some groups of children by *sparking* their interest in science. The study would bridge home and school, generating data with child and adult participants in both locations. The methodology for the proposed study would be based on the Mosaic approach and use multi-modal data generation tools, including arts-based methods, to allow participants to express layers of experiences and provide time for reflection (Bagnoli, 2009). Data generated in the family home would avoid prioritising adult household practices as the main unit of analysis by using techniques such as self-portraits and significant circle to focus on children's cultural signs and tools (Esteban-Guitart and Moll, 2014).

My proposal for further study builds on the findings reported here to recommend that teachers make the most of children's prior experiences and funds of identity as resources and approach STEM initiatives from this direction, as opposed to starting with activities involving stereotypically boys' toys such as Lego or K'Nex. There is a

large body of research exploring gender and science, in particular an entrenched gender gap between men and women in terms of science careers, especially in the physical sciences and engineering (Potvin and Hasni, 2014). Considering children's gender as part of how they self-author as interested (or not) in science from the perspective of a practice theory of interest was beyond the scope of my study, but warrants further exploration.

## 8.6 Implications for my future development as a researcher

I have learnt that my narrow educational background of studying science to degree level exacerbated the challenges that I encountered in beginning qualitative social science research. At the beginning of my research, I held some positivist assumptions, which I did not question, even assuming that they were *the correct way* of thinking about evidence and certainty of findings. These were so engrained that altering my viewpoint and opening up to other possibilities and ways of thinking has been a painful experience on occasions. I have also learnt about the siren song of frameworks such as diagrams showing phases of interest development, which imply that children acquire an interest in science in a predictable, linear manner. These appeared to be very inviting and reassuring at the start of the project, providing a comforting security blanket for my ideas. However, these frameworks also became a straightjacket into which I risked forcing my data to fit, restraining ambiguity (Brinkmann, 2014). In a similar way, qualitative data analysis software seduced me with promises of reliability and validity into over-coding data, rather than looking holistically and in depth.

Frameworks for theories or analyses do just that – they frame ideas, giving structure to a novice researcher, but also constraining thinking, driving it in a particular direction. Instead, I have learnt to work with theory in a different way. I have drawn on the work of others to develop my own theoretical framework and this includes a greater sense of flexibility because I have a better understanding and ownership of its complexity, allowing for a more nuanced interpretation of data. For the future, I would like to continue to develop a practice theory of interest by turning the 'make science interesting' agenda on its head, as described in section 8.5 (Ofsted, 2013:26).

## 8.7 Concluding points

This study contributes to a growing body of research that takes a sociocultural perspective on children's interest in science.

The key findings are:

- Children express their interest in science in terms of their practice.
- How children express their interest is deeply embedded in their narratives of self, which are intrinsically bound up with their self-authoring in family and school contexts.
- Interests, as a part of children's identity, are perceived, enacted and represented within discourses of imposed sociocultural meaning.

In this study, children expressed an interest in specific aspects of science, which has been noticed (and encouraged) by parents, but less so by school staff, and I recommend that primary teachers reflect on their own professional and science identities. The implications for practice are to give children more opportunities to express and follow their interests at school and for staff to consider how they story the children in their charge, particularly what they emphasise or marginalise in relation to performativity. I advocate that teachers instead value children's funds of identity and nurture their interests. The message of this thesis has been that we need to encourage children to be individuals and to develop personal interests, rather than feel that they must adopt stereotypical ways of behaving or thinking that limit their options in the present and future. For the science education research community, I caution against research methods that decontextualise children's interest in science. Children's identifying narrative determines their relationships with science, and viewing interest as expressed in children's practice acknowledges sociocultural context as paramount.

# References


Abd-El-Khalick, F., Bell, R.L. and Lederman, N.G. (1998) 'The nature of science and instructional practice: Making the unnatural natural'. *Science education*, *82*(4), pp.417-436.

Ainley, M. and Ainley, J. (2011) 'Student engagement with science in early adolescence: The contribution of enjoyment to students' continuing interest in learning about science'. *Contemporary Educational Psychology*, 36(1), pp.4-12.

Akkerman, S.F. and Bakker, A. (2019) 'Persons pursuing multiple objects of interest in multiple contexts'. *European Journal of Psychology of Education*, *34*(1), pp.1-24.

Alderson, P. and Morrow, V. (2006) 'Multidisciplinary research ethics review: Is it feasible?' *International Journal of Social Research Methodology, 9* (5), 405-417.

Alexander, J.M., Johnson, K.E. and Kelley, K. (2012) 'Longitudinal analysis of the relations between opportunities to learn about science and the development of interests related to science'. *Science Education*, 96(5), pp.763-786.

Alvesson, M. and Sandberg, J (2013) *Constructing Research Questions: Doing Interesting Research*, London: Sage.

Andresen, S., Diehm, I., Sander, U. and Ziegler, H. (eds.) (2010) *Children and the good life: new challenges for research on children* (Vol. 4), New York: Springer Science & Business Media.

Andrews, K.J. and Wang, X.C. (2017) 'Young children's emergent science competencies in family and school contexts: A case study'. *Early Child Development and Care*, pp.1-18.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2012) 'Science aspirations, capital, and family habitus: How families shape children's engagement and identification with science'. *American Educational Research Journal*, *49*(5), pp.881-908.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2013) ''Not girly, not sexy, not glamorous': primary school girls' and parents' constructions of science aspirations'. *Pedagogy, Culture & Society*, *21*(1), pp.171-194.

Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B. (2015) '"Science capital": A conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts'. *Journal of Research in Science Teaching*, *52*(7), pp.922-948.

Archer, L. (2019) *Primary Science Capital: A Whole School Teaching Approach*, Presentation at the International Primary Science Education Conference, Edinburgh, 7th June 2019.

Arthur, J., Kristjánsson, K., Cooke, S., Brown, E. and Carr, D. (2015) *The good teacher: understanding virtues in practice: research report,* Birmingham: University of Birmingham.

Aschbacher, P.R., Li, E. and Roth, E.J. (2010) 'Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine'. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *47*(5), pp.564-582.

Aubrey, C., David, T., Godfrey, R. and Thompson, L. (2000) *Early Childhood Educational Research, Issues in methodology and ethics*, London: Routledge Falmer.

Azevedo, F. S. (2011) 'Lines of practice: A practice-centered theory of interest relationships'. *Cognition and Instruction*, 29(2), pp.147-184.

Azevedo, F.S. (2018) 'An inquiry into the structure of situational interests'. *Science Education*, *102*(1), pp.108-127.

Bagnoli, A. (2009) 'Beyond the standard interview: The use of graphic elicitation and arts-based methods'. *Qualitative research*, *9*(5), pp.547-570.

Bakhtin, M. M. (1981) *The dialogic imagination: Four essays by MM Bakhtin*. Holquist, M (Ed.). Translated by Emerson, C and Holquist, M. Austin: University of Texas Press.

Baynham, M. (2004) 'Ethnographies of literacy', *Language and Education*, 18(4), pp. 286–92.

Bonnett, M. (2007) 'Environmental education and the issue of nature', *Journal of Curriculum Studies*, 39:6, pp.707-721.

Bergin, D.A. (2016) 'Social influences on interest'. *Educational Psychologist*, *51*(1), pp.7-22.

Berlyne, D. E. (1960) *McGraw-Hill series in psychology. Conflict, arousal, and curiosity.* New York: McGraw-Hill.

Bernauer, J.A., Lichtman, M., Jacobs, C. and Robinson, S. (2013) 'Blending the old and the new: Qualitative data analysis as critical thinking and using Nvivo with a generic approach'. *The Qualitative Report*, *18*(31), pp.1-10.

Berry, J. (1989) 'Imposed etics-emics-derived etics: The operationalisation of a compelling idea'. *International Journal of Psychology*, 24, pp.721-735.

Bourdieu, P. (1993) *The Field of Cultural Production: Essays on Art and Literature*. New York: Columbia University Press.

Brinkmann, S. (2014) 'Doing without data'. *Qualitative Inquiry*, *20*(6), pp.720-725.

British Association for Early Childhood Education (BAECE) (2012) *Development Matters in the Early Years Foundation Stage (EYFS),* Norwich: Crown Copyright.

British Educational Research Association (BERA) (2018) *Ethical guidelines for educational research,* 4th ed. www.bera.ac.uk (accessed 8.11.18)

Britsch, S. (2017) 'Exploring science visually: Science and photography with pre-kindergarten children'. *Journal of Early Childhood Literacy*, pp.1-27.

Brooker, L. (2011) 'Taking children seriously: An alternative agenda for research?' *Journal of Early Childhood Research*, 9(2), pp.137-149.

Brophy, S., Klein, S., Portsmore, M. and Rogers, C. (2008) 'Advancing engineering education in P-12 classrooms'. *Journal of Engineering Education*, *97*(3), pp.369-387.

Bruce, T. (2001) *Learning through play,* London: Hodder & Stoughton.

Buck, G. A., Plano Clark, V. L., Leslie-Pelecky, D., Lu, Y. and Cerda-Lizarraga, P. (2008) 'Examining the cognitive processes used by adolescent girls and women in identifying science role models: A feminist approach'. *Science Education*, 92(4), pp.688–707.

Chaiklin, S. (2003) 'The zone of proximal development in Vygotsky's analysis of learning and instruction'. *Vygotsky's educational theory in cultural context*, *1*, pp.39-64.

Chalmers, A.F. (2013) *What is this thing called science? 4th ed.* Indianapolis: Hackett Publishing.

Chesworth, L., (2016) 'A funds of knowledge approach to examining play interests: listening to children's and parents' perspectives'. *International Journal of Early Years Education*, *24*(3), pp.294-308.

Chesworth, L. (2018) 'Embracing uncertainty in research with young children', *International Journal of Qualitative Studies in Education*, 31:9, pp.851-862.

Clark, A. and Moss, P. (2005) *Spaces to play: More listening to young children using the Mosaic approach*, London: National Children's Bureau.

Clark, A. and Moss, P. (2011) *Listening to young children: The Mosaic approach,* 2nd ed. London: National Children's Bureau.

Clark, A. (2017) *Listening to Young Children, Expanded Third Edition: A Guide to Understanding and Using the Mosaic Approach*. London: Jessica Kingsley Publishers.

Cohen, L., Manion, L. and Morrison, K. (2017) *Research methods in education,* 8th ed. London: Routledge.

Colliver, Y. (2017) 'From listening to understanding: interpreting young children's perspectives'. *European Early Childhood Education Research Journal*, *25*(6), pp.854-865.

Conlin, L.D., Richards, J., Gupta, A. and Elby, A. (2015) *"Bring it on": Explaining persistence in science at the intersection of identity and epistemology*. https://arxiv.org/ftp/arxiv/papers/1502/1502.04421.pdf (accessed 13.10.18)

Cooley, C.H. (1902) *Human Nature and the Social Order*, New York: Scribner's.

Cooper, V. (2014) 'Children's developing identity'. *In* Reed, M and Walker, R. (eds.) *A Critical Companion to Early Childhood*, London: Sage, pp.281-295.

Cowie, H., Huser, C. and Myers, C-A. (2014) 'The Use of Participatory Methods in Researching the Experiences of Children and Young People'. *Croatian Journal of Education*, 16(2), pp.51-66.

Creswell, J. (2013) *Qualitative inquiry and research design,* 3rd ed. London: Sage.

Crompton, Z. (2013) 'What is science? Some research from primary schools'. *Education in Science*, 253, pp.12-13.

Crouch, C. H., Wisittanawat, P., Cai, M., and Renninger, K. A. (2018) 'Life science students' attitudes, interest, and performance in introductory physics for life sciences (IPLS): An exploratory study'. *Physical Review Physics Education Research,* 14(1), pp.1–14.

Dahlberg, G., Moss, P. and Pence, A. (2007) *Beyond quality in early childhood education and care: Languages of evaluation*. London: Routledge.

Dawson, E., Archer, L., Seakins, A., Godec, S., DeWitt, J., King, H., Mau, A. and Nomikou, E., (2019) 'Selfies at the science museum: exploring girls' identity performances in a science learning space'. *Gender and Education*, pp.1-18.

De Haan, E. (2011) *Relational coaching: Journeys towards mastering one-to-one learning*. John Wiley & Sons.

DeLoache, J.S., Simcock, G. and Macari, S. (2007) 'Planes, trains, automobiles – and tea sets: Extremely intense interests in very young children'. *Developmental psychology*, *43*(6), pp.1579-1586.

Denzin, N.K. (2012) 'Triangulation 2.0'. *Journal of mixed methods research*, *6*(2), pp.80-88.

Department for Education (2011) *Teachers' standards*, London: Crown Copyright. https://www.gov.uk/government/publications/teachers-standards (accessed 13.10.18).

Department for Education (2013) *National Curriculum in England: Primary Curriculum*, London: Crown Copyright.

Department for Education (2016) *Education Excellence Everywhere,* https://www.gov.uk/government/publications/department-for-education-single-departmental-plan-2015-to-2020/single-departmental-plan-2015-to-2020#educational-excellence-everywhere (accessed 13.10.18)

Department for Education (DfE) (2017) *Statutory framework for the early years foundation stage*, London: Crown Copyright.

Dewey, J. (1896) *Interest in relation to training of the will*, Public School Publishing Company.

Dewey, J. (1913) *Interest and Effort in Education*, Boston: Riverside Press.

Dohn, N.B. (2013) 'Situational interest in engineering design activities'. *International Journal of Science Education*, *35*(12), pp.2057-2078.

Driver, R., Asoko, H., Leach, J., Scott, P. and Mortimer, E. (1994) 'Constructing scientific knowledge in the classroom'. *Educational researcher*, 23(7), pp.5-12.

Duffy, G. and Bowe, B. (2014) 'An analysis of consistency in, and between, ontology, epistemology and philosophical perspective as contained studies of the first year experience'. *Frontiers in Education Conference*, pp.1-7.

Ebrahim, H.B. (2010) 'Situated ethics: possibilities for young children as research participants in the South African context'. *Early Child Development and Care*, 180(3), pp.289-298.

Edwards, A. (2004) 'Understanding context, understanding practice in early education'. *European Early Childhood Education Research Journal*, *12*(1), pp.85-101.

Einarsdóttir, J. (2007) 'Research with children: Methodological and ethical challenges'. *European early childhood education research journal*, *15*(2), pp.197-211.

Ellingson, L.L. (2014) '"The truth must dazzle gradually" Enriching relationship research using a crystallization framework'. *Journal of Social and Personal relationships*, *31*(4), pp.442-450.

Esteban-Guitart, M. and Moll, L.C. (2014) 'Funds of identity: A new concept based on the funds of knowledge approach'. *Culture & Psychology*, *20*(1), pp.31-48.

Fieldwork Education (2014) *The International Primary Curriculum* http://www.greatlearning.com/ipc/ (accessed 1.6.17)

Fink, B. (1991) 'Interest Development as Structural Change in Person-Object Relationships'. *In* Oppenheimer, L. and Valsiner, J. *The Origins of action,* New York: Springer, pp.175-204.

Fisher, C.B. (2005) 'Deception Research Involving Children: Ethical Practices and Paradoxes'. *Ethics and Behaviour*, 15(3), pp.271-287.

Fleer, M. (2006) 'The cultural construction of child development: Creating institutional and cultural intersubjectivity'. *International Journal of Early Years Education*, *14*(2), pp.127-140.

Flewitt, R. (2005) 'Conducting research with young children: some ethical considerations', *Early Child Development and Care*, 175(6), pp.553-565.

Foucault, M. (1980) *Power/Knowledge: Selected Interviews and Other Writings 1972-1977*. New York: Pantheon Books.

Gallacher, L.A. and Gallagher, M. (2008) 'Methodological immaturity in childhood research? Thinking through participatory methods'. *Childhood*, *15*(4), pp.499-516.

Gardner, P. (1996) *Students' interests in science and technology: Gender, age and other factors*, International Conference on Interest and Gender: Issues of Development and Change in Learning, Seeon, Germany.

Gilbert, L. S. (2002) 'Going the distance: 'Closeness' in qualitative data analysis software'. *International Journal of Social Research Methodology*, 5(3), pp.215–228.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013) 'Seeking qualitative rigor in inductive research: Notes on the Gioia methodology'. *Organizational Research Methods*, *16*(1), pp.15-31.

Goldsworthy, A. and Feasey, R. (1997) *Making Sense of Primary Science Investigations,* Hatfield: ASE

González, N., Moll, L.C. and Amanti, C. (eds.) (2006) *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. London: Routledge.

Gordon, A.P. (2016) *Building a Pathway to Engineering for Our Daughters – Brick by Brick.* UCF Today, https://today.ucf.edu (Accessed on 4.5.19)

Gray, C. and Murray, J. (2017) New theories warrant new research approaches: extending the toolbox of methods for research with young children, *International Journal of Early Years Education*, 25(3), pp.221-224.

Greenfield, C. (2007) 'What is it about the monkey bars?' *Early Childhood Folio*, *11*, pp.31-36.

Griffin, K.M., Lahman, M.K. and Opitz, M.F. (2016) 'Shoulder-to-shoulder research with children: Methodological and ethical considerations'. *Journal of Early Childhood Research*, *14*(1), pp.18-27.

Grossnickle, E.M. (2016) 'Disentangling curiosity: Dimensionality, definitions, and distinctions from interest in educational contexts'. *Educational Psychology Review*, *28*(1), pp.23-60.

Guillemin, M. and Gillam, L. (2004) 'Ethics, reflexivity, and "ethically important moments" in research'. *Qualitative inquiry*, *10*(2), pp.261-280.

Hallowell, A.I. (1955) *Culture and experience*. Baltimore, Maryland: University of Pennsylvania Press.

Haeussler, P. and Hoffmann, L. (2000) 'A curricular frame for physics education: Development, comparison with students' interests, and impact on students' achievement and self-concept'. *Science Education, 84*, pp.689-705.

Harcourt, D. and Conroy, H. (2005) 'Informed assent: ethics and processes when researching with young children'. *Early Child Development and Care*, 175(6), pp.567-577.

Harding, J. (1996) 'Science in a masculine straitjacket'. *Gender, science and mathematics: Shortening the shadow*, pp.3-16.

Harlen, W. (ed.) (2010) *Principles and big ideas of science education*. Hatfield: Association for Science Education.

Hawkes K. (2017) 'Research with Children'. *In* McNae R., Cowie B. (eds.) *Realising Innovative Partnerships in Educational Research*. *Theories and Methodologies for Collaboration*.

Hedges, H. and Cullen, J. (2005) 'Subject knowledge in early childhood curriculum and pedagogy: Beliefs and practices'. *Contemporary issues in early childhood*, *6*(1), pp.66-79.

Hedges, H. (2007) *Funds of knowledge in early childhood communities of inquiry: a thesis presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Education*. Massey University, New Zealand.

Hedges, H. and Cooper, M. (2016) 'Inquiring minds: theorizing children's interests'. *Journal of Curriculum Studies*, *48*(3), pp.303-322.

Hidi, S. (2006) 'Interest: A unique motivational variable', *Educational Research Review,* 1, pp.69-82.

Hidi, S. and Renninger, K. A. (2006) 'The four-phase model of interest development'. *Educational Psychologist*, 41, pp.111-127.

Hobbs, L., Stevens, C. and Hartley, J. (2017) 'Science Hunters – science learning through Minecraft', *Education in Science*, 268, pp.20-21.

Hofer, M. (2010) 'Adolescents' development of individual interests: A product of multiple goal regulation?' *Educational Psychologist*, *45*(3), pp.149-166.

Holland, D., Lachicotte Jr., W., Skinner, D. and Cain, C. (1998) *Figured Worlds. Identity and agency in cultural worlds*, Cambridge: Harvard University Press.

Holland, D. and Lave, J. (2009) 'Social practice theory and the historical production of persons'. *Actio: An international journal of human activity theory*, 3(2), pp.1-15

Holland, S., Renold, E., Ross, N.J. and Hillman, A. (2010) 'Power, agency and participatory agendas: A critical exploration of young people's engagement in participative qualitative research'. *Childhood*, *17*(3), pp.360-375.

Holquist, Michael (1990) *Dialogism: Bakhtin and his world*. London: Routledge.

Homan, R. (2001) 'The Principle of Assumed Consent: the Ethics of Gatekeeping'. *Journal of Philosophy of Education*, 35(3), pp.329-343.

Iran-Nejad, A. and Cecil, C. (1992) *Interest and learning: A biofunctional perspective*. *In* Renninger, K. A., Hidi, S., Krapp, A. (eds.) *The role of interest in learning and development*. New York: Psychology Press, pp.297-332.

Jack, B.M. and LIN, H.S. (2014) 'Igniting and sustaining interest among students who have grown cold toward science'. *Science Education*, *98*(5), pp.792-814.

James, W. (1890) *The principles of psychology* (Vol. 1), New York: Holt.

James, A. and Prout, A. (eds.) (2015) *Constructing and reconstructing childhood: Contemporary issues in the sociological study of childhood*. London: Routledge.

Jensen, E. (2014) 'The problems with science communication evaluation'. *Journal of Science Communication*, *1*, pp.C04.

Johnson, A., Brown, J., Carlone, H. and Cuevas, A.K. (2011) 'Authoring identity amidst the treacherous terrain of science: A multiracial feminist examination of the journeys of three women of color in science'. *Journal of Research in Science Teaching*, *48*(4), pp.339-366.

Kashdan, T. B., Rose, P., and Fincham, F. D. (2004) 'Curiosity and exploration: facilitating positive subjective experiences and personal growth opportunities'. *Journal of Personality Assessment*, 82, pp.291-305.

Kashdan, T. B. and Roberts, J. E. (2004) 'Trait and state curiosity in the genesis of intimacy: differentiation from related constructs'. *Journal of Social and Clinical Psychology*, 32, 792–816.

Kintsch, W. (1992) *Foreword*, *In* Renninger, K. A., Hidi, S., Krapp, A. (eds.) *The role of interest in learning and development*. New York: Psychology Press, pp.xiii-xiv.

Krapp, A. (2000) 'Interest and human development during adolescence: An educational-psychological approach'. *In* J. Heckhausen (ed.) *Motivational Psychology of Human Development,* London: Elsevier, pp.109-127.

Krapp, A. (2002) 'Structural and dynamic aspects of interest development: Theoretical considerations from an ontogenetic perspective'. *Learning and instruction*, *12*(4), pp.383-409.

Krapp, A., Hidi, S. and Renninger, K. A. (1992) 'Interest, learning and development'. *In* Renninger, K. A., Hidi, S., Krapp, A. (eds.) *The role of interest in learning and development*. New York: Psychology Press, pp.3-25.

Krapp, A. and Prenzel, S. (2011) 'Research on Interest in Science: Theories, methods, and findings'. *International Journal of Science Education*, 33(1), pp.27-50.

Krefting, L. (1991) 'Rigor in qualitative research: The assessment of trustworthiness'. *American journal of occupational therapy*, *45*(3), pp.214-222.

Langsted, O. (1994) 'Looking at quality from the child's perspective'. *Valuing quality in early childhood services: New approaches to defining quality*, pp.28-42.

Lawler, E. J. (2008) 'An Affect Theory of Social Exchange'. *American Journal of Sociology*, 107(2), pp.321-352.

Leary, M.R. and Tangney, J.P. (eds.) (2011) *Handbook of self and identity*. London: Guilford Press.

Leibham, M.B., Alexander, J.M. and Johnson, K.E. (2013) 'Science interests in preschool boys and girls: Relations to later self-concept and science achievement'. *Science Education*, 97(4), pp.574-593.

Lemke, J. L. (2008) 'Identity, development, and desire'. *In* Caldas-Coulthard, C. R. and Ledema, R. (eds.) *Identity trouble: Critical discourse and contested identities,* London: Palgrave/MacMillan, pp.17-42.

Lichtman, M. (2013) *Qualitative research for the social sciences*. London: Sage.

Lieberman, M.D. (2007) 'Social cognitive neuroscience: a review of core processes'. *Annual Review Psychology*, 58, pp.259-289.

Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic inquiry*, Beverly Hills, CA: Sage.

Lincoln, Y. S. and Guba, E. G. (1990) 'Judging the quality of case study reports'. *International Journal of Qualitative Studies in Education*, 3(1), pp.53-59.

Litman, J.A. (2008) 'Interest and deprivation factors of epistemic curiosity'. *Personality and individual differences*, *44*(7), pp.1585-1595.

Luce, M.R. and Hsi, S. (2015) 'Science-relevant curiosity expression and interest in science: an exploratory study'. *Science Education*, *99*(1), pp.70-97.

Macdonald, A. (2014) ''Not for People like Me?' Under-represented Groups in Science, Technology and Engineering: A Summary of the Evidence: The Facts, the Fiction and What We Should Do Next'. *Women in Science and Engineering Campaign*.

MacLure, M. (2013) 'Classification or wonder? Coding as an analytic practice in qualitative research'. *Deleuze and research methodologies*, pp.164-183.

Maltese, A.V. and Tai, R.H. (2010) 'Eyeballs in the fridge: Sources of early interest in science'. *International Journal of Science Education*, *32*(5), pp.669-685.

Mantzicopoulos, P., Samarapungavan, A. and Patrick, H. (2009) '"We learn how to predict and be a scientist": Early science experiences and kindergarten children's social meanings about science'. *Cognition and Instruction*, *27*(4), pp.312-369.

Maxwell, J.A. (2012) *Qualitative research design: An interactive approach* (Vol. 41). London: Sage.

Mayne, F., Howitt, C. and Rennie, L. (2016) 'Meaningful informed consent with young children: Looking forward through an interactive narrative approach'. *Early Child Development and Care*, *186*(5), pp.673-687.

Mead, G. H. (1934) *Mind, self and society from the standpoint of a social behaviourist*, Chicago: University of Chicago Press.

Medin, D.L. and Bang, M. (2014) *Who's asking?: Native science, western science, and science education*. London: MIT Press.

Merewether, J. (2018) 'Listening to young children outdoors with pedagogical documentation'. *International Journal of Early Years Education*, pp.1-19.

Millard, E. and Bhojwani, P. (2012) 'Gender and early childhood literacy'. In Larson, J. and Marsh, J. (Eds.) *The SAGE Handbook of Early Childhood Literacy*, London: Sage, pp.35-51.

Ministry of Education (2016) *Te Whāriki: Aotearoa New Zealand's early childhood curriculum, draft for consultation*, Crown Copyright: Wellington.

Moll, L.C., Amanti, C., Neff, D. and Gonzalez, N. (1992) 'Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms'. *Theory into practice*, *31*(2), pp.132-141.

Morse, J.M. (2015) 'Critical analysis of strategies for determining rigor in qualitative inquiry'. *Qualitative health research*, 25(9), pp.1212-1222.

Moss, P. (2014) *Transformative Change and Real Utopias in Early Childhood Education: A Story of Democracy, Experimentation and Potentiality*, London: Routledge.

Moss, P. (2017) *Foreword*, *In* Clark, A. (2017) *Listening to Young Children, Expanded Third Edition: A Guide to Understanding and Using the Mosaic Approach*. London: Jessica Kingsley Publishers, pp.9-10.

Mujtaba, T. and Reiss, M. (2013) 'What Sort of Girl Wants to Study Physics After the Age of 16? Findings from a Large-scale UK Survey', *International Journal of Science Education*, 35(17), pp.2979-2998.

Naylor S., Keogh B., Downing, B., Maloney, J. and Simon, S. (2007) 'The Puppets Project: using puppets to promote engagement and talk in science'. *In* Pinto, R. and Couso, D. (eds.) *Contributions from Science Education Research*, London: Springer, pp.289-296.

Neitzel, C. L., Alexander, J. M. and Johnson, K. E. (2008) 'Children's early interest based activities in the home and subsequent information contributions and pursuits in kindergarten'. *Journal of Educational Psychology*, 100, pp.782-797.

Nicolini, D. (2012) *Practice theory, work, and organization: An introduction*. Oxford: Open University Press.

Nolen, S.B. (2007) 'Young Children's Motivation to Read and Write: Development in Social Contexts', *Cognition and Instruction*, 25(2), pp.219-270.

Nolen, S.B. and Ward, C.J. (2008) 'Sociocultural and situative approaches to studying motivation'. *In* Maehr, M., Karabenick, S. and Urdan, T. (eds.) *Advances in motivation and achievement Volume 15 Social Psychological Perspectives*, Bingley: Emerald Group Publishing Limited, pp.425-460.

Ofsted (2013) *Maintaining Curiosity: A Survey into Science Education in Schools*. London: Crown Copyright.

Ofsted (2017) *School A Ofsted Inspection report* https://reports.ofsted.gov.uk (accessed 1.3.18)

Ofsted (2015) *School B Ofsted Inspection report* https://reports.ofsted.gov.uk (accessed 1.6.17)

Oppermann, E., Brunner, M., Eccles, J.S. and Anders, Y. (2018) 'Uncovering young children's motivational beliefs about learning science'. *Journal of Research in Science Teaching*, *55*(3), pp.399-421.

Ortner, S.B. (2006) *Anthropology and social theory: Culture, power, and the acting subject*. Durham, USA: Duke University Press.

Osborne, J. and Dillon, J. (2008) *Science education in Europe: Critical reflections* (Vol. 13). London: The Nuffield Foundation.

Palmer, D. A., Dixon, J., and Archer, J. (2017) 'Using situational interest to enhance individual interest and science-related behaviours'. *Research in Science Education,* 47(4), pp.731-753.

Paradise, R. and Rogoff, B. (2009) 'Side by side: Learning by observing and pitching in'. *Ethos*, 37, pp.102-138.

Parsons, S., Sherwood, G. and Abbott, C. (2016) 'Informed consent with children and young people in social research: is there scope for innovation?' *Children & society*, *30*(2), pp.132-145.

Patrick, H. and Mantzicopoulos, P. (2015) 'Young children's motivation for learning science'. *In* Trundle, K.C. and Saçkes, M. (eds.) *Research in early childhood science education*. Dordrecht: Springer, pp.7-34.

Pattison, S.A., Svarovsky, G.N., Corrie, P., Benne, M., Nuñez, V., Dierking, L.D. and Verbeke, M. (2016) *Conceptualizing early childhood STEM interest development as a distributed system: A preliminary framework*, National Association for Research in Science Teaching Annual Conference, Baltimore, Maryland.

Park, H. (2015) *Learning Identity: A Sociocultural Perspective*. Adult Education Research Conference 2015, Conference Proceedings, Manhattan, Kansas State.

Pendlebury, S. and Enslin, P. (2001) 'Representation, Identification and Trust: Towards an Ethics of Educational Research'. *Journal of Philosophy of Education*, 35(3), pp.361-70.

Peshkin, A. (1988) 'In search of subjectivity—one's own'. *Educational researcher*, *17*(7), pp.17-21.

Phillips, R. (2014) 'Space for curiosity'. *Progress in Human Geography*, 38(4), pp.493-512.

Pope, D. (2007) 'Peshkin's problematics: teaching the nature of interpretation in qualitative research'. *Qualitative Research Journal*, *6*(2), p.173.

Potvin, P. and Hasni, A. (2014) 'Interest, motivation and attitude towards science and technology at K-12 levels: A systematic review of 12 years of educational research'. *Studies in Science Education*, 50(1), pp.85-129.

Prenzel, M., Krapp, A. and Schiefele, H. (1986) 'Basic features of an educational theory of interest', *Journal of Education*, *32* (2), 163-173.

Pressick-Kilborn, K. (2015) 'Canalization and connectedness in the development of science interest'. In Renninger, K. A., Nieswandt, M. and Hidi, S., (eds.) *Interest in mathematics and science learning*. Washington: American Educational Research Association, pp.353-368.

Pressick-Kilborn, K., Sainsbury, E. and Walker, R. (2005) 'Making sense of theoretical frameworks and methodological approaches: Exploring conceptual change and interest in learning from a sociocultural perspective'. *The Australian Educational Researcher*, *32*(2), pp.25-47.

Prout, A. (2005) *The Future of Childhood: towards the interdisciplinary study of children*. London: RoutledgeFalmer.

QSR (2014) *Introducing NVivo10* http://www.qsrinternational.com/products_nvivo.aspx (accessed 1.8.17)

Rautio, P. (2013) 'Children who carry stones in their pockets: On autotelic material practices in everyday life'. *Children's Geographies*, *11*(4), pp.394-408.

Reio, T. G., Petrosko, J. M., Wiswell, A. K., and Thongsukmag, J. (2006) 'The measurement and conceptualization of curiosity'. *The Journal of Genetic Psychology*, 167(2), pp.117-135.

Renninger, K. A., Bachrach, J. and Hidi, S. (2018) 'Triggering and maintaining interest in early phases of interest development', *Learning Culture and Social Interaction,* in press.

Renninger, K. A. (1992) 'Individual interest and development: Implications for theory and practice'. *In* Renninger, K. A., Hidi, S. and Krapp, A. (eds.) *The role of interest in learning and development* London: Psychology Press, pp.361-398.

Research Ethics and Governance (2016) *Ethical Framework,* Manchester Metropolitan University http://www2.mmu.ac.uk/research/our-research/ethics-and-governance/ethics/ (accessed 12.11.16)

Richard, V. and Bélange, M. (2018) 'Accepting research: Teachers' representations of participation in educational research projects'. *International Journal of Educational Methodology*, *4*(2), pp.61-73.

Richards, J., Conlin, L., Gupta, A. and Elby, A. (2013) 'Coupling epistemology and identity in explaining student interest in science'. *In American Institute of Physics (AIP) Conference Proceedings,* 1513(1) pp. 334-337.

Rinaldi, C. (1993) 'The emergent curriculum and social constructivism'. *The hundred languages of children: The Reggio Emilia approach to early childhood education*, pp.101-111.

Rinaldi, C. (2001) 'Reggio Emilia: The image of the child and the child's environment as a fundamental principle'. *Bambini: The Italian approach to infant/toddler care*, pp.49-54.

Rinaldi, C. (2006) *In Dialogue with Reggio Emilia: Listening, Researching and Learning*. London: Routledge.

Rogoff, B. (1998) 'Cognition as a collaborative process'. *In* Damon, W. (ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language.* Hoboken, NJ, US: John Wiley & Sons Inc., pp. 679-744.

Rogoff, B. (2003) *The cultural nature of human development*. Oxford: Oxford University Press.

Rose, G. (2016) *Visual methodologies: An introduction to researching with visual materials*. London: Sage.

Rotgans, J.I. and Schmidt, H.G. (2017) 'Interest development: Arousing situational interest affects the growth trajectory of individual interest'. *Contemporary Educational Psychology*, *49*, pp.175-184.

Schiefele, U. (1991) 'Interest, learning, and motivation'. *Educational psychologist*, *26*(3-4), pp.299-323.

Schiefele, U. (2009) *Situational and Individual Interest. In* Wentzel, K. and Wigfield, A. (eds.) *Handbook of Motivation at School*, London: Routledge, pp.197-222.

Schiller, W. and Einarsdottir, J. (2009) 'Listening to young children's voices in research–changing perspectives/changing relationships'. *Early Child Development and Care,* 179(2), pp.125–130.

Schmitt, F.F. and Lahroodi, R. (2008) 'The epistemic value of curiosity'. *Educational Theory*, *58*(2), pp.125-148.

Schunk, D.H., Pintrich, P.R. and Meece, J.L. (2013) *Motivation in Education: Theory, Research and Applications,* 4th ed. London: Pearson.

Scribner, S. (1997) 'A sociocultural approach to the study of mind'. In Tobach, E., Falmangne, R., Parlee, M., Martin, L. and Kapelman, A. (eds.) *Mind and social practice: Selected writings of Sylvia Scribner.* New York: Cambridge University Press, pp. 266-280.

Sfard, A. and Prusak, A. (2005) 'Identity That Makes a Difference: Substantial Learning as Closing the Gap between Actual and Designated Identities'. *International Group for the Psychology of Mathematics Education*, *1*, pp.37-52.

Shaughnessy, J., Zechmeister, E. and Zechmeister, J. (2003) *Research methods in psychology* 6th ed. New York: McGraw-Hill.

Silvia, P.J. (2006) *Exploring the psychology of interest*. Oxford: Oxford University Press.

Simons, H. (2009) *Case study research in practice,* London: Sage.

Somekh, B. and Lewin, C. (eds.) (2011) *Theory and methods in social research*, London: Sage.

Stephenson, A. (2009) 'Horses in the sandpit: Photography, prolonged involvement and 'stepping back' as strategies for listening to children's voices'. *Early Child Development and Care*, *179*(2), pp.131-141.

Stryker, S. and Burke, P.J. (2000) 'The past, present, and future of an identity theory'. *Social psychology quarterly*, pp.284-297.

Swain, J. (ed.) (2017) *Designing Research in Education: Concepts and Methodologies*, London: Sage.

Thomas, G. (2011) 'A Typology for the Case Study in Social Science Following a Review of Definition, Discourse, and Structure'. *Qualitative Inquiry*, 17(6), pp.511-521.

Tracy, S.J. (2019) *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact* 2nd ed. Chichester: John Wiley & Sons.

Trend, R. (2005) 'Individual, situational and topic interest in geoscience among 11- and 12-year-old children', *Research Papers in Education*, 20:3, pp.271-302.

United Nations (1989) *Convention on the Rights of the Child*, Geneva: Office of the High Commissioner of Human Rights.

Valsiner, J. (1992) *Interest: A Metatheoretical perspective*, *In* Renninger, K. A., Hidi, S., Krapp, A. (eds.) *The role of interest in learning and development*. New York: Psychology Press, pp.27-41.

Valsiner, J. (1997) *Culture and the development of children's action: A theory of human development* 2nd ed. New York: Wiley.

Varpio, L., Ajjawi, R., Monrouxe, L.V., O'Brien, B.C. and Rees, C.E. (2017) 'Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking'. *Medical education*, *51*(1), pp.40-50.

Veresov, N. and Fleer, M. (2016) 'Perezhivanie as a theoretical concept for researching young children's development'. *Mind, culture, and activity*, *23*(4), pp.325-335.

Vygotsky, L.S. (1978) *Mind and society,* Cambridge, MA: Harvard University Press.

Vygotsky, L.S. (1994) 'The problem of the environment'. *In* van der Veer, R., and Valsiner, J. (eds.). *The Vygotsky reader.* Oxford: Blackwell, pp.338-354.

Walker, R.A., Pressick-Kilborn, K., Arnold, L.S. and Sainsbury, E.J. (2004) 'Investigating motivation in context: Developing sociocultural perspectives'. *European Psychologist*, *9*(4), pp.245-256.

Wellington, J. (2015) *Educational research: Contemporary issues and practical approaches* 2nd ed. London: Bloomsbury Publishing.

Wenger, E. (1998) *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.

Wood, E. (2013) *Play, Learning and the Early Childhood Curriculum*, London: Sage.

Wood, E. (2014) 'Free choice and free play in early childhood education: troubling the discourse', *International Journal of Early Years Education*, 22:1, pp.4-18.

Wyse, D., Selwyn, N., Smith, E. and Suter, L.E. (eds.) (2016) *The BERA/SAGE Handbook of Educational Research*. London: Sage.

Yang, L.-H. (2010) 'Toward a Deeper Understanding of Student Interest or Lack of Interest in Science'. *Journal of College Science Teaching*, 39(4), pp.68-77.

Yin, R.K. (2018) *Case study research and applications: Design and methods* 6th ed. London: Sage.

Young, J. (2005) 'On insiders (emic) and outsiders (etic): Views of self, and othering', *Systemic Practice and Action Research*, *18*(2), pp.151-162.

Zhao, P., Li, P., Ross, K. and Dennis, B. (2016) 'Methodological Tool or Methodology? Beyond Instrumentality and Efficiency with Qualitative Data Analysis Software'. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* 17(2), pp.1-21.

## Appendix 1 Science Curriculum in England for 4 to 7 year olds

### Statutory Framework for the Early Years Foundation Stage (DfE, 2017)

### The areas of learning and development

**Understanding of the world** involves guiding children to make sense of their physical world and their community through opportunities to explore, observe and find out about people, places, technology and the environment.

**Early Years Foundation Stage Profile Early Learning Goal – The world:**

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one to another. They make observations of animals and plants and explain why some things occur, and talk about changes.

### The National Curriculum in England Key Stage 1 Framework (DfE, 2013)

**Science**

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking simple questions and recognising that they can be answered in different ways
- observing closely, using simple equipment
- performing simple tests
- identifying and classifying
- using their observations and ideas to suggest answers to questions
- gathering and recording data to help in answering questions.

Pupils should be taught to:

- identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.

- identify and describe the basic structure of a variety of common flowering plants, including trees.
- identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals.
- identify and name a variety of common animals that are carnivores, herbivores and omnivores.
- describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).
- identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.
- distinguish between an object and the material from which it is made.
- identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.
- describe the simple physical properties of a variety of everyday materials.
- compare and group together a variety of everyday materials on the basis of their simple physical properties.
- observe changes across the four seasons.
- observe and describe weather associated with the seasons and how day length varies.

## Appendix 2 Research Plan

| Date | Research plan |
|---|---|
| February 2014 | **Visit 1**<br>Introduce project, explain and distribute consent forms, establish relationships, no data collected. |
| March 2014 | **Visit 2**<br>Collect consent forms and discuss questions. Establish relationships, gain verbal assent from children whose parents have given their consent. Observe children. |
| April 2014 | **Visit 3**<br>Observe for 2 hours. Offer children choice of media to communicate their interest. Communicate with parents and interview children and staff. |
| May 2014 | **Visit 4**<br>Select children (8) and observe for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| June 2014 | **Visit 5**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. |
| July 2014 | **Visit 6**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| October 2014 | **Visit 7**<br>Discuss with staff and narrow down number of children to 4 per school. Reconfirm assent with children. Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| November 2014 | **Visit 8**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. |
| December 2014 | **Visit 9**<br>Reconfirm assent with children. Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| January 2015 | **Visit 10**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. Communicate with parents |
| February 2015 | **Visit 11**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| March 2015 | **Visit 12**<br>Reconfirm assent with children. Observe children for 2 hours. Offer children choice of media to communicate their interest. |
| April 2015 | **Visit 13** |

| | |
|---|---|
| | Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| July 2015 | **Visit 14**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. |
| October 2015 | **Visit 15**<br>Reconfirm assent with children. Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| November 2015 | **Visit 16**<br>Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview children and staff. |
| December 2015 | **Visit 17**<br>Reconfirm assent with children. Observe children for 2 hours. Offer children choice of media to communicate their interest. Interview parents. |

## Appendix 3 Pen portraits of children

**Amita**

Girl, age 5 years old at the start of the project, attended School B, of Indian heritage. Parents' questionnaire completed by her mother. At the start of the project, Amita said that she liked playing with her friends, and she liked playing in the role-play and the writing area.

**Beth**

Girl, age 5 years 2 months at the start of the project, attended School A, of white British heritage. Parents' questionnaire and *My Hope and Dreams* entries completed by mother. Mother interviewed when she collected Beth at the end of the school day. At the start of the project, Beth said that she is interested in animals, swimming and ponies.

**Bilal**

Boy, age 5 years 3 months at the start of the project, attended School B, of Indian heritage. Parents' questionnaire completed by his mother. Mother interviewed when she attended parents evening. At the start of the project, Bilal said that he is interested in animals and basketball.

**Hakim**

Boy, age 5 years 2 months at the start of the project, attended School B, of Indian heritage. Parents' questionnaire and entry in school record book completed by mother. At the start of the project, Hakim said that he liked painting, running in the playground and going on the bikes.

**Isla**

Girl, age 4 years 8 months at the start of the project, attended School A, of white British heritage. Parents' questionnaire and *My Hope and Dreams* entries completed by her mother. Father interviewed when he collected Isla at the end of the school day.

At the start of the project, Isla said that she likes running outside and playing on the monkey bars.

**Jake**

Boy, age 5 years 1 month at the start of the project, attended School A, of white British heritage. Parents' questionnaire and *My Hope and Dreams* entries completed by mother. Father interviewed when he collected Jake at the end of the school day. At the start of the project, Jake said that he is interested in playing with his wooden swords and playing with bricks.

**Robert**

Boy, age 4 years 10 months at the start of the project, attended School A, of white British heritage. Parents' questionnaire and *My Hope and Dreams* entries completed by mother. At the start of the project, Robert said that he liked Lego and making things.

**Sunil**

Boy, age 5 years 3 months at the start of the project, attended School B, of Indian heritage. Parents' questionnaire completed by father. Both parents interviewed when they attended parents evening. At the start of the project, Sunil said that he liked riding bikes, and playing football and tennis.

## Appendix 4 Information sheet for parents/carers and staff

**Interest in science among 5 to 7 year olds**

*You and your child are invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.*

My name is Zoe Crompton and I am a part-time student at the University of Leeds where I am a Lecturer in Primary Science Education. The aim of the research is to develop a greater understanding of young children's interest in science and how this interest changes over time. In my study I would like to interview you and your child and observe science activities that take place in your child's class.

I'll visit school once a month starting in January 2014 and finishing in July 2015 (a total of 19 visits). Each visit, I'll ask children 3 or 4 questions about what sort of activities they enjoy doing and what they find difficult. I'll ask these questions informally during class time and each question will only take a few minutes. Children will be asked if they would like to answer my questions and I'll make it clear that they don't have to answer. I'd also like to ask you 3 questions about what your child is interested in doing outside of school. I can do this when you pick up your children at the end of the school day or by telephone. As well as observing children carrying out their usual activities in class I'll offer the children the choice to draw or use an iPad to take photographs of things they find interesting in the classroom and outdoors.

All the information collected during the course of the research will be kept strictly confidential. You and your child will not be able to be identified in any reports or publications. To provide confidentiality *all* data collected will be anonymised so that only I as the researcher will be able to identify the source. If any images the children take on the iPad include the faces of other children or staff I will blur these images so that it is not possible to identify anyone on them. The digital recordings made during

this research will be used only for analysis and for illustration in conference presentations and lectures. No other use will be made of them without your written permission, and no one outside the project will be allowed access to the original recordings. You can read more about the University's data protection policy at http://campus.leeds.ac.uk/dpa/

The results of my research will be written up in a doctoral study and potentially published in journals. Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will contribute to science educators' understanding of factors that support children's interest in science.

*It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time, you do not have to give a reason.*

*Thank you,*

Zoë Crompton
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## Appendix 5 Informed Consent Form

**Interest in science among 5 to 7 year olds**
**a research study by Zoe Crompton, University of Leeds**

*Initial the box if you agree with the statement to the left*

1. I confirm that I have read and understand the information sheet dated 21.11.13 explaining the research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my participation and is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. Should I not wish to answer any particular question or questions, I am free to decline. I understand that if I withdraw, I can decide whether or not the data collected from me up to that point can be used in the study or destroyed immediately. ☐

3. I understand that interviews will be audio recorded, and my responses will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research, and I will not be identified or identifiable in the reports that result from the research. ☐

4. I agree for the data collected from me to be used in future research. ☐

5. *For parents/carers ONLY:* I agree for my child to take part in the above research project under the same terms as above, provided my child also gives his/her verbal consent to take part. ☐

6. I agree to take part in the above research project and will inform the lead researcher should my contact details change. ☐

| _____ | _____ | _____ |
|---|---|---|
| Name of participant | Date | Signature |
| _____ | _____ | _____ |
| Lead researcher | Date | Signature |

*To be signed and dated in presence of the participant*

## Appendix 6 Verbal information sheet and verbal consent for children

**Interest in science among 5 to 7 year olds**
**a research study by Zoe Crompton, University of Leeds**

This information sheet will not be used as a script because participants are 5 years old. I will check children understand what I'm saying and rephrase or provide examples where necessary.

*I'm inviting you to take part in a project. Before you decide, you need to know a bit more about the project. Ask me if there's anything that's not clear or if you'd like to know more. Take time to decide if you wish to take part.*

My name is Zoe and I work at the University of Leeds. I'd like to find out more about what children are interested in. In my study I'd like to ask you some questions and observe activities in class.

I'll visit school once a month starting in January. Each visit, I'll ask you 3 or 4 questions about what sort of activities you enjoy doing. You don't have to answer my questions. You could draw or use an iPad to take photographs of things you find interesting in the classroom and outdoors.

When I write my report, I won't use your names and no one will be able to tell who said what. Other people will read my report to find out what I've done.

*It is up to you to decide whether or not to take part. If you do decide to take part you'll be asked to say that you agree or you could draw a picture to show that you agree. You can stop being part of the project at any time; you don't have to give a reason.*

**Verbal assent for each research method:**
Is it ok for me to ask you some questions?
Is it ok for me to sit here whilst you carrying on with…?
Would you like to take a photo of something you're interested in?
Would you like to draw a picture of something you're interested in?
Have you got any questions?

## Appendix 7 Parents' questionnaires

### Interest in science among 5 to 7 year olds

Thank you for agreeing to be part of this study. During the last month, I have been visiting class and observing what children are doing and asking them about what they enjoy doing (or asking them to take photos of things they are interested in). Your views are a really important part of the study to give me a more complete picture of what your child is interested in, rather than just what they do in school. I'll be in touch again in June to ask you the same 3 questions.

You can let me know your views by completing this from, e-mail or telephone interview, whichever you prefer. Please return the form below to school or get in touch with me if you'd like to discuss your child's interests by phone or if you'd like to communicate by e-mail.

Thanks again,

Zoë Crompton
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Leeds LS2 9JT

T: 0113 3434680

E: Z.Crompton@education.leeds.ac.uk

**Questions for parents and carers**

1. What does your child prefer to do during free play time?

2. If your child had 1 hour to do anything, what would he/she prefer to do?

3. Does your child seem to have a focused interest (and what is it in)?

**Please return this form to school**

## Parents' questionnaire for second year of study

### Interest in science among 4 to 6 year olds

During the last year, I have been visiting class and observing what children are doing and asking them about what they enjoy doing (or asking them to take photos of things they are interested in). Please return the form below to school or get in touch with me if you would like to discuss your child's interests by phone or if you'd like to communicate by e-mail. Your views are a really important part of the study to give me a more complete picture of what your child is interested in, rather than just what they do in school.

Thank you for being part of this study,

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**Questions for parents and carers**

4. What does your child prefer to do during free play time?

5. Does your child seem to have a focused interest (and what is it in)?

6. Have your child's interests changed in the last year? If so, can you describe what has changed?

***Please return this form to school or post it to me at the address above***

## Appendix 8 Children's interview questions

The questions in each semi-structured interview were not prescribed and I modified my questions depending on children's responses, often rephrasing them slightly. The list below represents the questions I asked most frequently. Interviews took place on school premises, inside or outside, before, during or after school.

1. What are you interested in? Or, what do you like/enjoy doing? Why?
2. Anything else you're interested in?
3. What do like doing at home?
4. What do you like doing at school?
5. Do you like playing inside or outside?
6. What is it you like about XXX?
7. If you had an hour spare when you got home from school, before teatime what would you like to do?
8. What would you like to read a book about?
9. What do you want to know more about?
10. What do you like learning about?
11. Any thoughts about what you want to be when you grow up?
12. What would you like to study when you're older, what would you like to learn?
13. What would you like to take pictures of? Why?
14. Is there anything here that you'd like to take a picture of?
15. Why did you choose to take a photo of XXX?
16. Do you remember that we took some pictures? *(pointing at photographs)* Do you know why you took these?
17. Anything else you want to tell me about?

Additional questions that I asked in the second year of the study:

1. So, I really want to know what's new. What are you interested in now?
2. What's your favourite subject/lesson in school? Why?
3. What about science, do you like science?
4. And what is it you like about science?

5. What do you think science is?
6. What kind of stuff do you do in science?
7. What do you think you'll study at university?
8. And what about any trips, have you been anywhere interesting recently?
9. So, I say to the visitors "Let me introduce you to XXX, and he is…" So what would I say, how would I describe you? What's the thing you like doing the most? XXX is… what would I say? What's the thing you really like to do?

**What children said to me rather than answer my questions:**

1. What does study mean?
2. What does that mean?
3. I thought we were going to take some pictures.
4. I want to take some pictures.
5. Please can we take picture now?
6. Can I talk to you whilst XXX takes some pictures?
7. Can I go?
8. I want to tell you something.
9. Guess what I can make?
10. Can I tell you what I'm writing about?
11. Can I tell you a joke? Why did the moose eat a moose?

## Appendix 9 Parents/carers and staff interview questions

The questions in each semi-structured interview were not prescribed. The list below represents the questions I asked most frequently. Interviews took place on school premises, either at the end of the school day, when parents came to collect their children, or at Parents Evening, whilst parents were waiting to see their child's teacher.

1. What sort of things is XXX interested in?
2. What kind of things does he like doing at home?
3. So, where do think his interests have come from? Who do you think is encouraging his interests?
4. My observations of XXX is that she does seem to be particularly interested in some things more than others. Would you say so? What would you say those interests are?
5. Do you think she had that interest anyway or do you think you've influenced her?
6. What do you think she is interested in and do you think that it has changed over the year?
7. In terms of her talking about hobbies or stuff that she does outside of school, is there anything that stands out?
8. Do you feel that his interests have changed and developed or do you think that what he is interested in now is the same as his interests in Reception?
9. And do you think that's come from you?
10. As you say, he's interested in XXX, where do you think that's come from? Has he always been like that?
11. So, what about things that he wants to research on his own and find out more about?

**Questions emailed to each teacher, Reception, Year 1 and Year 2:**

1. What does XXX enjoy doing inside?
2. What does XXX enjoy doing outside?
3. Does XXX have any special interests that he/she talks about?

## Appendix 10 Example of data analysis

I analysed the case record for each of the three case study children through the theoretical lens of a practice theory of interest, which maintains that children's interests are enacted as part of their identities. Such identities and interests are *situated* in a social, cultural and historical context, *positional* in that they are often developed and enacted in accordance with structural power relations, such as, gender, race, class and age (Ortner, 2006). Interests also emerge in response to *discourses*, in the context of the cultural worlds in which we engage. Funds of knowledge (González et al., 2006) are part of a practice theory of interest, because children draw on the funds of knowledge located in their family and community, so that their actions can be symbolic of deeper interests (Chesworth, 2016).

In addition, personal narrativisation (self-authoring) foregrounds communication, in other words as part of our identifying narrative we say and do things that identify us as *someone interested in…* so that identity-making is a discursive practice. Identity can be seen as a set of '*reifying*, *endorsable* and *significant*' stories about a person (Sfard and Prusak, 2005:16).

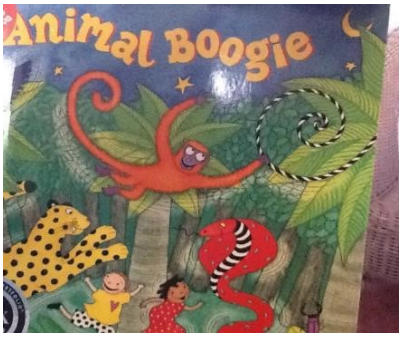
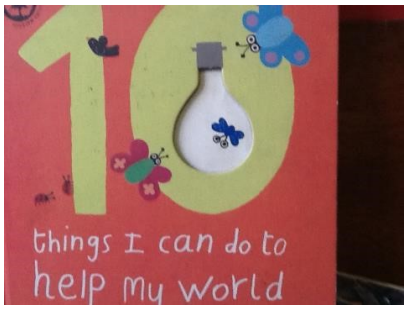
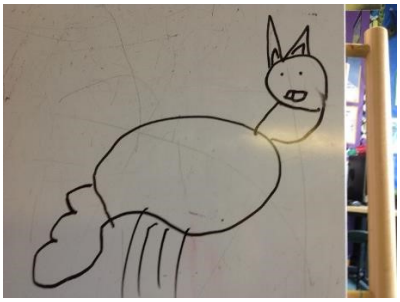
**Key**

| **Highlighted in data** | **Colour** |
|---|---|
| Situated | XXXXXXXXXXXXXX |
| Positional | XXXXXXXXXXXXXX |
| Discourses | XXXXXXXXXXXXXX |
| Funds of knowledge | XXXXXXXXXXXXXX |

## Extracts from Isla's case record with commentary

| Extract of data | Commentary | Practice theory of interest interpretation |
|---|---|---|
| **Interview with Isla in January of Year 1**<br><br>*Zoe: What are you interested in?*<br><br>Isla: Ermm…<br><br>*Zoe: Not sure? What do you like?*<br><br>Isla: I like Ryan's new puppets, because he got all the marbles in his jar and that means he got the puppets.<br><br>*Zoe: Why do you like them? What are they?*<br><br>Isla: One's a fox, one's a squirrel, one's a rabbit, one's a badger.<br><br>*Zoe: And why do you like them?*<br><br>Isla: Because it has a fox in them and I love foxes! They are my favourite wild animal.<br><br>*Zoe: And do you like wild animals?*<br><br>Isla: Yes, when we were at the canal, me and mummy, and we saw a swan that had died and a heron.<br><br>*Zoe: The heron and the swan had died?*<br><br>Isla: No, I saw the heron when we were walking, then there's a bridge and then a big massive bit of water and we saw the swan in there and it was dead, so I think a fox has been to kill it.<br><br>*Zoe: Yes, maybe. That's very sad isn't it? And have you got any pets at home?*<br><br>Isla: I'm going to get two and they're both chickens, but they're not *boy* chickens because we don't want boy chickens, because they're going to wake us up at four in the morning, (chuckling) I already know that.<br><br>*Zoe: That's right they go "cock a doodle do!"*<br><br>Isla: (laughing) | (I rephrase the question as Isla seems to be unsure about what she is 'interested' in)<br><br>I ask two questions at once, Isla answers the second question and names all four puppets.<br><br>Isla emphasises the depth of her feelings about foxes by raising her voice and using the strong language 'love' and 'favourite'.<br><br>My question about why she likes wild animals goes unanswered. Instead, she chooses to tell me more about what she knows about wildlife.<br><br>Remember she is talking about a fox – her *favourite* wild animal – she seems sanguine about it potentially having killed a swan.<br><br>(My response does not match her tone; she does not express any sadness about the dead swan.)<br><br>Isla starts the sentence with the pronoun 'I', but quickly switches to 'we' and 'us' to place herself in her family. The phrase about being woken up at four in the morning sounds like a recycled strip of words her parents would say (Sfard and Prusak, 2005). | Isla shows herself to be knowledgeable about the names of UK wildlife.<br><br>She endorses the way her parents story her as someone who is into wildlife, so that it is a story she tells herself.<br><br>Isla makes it clear she shares her activities with her parents (on this occasion, her mother).<br><br>Isla self-authors as a person who is knowledgeable about wildlife, including who eats who – these things happen in the natural world and we need to accept them.<br><br>Isla self-authors as knowledgeable about chickens and emphasises ownership of this knowledge. |

| Extract of data | Commentary | Practice theory of interest interpretation |
|---|---|---|
| **Interview with Isla's Dad**<br><br>*Zoe: My observations of Isla is that she does seem to be particularly interested in some things more than others. Would you say so?*<br><br>Isla's Dad: Yes.<br><br>*Zoe: What would you say those interests are?*<br><br>Isla's Dad: Well quite a few things, but in particular we have tried to get her into wildlife.<br><br>*Zoe: Why is that?*<br><br>Isla's Dad: We think it'll make her a better and more balanced person and she'll have a better understanding of the world.<br><br>*Zoe: She's told me about quite a few of her trips.*<br><br>Isla's Dad: Yes, a lot of our visits do involve wildlife places.<br><br>*Zoe: Do you think she had that interest anyway or do you think that you've influenced her?*<br><br>Isla's Dad: Ermm, she's always been prone to it. I'm also a keen runner and I have brought her to events and she has shown no interest what so ever, so obviously she must hold some interest herself.<br><br>*Zoe: Now I asked her today what her favourite subject was in school and what do you think she said?*<br><br>Isla's Dad: Ermm, she seems at the moment maths, she is arty and she does like art.<br><br>*Zoe: Yes, that's what her teacher said, I bet she says art, but she said computing, because they've been doing some coding, which she's enjoyed.* | Dad does not quite answer the question I ask, instead he tells me that he and his wife have encouraged Isla to 'get into' wildlife.<br><br>I use the phrase 'quite a few' and Dad replaces this with 'a lot of' when he replies to add emphasis.<br><br>Dad talks about what Isla is doing with reifying language about her having essential characteristics. The adverb 'always' stresses the enduring nature of her interest (Sfard and Prusak, 2005).<br><br>'She is arty' is another example of reifying language that stories Isla, 'turning properties of actions into properties of actors' (Sfard and Prusak, 2005:16).<br><br>Isla demonstrates agency through her choice of a subject that surprises her teacher and father. | Dad uses 'we' to make it clear he shares his actions and views with Mum and that they are inducting Isla into their family values (funds of knowledge). Dad's responses suggest **positioning** due to a structural power relation.<br><br>*A better person is into wildlife* – this is the **discourse** he ascribes to. He is drawing on a cultural resource about stewardship of the world, which is a predominantly Western anthropocentric view. Dad represents this as a family collective identity and funds of knowledge for Isla, as a way of thinking about the world.<br><br>Isla's self-authoring as someone interested in nature is **situated** in her family practice.<br><br>Dad narrativises Isla's possession by using the word 'hold' and emphasises that this is undeniable by prefacing his statement with 'obviously'.<br><br>According to Sfard and Prusak's categories of identity, this as a third-person identity, because it is a story about Isla told to me. |

| | | |
|---|---|---|
| Isla's Dad: Oh right, it's quite weird, because we don't have a computer at home and we're not really knowledgeable about computers.<br><br>*Zoe: Thank you very much, because, I've got the information from Isla, but you're a piece of the puzzle in terms of thinking about where she gets her interests from.*<br><br>Isla's Dad: Well we don't push her, but we do encourage her. | Dad's distinction between push and encourage is interesting and links back to his opening comment about getting her into wildlife. | Dad's stories himself (and his wife on her behalf), as not knowledgeable about computers. His choice of the word 'weird' suggests he sees Isla's choice of favourite subject as strange to him and his response distances him from her practice.<br><br>Both his opening and closing comments suggest **positioning** due to a structural power relation. The parents have the power to decide what will make their child 'a better person' and what funds of knowledge are available to her. |
| **Examples of Isla's photographs during Reception**<br><br>  <br><br>  <br><br>  | *Animal Boogie* names jungle animals and their actions. Isla talks about animal books in another interview, saying that 'there are loads of books about animals' at her home.<br><br>*10 things I can do to help my world* is about valuing and conserving our world and includes simple activities such as turning off lights, recycling, feeding birds in winter and planting seeds. In another interview, Isla describes how she has grown a sunflower from seed and repotted it when 'it grew a little bit high'.<br><br>The third photograph (which Isla chose to take) is of Isla's drawing of a rabbit, she described to me how it had big ears and a fluffy tail. | At home, Isla's parents are trying to 'get her into wildlife'. What these three photographs show is that Isla has accepted this narrative and actively authors herself as someone who cares for nature and knows about wild animals. According to Sfard and Prusak's (2006:17) categories of identity, this is a first-person identity – 'an identifying story told by the identified person herself'.<br><br>Esteban-Guitart and Moll (2014:31) use the phrase 'funds of identity' to describe when children actively use their funds of knowledge to define themselves and this is what Isla is doing through her social practice – what she chooses to read, do, talk about, draw and photograph. |

| Extract of data | Commentary | Practice theory of interest interpretation |
|---|---|---|
| **Interview with Isla's teacher**<br><br>*Zoe: The question is, I've been following Isla over the year and have asked her what she enjoys doing and it's really just from your perspective, what do you think that she is interested in?*<br><br>Teacher: To me, Isla is one of these girls that has got a real interest in lots of different things, and she's just really… Oh gosh, I don't know if there's anything that springs to mind that is something in particular. She's really good at her literacy and she loves her writing, but I think that she is one of these children that is keen, she just absorbs everything really.<br><br>*Zoe: So she enjoys learning?*<br><br>Teacher: Yes, she enjoys the learning of whatever we are doing, she's always one that is totally engaged with everything, which is really good.<br><br>*Zoe: So, in terms of her talking about hobbies or stuff that she does outside of school, is there anything that stands out?*<br><br>Teacher: I'm not really sure what she does outside of school, to be honest, so I couldn't really say about that, so… yes.<br><br>*Zoe: Yes, it's interesting isn't it.*<br><br>Teacher: Yes, she's quite quiet actually, that's the thing with her isn't it? And she's got this very close relationship with Alfie, and that's gone right through from Reception, that really close friendship. That's not to say that she's not good at making friendships with others, because she is.<br><br>*Zoe: That's right, they're not exclusively working with each other.*<br><br>Teacher: No, it's a really lovely friendship isn't it, for this age, to have that close friendship is really nice isn't it. | The teacher **positions** Isla in a gendered group who have lots of interests.<br><br>Stating that they enjoy learning and are 'always… totally engaged', she makes her approval of these behaviours clear.<br><br>The teacher's comment about not knowing what Isla does outside of school connects to her opening point that Isla is 'one of these girls' and seems to further anonymise her.<br><br>(my response seems like a non-sequitur as if I'm not sure how to respond)<br><br>The teacher looks for my confirmation of her assessment of Isla as quiet. She seems to associate Isla's quietness with her close friendship with Alfie. The teacher acknowledges that Isla's long lasting friendship is important to her and emphasises that she views it as a good thing by saying it is 'really nice'. | The way she authors Isla as being good at literacy and loving writing intimates at a gender stereotype that this is what girls are good at. Stating that Isla is keen suggests she sees this as an enduring characteristic, within a **discourse** of how a good student should be.<br><br>The teacher's response emphasises the points she has just made about the features of a good student. |

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|---|---|---|
| *Zoe: Has she told you what her and Alfie want to do when they grow up?*<br><br>Teacher: No, are they going to get married?<br><br>*Zoe: They're going to both become teachers at this school.*<br><br>Teacher: How lovely. Well Alfie dressed as a teacher for Aspiration Day but Isla was away, so it would have been interesting to see if she would have come dressed as a teacher as well. | | The teacher endorses Alfie and Isla's desire to be teachers when they grow up and this can be seen as another example of Isla being storied as a good student. |
| ***My Hopes and Dreams* booklet: Isla's entry at the end of Year 1**<br><br>*I said that by the end of this year I hoped to be able to…* get lots of house points and always write my name neatly<br><br>*Did this happen?* I think I got loads of house points and I sometimes write my name neatly. Sometimes it's a bit big.<br><br>*What would you like to do by this time next year?* Read better and be better as doing big sums<br><br>*Is your dream job still the same?* No, now I want to be a teacher | (Note that the Isla's entries have been scribed for her, so are filtered through an adult.)<br><br>Isla chooses to role-play being a teacher with her friend Alfie during free-flow play at school, as well as talking about wanting to be a teacher in the future (in her previous entry she says her dream job is 'looking after animals'). | Isla self-authors as someone who aspires to have neat handwriting, 'read better' and do 'big sums' as part of her performance of being a good student.<br><br>Isla plays her part in this 'cultural game' (Ortner, 2006:7) of being a good student. |
| ***My Hopes and Dreams* booklet: Mum's entry at beginning of Year 2**<br><br>*What makes my child special?* Isla is a really friendly, kind and thoughtful girl, she is very chatty and always makes me laugh.<br><br>*What do I think my child is good at?* Drawing and writing, both of which she really enjoys.<br><br>*I would like to help her learn…* to be more open minded in new situations.<br><br>*My hopes for my child for this year.* To learn to ride her bike and to continue to love school as much as she does. | Mum emphasises Isla's qualities with 'really', 'very' and 'always'.<br><br>The format of the *My Hopes and Dreams* booklet with entries from the child, teachers, and parents, and the way it aggregates across seven years of a child's time in school, means its contents are **situated** in school culture. | Her description contains an intimation of gendered ways of behaving as a girl and **positions** Isla by her gender.<br><br>Each person writes within a **discourse** of what the other parties want to hear, emphasising the attributes of a good student. In this school culture, there does not seem to be space for Isla to author herself as someone interested in nature and animals. |