Investigating social factors within children's non-formal learning experiences in an aquarium

"They live five minutes from the beach, but they've never even seen a limpet..."

by

Sarah-Jane Judge

Presented for PhD Examination

University of Warwick

Department of Sociology

August 2019

Table of Contents

Table of Figures and Tables

Acknowledgements

In some ways I have felt very alone during this PhD journey but in reality, I have had a solid, supportive team around me.

First and foremost, I want to thank Professor Des Hewitt for his unwavering support, 100% of the time. I do not take for granted having a supervisor who understood my passion and the direction I wanted to take my research in, who clearly cared about my success and who answered my queries and questions so promptly and patiently. No amount of thanks will ever be enough!

Thank you also to Associate Professor Eric Jensen for selecting me for this incredible opportunity to research my passion. I will never forget being interviewed over the phone at the reception of a pub in the dead centre of Australia, it obviously didn't go as badly as I thought it had! Thank you to the Economic and Social Research Council for funding my research and Midland Doctoral Training Centre for supplying me with the tools I needed to conduct it. Thank you to everyone at the National Marine Aquarium in Plymouth for providing access and support in every way they possibly could and thank you to all the non-formal learning institutions in the United States who took an interest in my work and met with me as part of my non-academic collaboration scholarship.

Thank you to the University of West of Scotland for their unexpected support (from library access, to training courses, to access to their researcher spaces) they made me as welcome as one of their own. Thank you also the University of Newcastle, Australia, in particular to Dr.Terry Burns. It was there I was inspired to go into research, my project themes were formed, and not to mention they have kept me in gainful employment, even from 10,000 miles away.

A massive thank you to Janet Smith PhD Programmes Officer and angel of the Sociology department. I wouldn't have even lasted a year of the PhD. without having you to turn to when things got sticky.

Thank you to the following people for their advice, support, proof reading, drawing, anonymising and general confidence boosting– Samantha, Herod, Kat, Matt, Lindsay, Hayley, Kirsty, Lorna, Cassandra (thanks moving across the world to within 30 minutes of Warwick Uni just to keep me going!), my wee cousin (future superstar teacher!) Emily and Dr. Ablett, my sociology guru.

Thank you to the Molloy family for hosting me in their home for the first two years of my studies. You really made me feel part of the family when I was away from own and made the process of going back to be a student that much easier.

Thank you to Warwick Comedy society for keeping my laughing even when I very much did not feel like laughing!, Chris for providing something to punch when it was, regularly, needed (I promise to be much more reliable in my gym training now I'm finished- maybe!) and to the Royal Institution for providing me with a regular reminder as to why I was so passionate about science 'edutainment'.

To Liz, Noonan, Matt, Kat, Joanne, Alex, Chris, Ellen, Giles, Eric, Pete, Ellen and particularly Dr. Dooner, thank you for the Warwickshire based sofa beds, baths, tears and mostly laughs. I definitely didn't want to make friends at Uni this time around you know!

To my Gran (my best mate), my Grandad and all my family, thank you for your support and your understanding that I've been pretty rubbish at keeping in touch over the past few years. You probably heard from me more when I was in Australia than when doing this PhD!

To Mum and Dad, thank you for supporting me (in every way imaginable) in each crazy new adventure I undertake in my efforts to avoid living a 'normal' life. You've brought me up to be curious, passionate, persistent, hardworking, justice seeking, critical and to believe that I could do anything I wanted (except maybe

grow taller) – all skills vital to research. I hope this makes you proud (and thanks for the proof-reading Mum, now's Dad's turn to read it!).

To my partner David, thank you for sticking by my decision to go back to Uni, even though you always said you'd never date a "*tax-dodging student*". Thank you for letting me move to the other side of the world for this opportunity and then following me back here. I truly appreciate you letting me be me and trusting me to go away and satisfy my need for adventure. Thank you for putting up with me being so unavailable, stressed out and grumpy and for your support and encouragement in this process and in every aspect of life. I am holding you to your promise of reading the whole thesis!

Most importantly thank you to all the participants of my research, the schools, the teachers and the pupils. I hope you feel that I have accurately represented your school trip experiences.

And finally, thank you to Albie and Nala who came along in the middle of this process to keep me calm and my feet warm as wrote up - extra walkies from now on I promise!

Dedication

This PhD thesis is dedicated to three wise, fiery and much-missed Scottish women who shared their love and wisdom and made me believe I was capable of anything – even 80,000 words!

Fiona Colley
Caroline McDonald
Peggy McMeeking

and to Snorkel the turtle
(much loved by many of the participants)

Declaration

This thesis is the result of the candidate's own work during the registration period of the PhD and has not been submitted for a degree at any other University.

Abstract

A key sociological concern is that families higher up the socio-economic ladder are more likely to spend leisure time taking their children to non-formal learning institutions, thus presenting a risk that any educational benefits arising from such visits will have the potential to increase educational inequalities across different socio-economic groups. As school trips tend to consist of children from more diverse backgrounds, more representative of the general community, such visits have been mooted as a method of levelling the educational playing field between socio-economic groups. Additional research in this area, however, points to the contrary, suggesting that prior experience of non-formal learning venues plays an important role in shaping how much learning is achieved during subsequent visits to similar establishments. If correct, school trips could therefore be exacerbating the problem, acting as a form of cultural capital, further widening the gap in educational inequalities, as children from middle class families know how to behave and perform in such settings, getting more educational value out of the trip.

Aquariums, along with zoos, comprise a key category of non-formal learning with the Association of Zoos and Aquariums reporting over 12 million students annually attending their member institutions on school trips. This mixed method research used interviews with educators and pre- and post-visit questionnaires, including a drawing element with children, to investigate how social factors, teacher practice and prior experience of non-formal learning institutions may influence learning outcomes of school aquarium visits. No correlation was found between prior experience levels of non-formal learning institutions and cognitive learning, but some influence was found across age, ethnicity and socio-economic status. Whilst teachers reported a general lack of concern about inequalities during school trips, practices such as booking staff member guided tours of the aquarium and undertaking linked pre-visit activities were found to have influence on learning achieved.

Abbreviations

NMA	-	National Marine Aquarium
KS	-	key stage
SES	-	Socio-economic status
BME	-	Black or Minority Ethnic
STEM	-	Science, Technology, Engineering and Mathematics
WAZA	-	World Association of Zoos and Aquariums
BIAZA	-	British and Irish Association of Zoos and Aquariums
EAL	-	English as an additional language
FSM	-	Free school meals
MDI	-	Multiple Deprivation Index
GLM	-	General Linear Model
OFSTED	-	Office for Standards in Education, Children's Services & Skills
ESRC	-	Economic and Social Research Council
SPSS	-	Statistical Package for Social Sciences

Chapter 1 – Introduction

1.1 Personal motivations for research

When I was nine years old, I went on a school trip to an aquarium and ten years later I graduated from university as a marine and freshwater biologist. Whilst I cannot solely attribute this school trip for my ongoing academic choices, I have no doubt that the aquarium visit was a formative experience. More than twenty years later, I still vividly remember travelling through the tunnel under the main tank with sharks passing over my head and the aquarium staff member explaining how to differentiate between the shark species, something I have gone on to find extremely useful during my recreational diving. That school trip was my first experience of an aquarium. For much of my childhood, due to a workplace injury and returning to their own studies, neither of my parents were in employment, so days out tended to be to places with no entrance cost; a park, the beach or one of the free museums in town. My school trips opened up a world of new opportunities for me and, it could be argued, a lifelong interest in nature and science.

I did not go on to become a dolphin trainer, as nine-year-old Sarah-Jane dreamt, but I did stay in the world of science-based visitor attractions starting as a science communicator and then creating programmes and exhibits for science centres and museums. For the past fifteen years I have worked as a practitioner of non-formal science learning in all manner of different positions, from live science show presenter to board member of National Science Week for the New South Wales Government. In every role I have aimed to be an ambassador for science, and I hope that I have inspired young people to consider a career in science, just as I was inspired all those years ago. It was during my time in Australia that I began working in educational equity programmes and witnessed first-hand how great the knowledge and experience divide can be between pupils from different socio-economic groups. I came to realise how non-formal education experiences can, with varying degrees of success, be used as a tool in addressing this gap. It is that experience which drives my research, a quest to understand more about the field I am so passionate about, to contribute to sociological knowledge in the field of non-

formal education and to influence my own practice and the practice of my fellow educators, formal and informal alike. Throughout this thesis, it is therefore my aim to answer one, overarching research question – "*Are school trips to non-formal learning venues a potential source of replication of educational inequalities?".*

1.2 Research Context

1.2.1 School trips

Research into school trips has been ongoing for more than 30 years and has been on the most part very positive, identifying a range of benefits to children who undertake such experiences. Whilst school trips are not currently compulsory, they are commonplace, with the UK Department for Education and Skills expressing its support for trips in its '*Learning outside the Classroom Manifesto'* stating that:

"Every young person should experience the world beyond the classroom as an essential part of learning and development" *(2006: pg 1)*

The House of Commons Children, Schools and Families Committee's 2009/2010 '*Transforming Education outside the Classroom'* paper identified concerns about equality in access to learning outside the classroom particularly for children from low-income families where school trips may be the only opportunity for children to experience new environments.

"*Obviously, the role of the family in providing those opportunities is the first port of call and is pivotal, but as a society we have to ask ourselves: are these things important enough that we leave them to a random chance that if the family does not provide them, the schools may or may not provide them?"(2010 :pg.3)*

The committee also reported on evidence which had found that the more deprived a school population was (measured by number of pupils eligible for free school meals) the less trips the school tended to offer with respect to both quantity and diversity of the experiences. The committee went on to recommend that the

National Curriculum should include an entitlement for at least one out of school visit per term and that provision for this should be included in OFSTED's inspection frameworks.

Given that school trips are not a compulsory part of education they simply would not happen if teachers did not have the drive to make them happen. There is little doubt that teaching is an important, and at times very challenging, occupation with a range of demands on a teachers' time both inside and outside of usual school hours. It stands to reason that school trips will increase teacher workload with the time required to research locations, make bookings, organise payment, get parental consent and organise additional adult help. It is, therefore, perhaps surprising that studies into school trips have found that teachers tend to be very positive about trips (Jarvis & Pell, 2005).

1.2.2 Trips for science learning

Whilst all manner of learning can take place during school trips, the popularity of venues such as museums, science centres, zoos and aquariums mean that trips now have a particular association with science learning. The promotion of science is currently a key concern, due to a shortage of young people choosing to study STEM subjects beyond the compulsory age. This has resulted in a STEM skills gap in the work force and low levels of science literacy in the general public. A strong, skilled STEM workforce is viewed as critical for economic growth and for competitiveness in the international market, particularly in the uncertain conditions of a post Brexit U.K. Trips to science based venues, particularly those which showcase the diversity of science careers, could therefore have an important part to play in engaging young people with science.

With over 12 million students attending zoos and aquariums each year as part of organised school trips (AZA, 2015) they make up a key category of out of school science learning. Where zoos and aquariums were traditionally associated as entertainment venues, where the public could be voyeurs of wildlife, they have now been forced to shift their focus towards an agenda of conservation and education,

to meet the demands of a more environmentally and welfare conscious public. With school students making up such a large proportion of their audience, aquariums should be well placed to support delivery of the curriculum. Their subject matter lends itself well to teaching of the science curriculum, which of course includes elements of conservation and sustainability, but also cross-curricular and life skills such as observation and empathy, along with general good citizenship.

There is however a deficit of research into how well zoos, and particularly how aquariums, are meeting these new goals and this has resulted in accusations of zoos and aquariums being overzealous or even dishonest in their claims in this area. Whilst it is not a key theme of the research, the present study will look to build on work conducted by Tunnicliffe (1997), Tofield et al. (2003), Cainey et al. (2012) and Jensen (2014) etc. to assess the value of zoos and aquariums as science learning venues.

1.2.3 Diversity in science learning

The lack of participation in science is further exacerbated by the absence of diversity apparent in those who do choose to go to study science at a higher level and take up careers in science. Post-16 STEM students, and hence those likely to go on into STEM careers, tend to fit into the profile of white or Asian, middle class and male. This under-representation of women, working class and certain ethnic minority groups has been identified across STEM subjects but holds particularly true for the physical sciences (Dawson et al., 2019). This pattern is found to be mirrored in the standard visitor profile of visitors to non-formal learning venues where public audiences tend to be ethnically dominant, middle-class and affluent (Bell et al., 2012; Dawson, 2014a; Feinstein & Meshoulam, 2014).

Whilst the House of Commons Children, Schools and Families Committee have identified some issues around participation by more deprived schools, school trips generally tend to consist of children from more diverse backgrounds, more representative of the general community than the standard public visitor profile (Feinstein & Meshoulam, 2014). School trips have therefore been proposed as an

important tool in levelling the playing field, exposing a much wider range of students to non-formal learning experiences. It is therefore surprising that there has been very little research looking specifically at school trips from a sociological perspective. Again, this research looks to address this deficit of knowledge by contributing to the limited body of work which has been conducted in this area.

1.2.4 A Bourdieusian perspective of school trips

Bourdieu's theory of social reproduction, and specifically cultural capital, have helped to shape my understanding around inequalities in non-formal learning and education more generally. Bourdieu uses the term 'cultural capital' to describe the non-financial assets a person accumulates, and which influence their role in society such as education, skills, credentials, tastes, material possessions and even posture and mannerisms (Edgerton & Roberts, 2014). Cultural capital is described as having an influential role in education systems, providing an advantage to students who possess it and a disadvantage to those who do not (Bourdieu, 2011; Halsey et al., 1997). Activities linked to cultural capital include reading books, playing a musical instrument or attending museums, theatres and concerts; sometimes referred to as participation in the '*beaux-arts'* (Crook, 1997; De Graaf et al., 2000). Access to these activities is not evenly distributed across populations, with children from middle- and upper-class backgrounds tending to have greater exposure to cultural experiences (Bourdieu, 1999; Bourdieu, 2011). As exposure to such activities has been linked to the development of knowledge and skills which are of benefit in formal education environments (Ganzeboom, 1982), middle- and upper-class children hold an educational advantage.

Nowadays, middle-class families are now far more likely to visit zoos, aquariums and science centres than operas and art galleries, but just as entering an art gallery or attending a classical music concert requires learning certain embodied skills and behaviours (such as knowing when not to clap during a performance), visiting zoos, aquariums and science centres also require visitors to practice similar sets of skills. I therefore propose that non-formal learning venues such as zoos and aquariums should be evaluated in much the same way that Bourdieu considered the role of the

beaux-arts; that they are important contemporary sites of the production of forms of cultural capital which have the potential to influence educational attainment. For the purposes of this research, aquariums and zoos will therefore be grouped with museums, art galleries, science centres and other non-formal learning institutions– considering them all as cultural activities with the potential to build cultural capital in their visitors. This is a novel approach to analysing children's visits to zoos and aquariums.

If trips to non-formal learning institutes can indeed be viewed as a site of the accumulation of cultural capital and educational attainment, then visits to such venues should be analysed as a potentially important moment when the production and reproduction of educational inequalities may be taking place. Research from the field of visitor attraction studies appears to support this, finding that visitors to non-formal learning institution tend to learn more during repeat visits to such venues (Falk & Dierking, 2000). In the context of school trips, if a child has previously visited a non-formal learning venue with family members, they may have a learning advantage compared to a child who is visiting for the first time as part of the school visit. My framing of school trips having a potential role in the reproduction of educational inequalities is central to my research and is what I will be attempting to investigate using the following research questions.

1.3 Research Questions

This thesis has three supporting questions which, together, aim to answer the first, overarching research question – **Are school trips to non-formal learning venues a potential source of replication of educational inequalities?**

- What role do social factors such as ethnicity, gender and social class have on learning during such trips and do teachers recognise, and mitigate against, inequalities in this area?

- How does prior exposure to such venues affect subsequent experiences and learning processes for students on school trips to an aquarium? How might

prior experience act as a form of cultural capital, underpinning differential learning outcomes from the aquarium experience?

- What role do teachers' practices play during school trips in relation to meaning making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capital?

1.4 Range, Scope and Limitations

The present study engages with the role of children's social class and related sociological factors within non-formal learning experiences in an aquarium, specifically the National Marine Aquarium in Plymouth (hereafter referred to as NMA). Additionally, this study also aims to explore the practices of classroom teachers around such trips: evaluating their influence on school children's non-formal learning experiences. This project was a collaboration between Warwick University, the ESRC (who granted the research funding), and the NMA (who provided the research site).

The NMA, a not-for-profit charity, is the largest aquarium in the UK and, whilst clearly providing entertainment to its visitors, it was the first aquarium in the country founded with the specific aim of conservation, education and research. It places a strong focus on its plant and animal collection and compared to other aquariums has less in the way of interactives and hands-on elements. For instance, the NMA is unusual among aquariums for its stance of not having any touch pools. The aquarium attracts over 300,000 visitors per year, with around 10% of these coming from school visits (NMA, 2017). Whilst the ESRC funding provided was for research into either public or school visits, the latter was selected as this was where there appeared to be a greater deficit in the existing literature and was an area of particular interest to the NMA.

Due to the collaborative nature of the PhD, field work was limited to the afore-mentioned institution and therefore was constrained by the narrow diversity in the NMA's visitor profile. Participants came from six primary schools who had self-elected to visit the aquarium during the research period between November 2016 and July 2017.

1.5 Approaches used

A combination of quantitative and qualitative research methods was used in addressing my research questions. Quantitative questionnaires provided the central data for the study with every participating student completing a pre and post aquarium-visit survey. Preliminary aquarium observations and qualitative interviews with teachers as part of the pilot study acted as sequential contributions, informing the production of the student questionnaires. Teacher interviews, both pre and post visit provided additional coverage, clarifying and building on information provided within the surveys (Morgan, 2013). A number of emergent themes also arose from the interviews which aided in addressing the research questions. Each of these methods and their relation to each other are discussed in detail in the third, Methodology chapter.

1.6 Structure of thesis

This thesis consists of seven main chapters including this introductory chapter.

In Chapter 2 I present the literature relevant to my research and introduce my theoretical foundations. I explain how I am relating Bourdieu's theory of cultural capital to children's experiences of non-formal learning institutions and consider school trips from the perspective of social reproduction of educational inequalities. I then go on to introduce literature from the fields of sociology, education and visitor attraction studies formative to my own work.

Chapter 3 provides a detailed discussion of the methodological issues of the present study. I begin by outlining my research epistemology and provide a statement of

positionality along with an overview of my research methods. Next, I present the research site, provide an overview of the schools participating in the research and introduce the research design. Finally, I address issues of ethics and the validity, reliability, generalisability, transferability and credibility of my research.

The fourth, fifth and sixth chapters present the findings of my research, with each chapter aligned to one of my research questions. In each of the findings chapters, quantitative and qualitative analysis are described separately and then are summarised together. Chapter 4 investigates the potential influence of social factors on school trip learning, Chapter 5 is concerned with the role prior experience may play during subsequent school visits and Chapter 6 focusses on teacher practice during trips to non-formal learning institutions. In each of these findings chapter, the quantitative and qualitative results are brought together and discussed in relation to the wider research literature to answer my second, third and fourth research questions.

In Chapter 7, the findings from chapters four, five and six are brought together with the ultimate aim of answering my overarching research question - "*Are school trips to non-formal learning venues a potential source of replication of educational inequalities?"*. It outlines my contribution to the existing literature, provides recommendations for further research studies and makes suggestions for alterations to professional practice around school trips.

Chapter 2 – Literature Review

2.1 Introduction

There is an extensive body of literature from educational research studies outlining the benefits to children - cognitive and otherwise - of school excursions to non-formal learning institutions. There are, however, fewer examples of studies looking specifically at school trips from a sociological perspective, and even fewer examples of studies considering whether school trips to non-formal learning settings, such as an aquarium, benefit some children more than others based on gender, class and ethnic differences. This review draws together the literature that does exist in this area, from the fields of sociology, education, and visitor attraction studies, underpinning them using Bourdieu's concepts of cultural capital and social reproduction. This review has been divided into four sections: theoretical foundations; non-formal education; social influences on non-formal learning and the role of educators and their school trip practices.

2.2 Theoretical Foundations

2.2.1 Cultural Capital

At the heart of my study is the concern, which Bourdieu shared, with how educational inequalities occur and persist. In this section I will explain how I plan to use Bourdieu's concepts (from within his framework of social reproduction) and apply it to my project. I do this in two ways; by framing non-formal learning venues as potential sites of educational inequality, and by using the concept of cultural capital – and how it relates to educational attainment – to explain and understand those inequalities.

As introduced in Chapter 1, Pierre Bourdieu uses the term 'cultural capital' to describe the non-financial assets a person has which influence their role in society. Just like material assets, he sees them as being accumulated and transferable from one arena to another, categorising them into 3 types: embodied (accent/dialect),

objectified (material possessions), and institutionalised (credentials/qualifications) He proposes that cultural capital plays a major part in power dynamics within society with social order being inscribed in people's minds through their consumption of cultural products such as education, language, and values. (Bourdieu, 2011; Edgerton & Roberts, 2014; Szeman & Kaposy, 2010).

Whilst Bourdieu does not see education itself as creating inequalities, he highlights its role in legitimising class structures, with schools and educators rewarding, consciously and unconsciously, the possession of elite cultural capital in students.

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

As it is the dominant class who are seen to define what has capital, and determine its value, whilst simultaneously promoting their own agenda and ensuring stability in their dominance, it is they who benefit most from such a system. Therefore, educators' bias towards those with greater cultural capital promotes better outcomes for students from middle- and upper-class backgrounds both during the period of their education and then on into their occupational achievements. Consequentially this is to the detriment and exclusion of others who lack similar capital, referred to by Bourdieu as a form of "symbolic violence" against the working class or minority pupils (Tzanakis, 2011).

Bourdieu therefore believed that the education system was set up in such a way as to perpetuate class structures, favouring those with greater amounts of cultural capital (the middle and upper classes) and excluding those with reduced capital (the lower classes) (Bourdieu, 1999; Collins, 2009; Hoadley, 2008; Sullivan, 2002) . Children with the 'right' kinds of cultural capital were more closely aligned to middle-class educational expectations and would therefore be in a better position to achieve, thus contributing to the reproduction of middle- and upper-class values as dominant within schools (Bourdieu, 1974; Giroux, 1983). Those with greater educational attainments would then be more able to access better occupational

achievements in positions where they were able to continue to set agendas around education and capital, hence perpetuating the cycle of privilege (Collins, 2009; Hoadley, 2008). This results in a subconscious acceptance of social differences, the hierarchical structure and one's own place within them (Bourdieu, 1986).

There are criticisms of Bourdieu's work (and social reproduction theories more broadly) which come from various different angles. For instance, there are those who point out that the development of children's cognitive abilities involves a complex combination of social actors and institutions. For example, some argue that any influence on cognitive ability is more likely to come from parental involvement, i.e. a parent who enjoys reading is more likely to assist in teaching their child to read (van der Werfhorst, 2010). For others, the witnessed expansion of education in the working classes, and existence of social mobility, indicate that society does not simply reproduce itself through education and other social institutions in a straightforward way (Goldthorpe, 2007). Sociological studies have shown that the concept of 'reproduction' is a complex one, and that dominant ideas and practices in education are contested and challenged (Ghaill, 1994; Willis, 2017). Therefore, Bourdieu's contribution to our understanding of the role of education in reproducing class structures sits within a larger, non-deterministic system where social structures and individual agency can disrupt the standard processes of reproduction (Giroux, 1983).

In his 1981 work with Boltanski, *The Education System and the Economy,* Bourdieu describes how partaking in cultural activities such as reading books or attending museums, theatres and concerts, sometimes referred to as participation in the '*beaux-arts'*, is closely linked to both social class and educational attainment (Bourdieu & Boltanski, 1981). Ganzeboom provides a practical explanation for this link, proposing that involvement in cultural activities leads to the development of knowledge and skills, which are of benefit within formal education environments (Ganzeboom, 1982). There are many examples of education-based research attempting to identify an empirical link between cultural capital and educational attainment to varying degrees of success (Aschaffenburg & Maas, 1997; Egerton, 1997; Roscigno & Ainsworth-Darnell, 1999). Numerous empirical studies have employed various methods to prove the link between cultural participation and

educational attainment including; recording of the number of cultural items in the home (Graetz, 1988; Mohr & DiMaggio, 1995), attendance of cultural classes (Aschaffenburg & Maas, 1997; Roscigno & Ainsworth-Darnell, 1999) or self-reported attendance at museums and galleries (Katsillis & Rubinson, 1990). Studies by Crook (1997), De Graaf et. al (2000) and Sullivan (2001) focused specifically on attendance of cultural venues. Using existing data sets, both Crook - the 1993 Australian National Social Science Survey - and De Graaf - Netherlands Family Survey 1992 -1993 - reviewed information provided by respondents on their own, or in the case of De Graaf, their parent's, cultural activities such as attendance of ballet, opera, museums and theatres. In both cases, their responses were analysed against educational and occupational outcomes of the respondents. Sullivan's study, which involved direct surveying of 16-year olds, broke cultural participation into 4 categories; reading, viewing of 'highbrow' TV programs, listening to classical music or playing of an instrument, and 'public' cultural participation. More recently studies by Dawson (2014a) and Archer et al., (2015) have found that museum visitors with higher levels of cultural capital can use this as leverage to gain further capital during their visits which in turn results in increased science learning.

Such studies endeavour to operationalise cultural capital in various ways, with some even trying to measure it directly. This involves aligning children's academic achievements with perceived indicators of cultural capital such as; linguistic competence, culture knowledge, cultural participation or parental occupation / level of education (De Graaf et al., 2000; Katsillis & Rubinson, 1990; Roscigno & Ainsworth-Darnell, 1999). Whilst the linguistic benefits of reading are obvious in terms of the transferability of the skill, an appreciation of art and culture is perhaps less immediately apparent as an educational benefit.

However, such an appreciation can lead to increased cultural knowledge, which Bourdieu then proposes can be converted into elite educational accreditations (McDonough & Nunez, 2007; Sullivan, 2001). One means by which such an appreciation for high culture could be passed on is through parents taking children to cultural venues such as museums and galleries; thus, helping their offspring to develop competence, confidence and a taste for such culture in later life (Bourdieu,

1999; Calarco, 2014). Whilst perhaps not immediately associated with 'highbrow' culture in the same way as art galleries or museums, aquariums and zoos do require visitors to employ similar behaviours, bodily comportment and cognitive set of skills during a visit; including observation, exploration, reading of signage, etc. For the purposes of this research therefore, visits to non-formal learning visits to venues such as zoos and aquariums will be considered as cultural activities with the potential to build cultural capital in their visitor and so will be analysed with this in mind.

2.2.2 Extending Bourdieu's cultural capital from arts to science

The idea of extending Bourdieu's analysis of cultural capital and beyond the arts and into the realm of science is not a new one, with a number of authors applying it as lens to critique science education (Elmesky & Tobin, 2005; Claussen & Osborne, 2013; Prieur & Savage, 2013). The Enterprising Science project, a five-year (2013-2018) partnership between the Science Museum Group, University College London and Kings College London, funded by BP, aimed to engage young people with science, using '*science capital'* as its foundation. It builds on the work of the ASPIRES project, an ESRC funded study run from 2009 - 2013 out of Kings College London, which tracked young people's science and career aspirations and constituted a similar research team as the Enterprising Science project. By applying science capital as a conceptual lens, project director Professor Louise Archer and the Enterprising Science team attempted to operationalise science capital and aimed to apply this knowledge to create effective science engagement tools for practitioners. This resulted in many publications (Archer et al., 2015; Archer et al., 2016a, 2016b; Archer et al., 2017; Archer et al., 2018a; Dawson et al., 2019; DeWitt et al., 2016; DeWitt & Archer, 2017; Godec, 2018; Godec et al., 2018; King et al., 2015; King & Nomikou, 2018; Nomikou et al., 2017).

In their 2015 paper, Archer et al. provide their definition of science capital, which they do not see as separate to cultural capital, but rather an additional conceptual lens with which to specifically examine how social factors may influence

participation and engagement in both science education and science more generally.

> *"Our first iteration of a theoretical model of science capital combines the following: scientific forms of cultural capital (scientific literacy; science dispositions, symbolic forms of knowledge about the transferability of science qualifications); science-related behaviours and practices (e.g., science media consumption; visiting informal science learning environments, such as science museums), science-related forms of social capital (e.g., parental scientific knowledge; talking to others about science" (Archer et al, 2015: pg. 929)*

Formal scientific knowledge and training, the understanding of the theories and facts that could be tested in an exam scenario, is therefore just one aspect that makes up a person's overall science capital. Equally, having increased overall scientific capital (for instance, for increased exposure to science-related media) is likely to manifest within educational scenarios as an improved ability to be able to increase one's science knowledge. Just like cultural capital, science capital can be viewed in terms of resources which are unevenly spread within society. As families with increased levels of science capital are found to better foster their children's scientific interest and aspirations (DeWitt & Archer, 2017) the system which reproduces such privilege/disadvantage continues.

The Enterprising Science team considered possible restrictions in accessing of informal science learning institutions (and the gains in capital that could be associated with such visits) including; physical proximity to such venues, admission charges, availability of leisure time and conflicting interests from other family members in how to spend such free time. Access restrictions were also discussed specific to school trips to non-formal science learning institutions which, again, comes down to finances but also *"pressures of accountability and performativity within the school system" (*DeWitt & Archer, 2017: pg.358). In this paper, and others, The Enterprising Science team go on to discuss how different degrees of science capital may manifest themselves during non-formal science learning visits, school or otherwise, influencing how deeply children may engage

with the experience and what they gain from that experience depending on the cultural and intellectual tools they bring with them during a visit (Archer et al., 2016a).

In their attempt to investigate who is participating in various areas of informal STEM learning outside the classroom, DeWitt and Archer (2017) categorised three types of science engagement; school-led enrichment, informal science activities and everyday science engagement including provision of science toys or watching science programmes at home. Visits to non-formal science learning institutions fell into the first two of these categories depending on whether they were part of a school trip (school-led enrichment) or family members (informal science activities). As well as participation in these activities, participants year group, gender, ethnicity and attainment (top, middle or bottom set for science) were recorded. A four point 'cultural capital' level scale ranging from low to very high was estimated for each student using measures similar to the studies described in section 2.2.1; information on parental university attendance, parental school leaving age, number of books in the home and previous museum visitation. DeWitt and Archer's study found that participation in informal science learning experiences (of all three types) varied depending on student backgrounds. Overall students from more privileged backgrounds tended to participate more in informal science learning activities but with patterns of participation found within each category for gender and ethnicity. Most relevant to my own research was their finding that students with increased cultural capital were more likely to participate in all three types of non-formal science activities.

My own research, though not so wide in scope as the Enterprising Science project, extends and deepens a specific element of their analysis looking specifically at children's prior experience of non-formal learning institutions. As I seek to frame such visits as parallel to the cultural capital / educational attainment effect of participations in the Beaux arts, I decided to continue to use '*cultural capital'* in my framework rather than using the label of 'science capital'. It is also worth noting that my own research began back in 2014, before any publications had arisen from the Enterprising Science project, but after the publication of the ASPIRES report which I drew from in my own research planning.

2.2.3 School trips: levelling an uneven field?

Audiences to non-formal learning venues comprise two key distinct groups: public visitors and school trips. Whilst visitors from public audiences tend to come from affluent, middle-class and ethnic majority backgrounds, studies show school groups to be more diverse and more representative of the community in which the non-formal learning venue is based (Dawson, 2014b; Feinstein & Meshoulam, 2014; Ganzeboom, 1982). In contrast, many 'highbrow' beaux-arts activities, such as opera and gallery attendance, are often foreign to a large proportion of even the middle and upper classes (Sullivan, 2002). This provides an interesting space which non-formal learning venues seem to occupy in relation to how the middle classes consume and participate in non-formal learning experiences; that though they may still be dominated by middle class families, they are also more open and accessible to others than many arts-based informal learning environments are.

Previous studies have argued that school trips to informal learning institutions, like museums and science centres, benefit children from low socio-economic and ethnically diverse backgrounds (Hooper-Greenhill et al., 2009). Research also suggests, however, that children who are more regularly taken to such locations are better equipped to learn from future experiences, with those who have visited a museum before already having cultural capital in this area, knowing how to behave and perform in such settings to get maximum value from the experience (Falk & Dierking, 2000). This paints a more complicated picture for those children from lower socio-economic backgrounds, for whom the first time they visit a non-formal science learning venue is on a school trip. In this scenario, school trips to informal learning institutions may provide difficult or ambivalent learning experiences for those with little previous exposure to them and may highlight or exacerbate existing inequalities between students from different socio-economic backgrounds. Class differences between students are made visible in different ways; having the 'right' shoes or plentiful money to spend in the gift shop during a trip, for instance, may symbolise students' different class statuses within informal peer groups in schools. This study attempts to do show how students' previous exposure to non-formal

learning venues may highlight class differences in relation to formal learning and educational attainment levels. If correct, this could provide further evidence to support Bourdieu's theories around education as a source of reproduction of social inequalities and exclusion.

Viewed through the lens of social reproduction, it is possible that parents from middle and upper class families are increasing their children's cultural capital by taking them to informal learning venues in their leisure time, and that this prior experience is providing children with social tools that aid their learning experience during subsequent school trips. This could potentially give students with a background of cultural capital an advantage over students from lower socio-economic backgrounds who lack such capital, even if they are visiting the same informal learning institutions. Of course, not all leisure visits will result in equal capital gain. With so many varying factors – location, time spent, who is in attendance, what support is given, quality of interaction with exhibits, to name just a few – the capital gained from visits will also vary drastically. It is also possible that teachers' practices around school trips could demonstrate bias, consciously or subconsciously, in favour of students with more of this form of capital. This question is the primary focus of my research project - what role might cultural capital be playing in the experiences and outcomes of a school-led aquarium visit? I attempt to answer this in various ways but specifically by taking into account the students' prior experiences of non-formal learning institutions when evaluating pre- and post-visit outcomes across different socio-economic groups.

2.3 Non-formal learning

Across their primary and secondary school career, students spend an average of 11,000 hours in formal, school-based education (Gerber *et al.*, 2001; Medrich *et al.*, 1982). Many studies have investigated the potential for learning, and specifically science learning, that occurs outside this time, away from the classroom, in less formal environments such as playgrounds, homes and, nowadays, through media- online or otherwise. Numerous studies attempt to define and evaluate this kind of learning, often referred to as informal learning (Ainsworth

& Eaton, 2010; Diamond, 1999; Gerber, 2001; Griffin, 2007; Rennie, 2007). Perhaps the most all-encompassing definition comes from the Informal Science Education Program of the National Science Foundation who describe it as:

"voluntary, self-directed' life-long and motivated by intrinsic interests, curiosity, exploration, manipulation, fantasy, task completion and social interaction. It can be linear and often self-paced and visual, or object orientated. It provides an experimental base and motivation for further activity and learning" (NSF, Evaluation, 1997: pg.8).

In his 2007 paper Eshach proposes three distinct types of learning: formal, occurring in traditional education institutions; informal, occurring un-intentionally as part of everyday life and a third category of non-formal, planned learning that occurs outside of traditional education institutions. Whilst non-formal and informal are often used interchangeably, in this study I will be applying Eshach's category of non-formal to describe school trips as, for the most part, at least some form of learning is intended as part of the activity. It is however worth noting that there is school of thought that since learning is a lifelong, ongoing, cumulative process and that learning is learning regardless of location, that it is not particularly helpful to label it as formal, informal or non-formal (Rennie, 2007; Walton, 2000).

The very nature of this kind of non-formal learning makes it difficult to study with many of the previous studies attempting to quantify anecdotal evidence (Dierking & Falk, 1994). Critical views of non-formal education include concerns over whether the education value of such activities may be overshadowed by the entertainment factor, resulting in an ineffective, maybe even dishonest or damaging learning experience (Anderson, 1997; Behrendt & Franklin, 2014; Eshach, 2007; Shortland 1987). Others argue that when non-formal learning spaces are well designed, engaging in the learning process can in itself can be the entertaining aspect of the experience. Packer (2006) coined the phrase "*learning for fun"* to describe the multisensory, free choice, discovery-based learning experience she believes is fairly unique to educational leisure settings. Overall the literature has been overwhelmingly positive finding non-formal education activities to be valuable to students, offering benefits distinct from formal educational experience (Avraamidou, 2015; Martin, 2004; Plummer & Small, 2013; Stocklmayer et al.,

2010; Whitesell, 2016). Malone (2008) refers to non-formal education's strength in the realm of experiential learning (Kolb, 2004) and how such hands on, real world experiences in museums provide children with a chance to grow in knowledge, confidence and identity. Ramey-Gassert et al. (1994) and Pedretti (2002) both focus on how non-formal learning institutions can make education enjoyable for people, fostering wonder, enthusiasm and eagerness to learn. Whilst the cognitive aspect of learning is more associated with the formal education environment, some studies have found non-formal learning spaces to provide valuable learning outcomes in this area too (Behrendt & Franklin, 2014; Eshach, 2007; Rennie, 2007). The next section looks at reported educational benefits of non-formal learning venues in more detail, specific to the school trip context.

2.3.1 School Trip Learning

Whilst research into public/family visits to non-formal learning institutions is more extensive, various studies over the past 30 years have attempted to identify and measure the specific value of school trips, with most of the early research focusing on visits to museums (Alon & Tal, 2015; Behrendt and Franklin, 2014; Griffin, 2004; Kisiel, 2003). Learning outcomes are often much harder to measure in non-formal learning than in formal learning environments due to the free choice nature of the learning experience and because such spaces tend to be designed for a diverse range of learners, with quite specific learning and experiential goals in mind (Mujtaba et al.,2018; Rennie, 2007). This is complicated further for school trips where the educators, teachers and institution staff, may have substantially different intended outcomes for the visit than the students taking part - or in other words- the students may well be learning, just not on the subject they are being assessed against (Ansbacher, 1998). What is clear is that school trips are seen to have an important role in the UK education system. In 2006 the UK government Department for Education and Schools showed its support for school trips in its '*Learning outside the Classroom Manifesto*' stating that:

> *"Every young person should experience the world beyond the classroom as an essential part of learning and development*" (2006: p.1).

School trips are mooted as having a range of potential impacts on students including knowledge, behaviours, attitudes, interests and career aspirations and can be particularly influential on students who don't perform as well academically in the formal school setting (Hutson et al., 2011; Rennie, 2007). Studies investigating the merits of school trips have found a myriad of educational outcomes covering all three of Bloom's learning domains; cognitive, affective and psychomotor (Bloom, 1956; Singal & Swann, 2011; Zeyer & Dillon, 2019). Affective outcomes include attitudinal shifts, increases in motivation towards learning, building confidence as a learner and aspiration building (Bamberger & Tal, 2008, Behrendt & Franklin, 2014; Zeyer & Dillon, 2019). Psychomotor skills are also seen to be developed on trips, particularly when students are able to get 'hands on' with interactive exhibits or other activities commonly associated with science centres etc. (Füz, 2018; Szczepanski et al., 2007). The domain most commonly represented in the literature however - some argue over represented - is that of cognitive learning which is displayed through content related outcomes, such as the building of new knowledge and forging connections to prior knowledge (Bamberger & Tal, 2008; Falk & Dierking, 2000; Kisiel, 2006; Schauble et al., 2002; Scribner-MacLean & Kennedy, 2007).

Bandura's theories of learning (1986, 1977) provide a link between the social and psychological aspects of learning and can also be used as a lens with which to consider how learning occurs during school trips. Whilst Bandura subscribes to an observational style of learning, with children imitating what they see performed and promoted by those around them, he recognises there to be an intermediate stage, where cognitive processes result in the individual considering the outcome of modelling a behaviour they have seen i.e. it's not as simple as '*monkey see, monkey do*'. His social cognitive theory specifically considering the reciprocal, three-way, relationship between an individual's personal thoughts and beliefs, their behaviours and their environment (Bandura, 1977). Applied within a school trip setting, if a student's personal thought/belief is that they are positive about a trip, interested in its subject matter and so are keen to attend and eager to know more, they are likely to demonstrate behaviours more conducive to cognitive gain, something Zimmerman (1990) would identify as a high status self-efficacy of learning. Similarly, if the learning environment provided during the trip is engaging

with easy to access information, the child is likely to feel more positive about the trip. Bandura's social cognitive, along with Dweck's mindset (2015) and Zimmerman's self-regulated learning theories, also promote the idea that teachers can influence student's cognitive outcomes through their social interactions with students, particularly through praise or chastisement. Dweck proposes that students can, over time, form a growth mindset of learning through positive reinforcements towards effort made rather than inherent intelligence. So, in a school trip scenario, if a student has a growth mindset, they are less likely to have apprehension about the new environment and new information as they believe that they can grow to meet the demands of new situations. A fixed mindset student on the other hand is less likely to thrive in the new situation as they have a greater fear of failing due to the inherent, fixed nature of their knowledge (Dweck, 2014). Zimmerman believes that educators can and should teach students self-efficacy in their learning and in a school trip scenario this may come from building their confidence in visit related skills such as observing, asking questions or even reading signs (Zimmerman, 1990). Whilst this relationship between the psychology and cognitive gain is rich for exploration, my own study focusses on the concept of educational capital and its relationship with learning.

2.3.1.1 Methods of assessing school trip learning

Since the late 1980's and early 1990's there has been a general trend towards qualitative assessment of school trips (Griffin, 2004) resulting in less quantitative evidence of how field trips influence the various learning outcomes (Whitesell, 2016). Research on affective outcomes has typically taken the form of student interviews or surveys looking at shifts in student attitudes, emotions, motivation, interest and spirations in specific subject areas (Anderson et al., 2006a; Greene et al., 2014; Hooper-Greenhill., 2006; Jarvis & Pell, 2005; Knapp, 2000; Krombaß & Harms, 2008; Salmi, 2003; Storksdieck, 2006). Studies into cognitive outcomes tended to use post-visit questionnaires and focus on relatively narrow areas of knowledge or skill-building related to specific exhibits (Anderson et al., 2003; Bamberger & Tal, 2007; Cox-Petersen et al., 2013; Gutwill & Allen, 2012; Miglietta et al., 2008).

A number of recent studies have utilised dialogue as a measure of the learning potential of a trip (DeWitt & Hohenstein, 2010; DeWitt & Osborne, 2010; Mortensen & Smart, 2007). DeWitt and Hohenstein found that peer-to-peer and student-to-teacher discourse differed outside the classroom, with an increased number of interactions promoting learning, such as teachers asking more open-ended questions and students volunteering more information (DeWitt & Hohenstein,2010). Others have considered student behaviours such as the reading of labels, instances of group working, and completion of exhibit-related tasks as indicators of trip success (Bamberger & Tal, 2008; Hauan et al., 2017)

Given that my own study looks to directly compare the trip-associated learning achieved by students from different backgrounds and considering my limited access to the young participants, I have chosen to use measures of cognitive, conceptual learning only: primarily through the use of questionnaires. Whilst this will, of course, leave me open to accusations of adding to the over-emphasis on studies in this domain, I feel that using cognitive measures, which are more straightforward to measure than affective and psychomotor outcomes, will produce more reliable quantitative data to support or deny my hypothesis. This decision is discussed in more detail in the next chapter.

2.3.2 Science learning during school trips

Out of school learning environments are particularly beneficial to the teaching of science due to the hands on, real world experiences they can provide with which to engage and inspire students (Füz, 2018; Kiziltas & Sak, 2018; Scriber-MacLean & Kennedy, 2007). Many children's first experience of science learning will take place in non-formal learning environments such as museums and science centres before they have even started school (Bell, 2009; Mujtaba et al., 2018). In line with the more general benefits of non-formal learning, as outlined in section 2.3.1, trips to non-formal venues have been associated with an increase in students overall science performance in school, increases in science literacy along with the development of more positive attitudes towards science and science careers

(Griffin, 2004; Murray & Reiss, 2005; Woods-McConney et al., 2011). Studies show that such venues have a particularly important role in supporting science learning, not just as an add on to, but enhancing and enriching, formal classroom-based education (Bell, 2009; Braund & Reiss, 2006). The potential for formal and non-formal learning environments to come together, pool their strengths and provide robust science learning experiences is widely recognised (Gupta et al., 2010; Kisiel, 2014 & 2016), Most non-formal learning institutions having created tools to bridge the gap between formal and non-formal learning, primarily through their provision for visiting schools. This may be in the form of guided tours, pre, post and on-site educational materials or increasingly so, through online / digital tools that bring institution content directly into the classroom (Hauan et al., 2017; Hauan & DeWitt, 2017; Kisiel, 2014, 2016; Spicer & Stratford 2001).

Research by Bell et al. (2009) suggests that the development of a set of science learning goals, general to all non-formal science learning institutions, could further enhance educational visits to such venues. Bell et al.'s work, based on the United States K-8 Science Learning framework proposes that non-formal science learning venues should consider the following strands when developing their education programs; student experience, understanding, reflection, participation, self-efficacy (as a science learner) and manipulation (of information).

Whilst school visits most commonly take the form of one off, day-long visits, studies have shown that sustained engagement between schools and non-formal learning venues result in better outcomes for students (Dierking et al., 2003; Dori & Tal, 2000; Füz, 2018). Such intensive, repeated exposure can be expensive in terms of resources, time and finances making it out of reach for many schools (Alon & Tal, 2015; Füz, 2018). This is reflected in the literature, with most studies tending to look at single trips to one location and working with small sample sizes that did not enable conclusions to be drawn from quantitative data (Griffin, 2004; Tal et al. 2014). My own research will look at visits to one non-formal learning venue, an aquarium, by multiple schools with a sample size large enough to enable the use of quantitative analysis alongside qualitative methods.

2.3.3 Learning in zoos and aquariums

Some of the locations most readily associated with such non-formal learning are museums, science centres, zoos and aquariums, and consequently there are a number of studies concerned with the learning potential of such venues (Cainey et al., 2012; Falk & Dierking, 2000; Jensen, 2014; Phillips et al., 2007; Rennie & McClaffert, 1996). With over 700 million visitors per year (WAZA, 2012), zoos and aquariums now comprise a key category of non-formal learning internationally and in the UK. School audience are an important audience for these venues, particularly when it comes to meeting the education goals found in most of their mission statements (Lohne et al., 2009). The British and Irish Association for Zoos and Aquariums reports hosting 1.2 million visits annually on organised educational trips (BIAZA, 2015) whilst in the United States, the Association of Zoos and Aquariums reports that 12 million students attend zoos and aquariums each year (AZA, 2015).

With school trips making up a key demographic of their visitors, zoos and aquariums seem well-placed to support delivery of the national curriculum; a service which most aquariums appear to be attempting via dedicated school programmes (Rennie, 2007). The NMA, for example, state in their school marketing materials that they can tailor tours, workshops and shows around a wide range of topics, including mathematics, biology, physics, chemistry, English, geography, design and technology, and art and design. However, their most frequently-requested topics for primary school groups – the focus of this study – tend to be directly linked to the science curriculum. These topics, including food chains, habitats, life cycles, adaptations, conservation and sustainability (full list can be found in Appendix 2), fall within the key stage 1 and 2 curriculum areas of *Animals – including humans*, *Plants*, *Living things and their habitats* and *Evolution and inheritance* (Department for Education, 2013). There are also some parallels to be drawn between the primary geography curriculum and aquarium content: specifically, student understanding of the water cycle, the ability to name all five oceans and understanding of geographical similarities and differences. In the case of the NMA, for example, this could involve noting differences between the Great Barrier Reef tank and the British Coastal tanks. These curriculum areas all fall

within the domain of cognitive learning and have the common theme of creating a greater understanding of the natural world. Such increased understanding should result in a greater appreciation and emotional attachments such as empathy, which in turn can lead to an increase in environmentally-friendly behaviours (Wharton et al., 2018). Additionally, increased interest and passion can promote deeper learning in students as they are eager to know more on the subject matter and to discuss it with peers or teachers (Falk & Dierking, 2000). As touched on in the introduction, zoos and aquariums believe that they have an active role to play in conservation education to both school and public audiences, including issues around biodiversity, climate change and pollution (Rennie, 2007). This will be discussed in greater depth in the next section. Whilst significance has been attributed to knowledge of such matters from a cognitive and curriculum point of view, this knowledge arguably has a far greater importantance, that of creating accountable and responsible citizens of the world.

In addition to the specific topics listed above, a strong case may also be made for aquariums having a role in addressing an additional area of the science curriculum: that of 'working scientifically'. Aquarium-related skills from this area of the curriculum could include observing, identifying and classifying, as well as asking and answering questions. These are all activities, along with group/team working and communication with peers, that are regularly practiced during aquarium visits; particularly the activity of observation (Farmer et al., 2007; Nabors et al., 2009). Even the journey to the venue could create new learning experiences, as students may gain knowledge about neighbours, communities, transport and careers as they travel from their school to their destination (Nabors et al., 2009). Such cross-curricular skills are also important beyond the traditional education system and so are often referred to as 'life' skills, or 'the soft curriculum'. They tend to fall into the affective and interpersonal domains of learning and, like conservation knowledge, are an important part of creating well-rounded future citizens.

Whilst aquariums appear to have a role in education, there is however a distinct deficit of research into the specific educational value of school trips to zoos and aquariums (Jensen, 2014; Mason, 2000; Roe et al., 2004). A shortage of time, finances and qualified staff has resulted in even inhouse evaluations of zoos and

aquariums tending to be lacking in terms of quality and quantity (Luebke & Grajal 2011; Roe et al., 2014.) The resulting dearth of evidence has led to accusations of zoos and aquariums being overzealous or even dishonest in their educational claims (Esson, 2009; Moss, 2013; Jensen 2014) something that zoos and aquariums are understandably keen to refute.

An example of a study that does investigate school led trips is Jensen's 2014 paper, "*Evaluating Children's Conservation Biology Learning at a Zoo".* Using pre- and post-visit questionnaires, Jensen investigated the change in attitudes towards, interest in, and knowledge of conservation issues in over 2800 school pupils before and after a zoo visit. Results found 38% displayed a positive change, demonstrating some form of relevant learning gain from the zoo experience. Similarly, Bowker's 2007 research at the Eden Project and Cainey et. al.'s 2012 study at the NMA also compared pre and post visit changes in school children's learning from trips and like the Jensen study utilised children's drawings as part of the evaluation process. Pre- and post-institution visit drawings were quantitatively scored against a range of criteria and then compared to measure any change in the children's perceptions and knowledge. All three studies found children's drawings tended to improve after their institutional visit, suggesting a possible positive effect on knowledge construction. Sattler and Bogner's 2017 study also utilised pre and post multiple-choice quizzes to establish knowledge gain in high school students who attended educational sessions in zoo. Participating students were found to make significant gains in both their short- and longer-term knowledge of marine ecology and conservation as compared to a non-participating control group. More recently, Wunschmann et al.'s study (2017), which also used pre and post questionnaires with high school students, found that students appeared to learn more, in this case on the subject of reptile biology, when they received lessons in a zoo setting than the same lessons in a classroom environment. Wunschmann et al. also provide an example of one of very few studies which consider how social factors, in this case gender, may play a role in zoo and aquarium learning, this is discussed in more detail in section 2.4.1.

The comparison of pre and post visit questionnaires, and the analysing of children's drawings are both tools implemented in my own research to investigate changes in

knowledge, attitude and interest in conservation and biodiversity issues, before and after an aquarium visit. The process of using drawings as a research tool is discussed in more depth in the methodology chapter.

The Jensen, Bowker and Cainey studies all conform to a constructivist view of learning – acknowledging that students come into the research period with differing perceptions, experience, skills and knowledge levels (Mackenzie & Knipe, 2006; Schwandt, 1994). However only Jensen's study aimed to establish prior non-formal learning experience asking participants to confirm *"Have you ever been to a zoo before today?"*. Jensen went on to compare drawing and survey results between first-time and repeat visitors and whilst finding no difference between the mean levels of learning, he did find repeat visitors demonstrated greater concern about species extinction and more belief that they personally could do something to prevent it. As discussed in section 2.2, examined through a Bourdieusian lens, such prior experiences of non-formal learning institutions could be viewed as a source and indicator of cultural capital. In the present study, which similarly conforms to a constructivist view of learning, I attempt to ascertain prior non-formal learning experiences of the participants through direct questioning of the students and their parents in the questionnaires and during interviews with their teachers.

Other studies in the zoo/aquarium learning field tend to look at school visits only as part of wider assessments of the educational potential of these venues such as Tofield's et al.'s 2003 study "*Zoos as a source of free choice learning*". This study used observations and interviews, including the use of photo stimuli, with public visitors, teachers and pupils to review the potential of zoos as a source of 'free choice' learning (Dierking & Griffin 2001). Specifically, this study aimed to measure learning in the area of environmental enrichment and enclosure design. School group interviews were undertaken before and after their zoo visit with any pre and post trip activities also being observed. Again, children's drawings were reviewed, along with worksheets they had completed to give a complete picture of their zoo experience. This study appears to purport free choice learning being proven in various, what I believe to be, tenuous ways including attributing visitor satisfaction towards enriched exhibits with having been educated that enriched cage designs are better. It also states that learning potential is more limited for

general visitors than for school groups, which although true, is probably down to the extra activities available to school groups rather than an inherent difference in the level of learning achievable.

Tunnicliffe et al.'s 1997 study "*School visits to zoos and museums: a missed educational opportunity*?" also looks to compare school and public visits to a zoo, and in this case to a museum also. Through observation and discourse analysis, the authors determined patterns in topics of conversations and coded them accordingly. Having found very little difference between the conversation of school and family group visitors, the authors reason that schools are failing to make effective use of the educational potential of such visits. Whilst I did not elect to work with the general public, I did utilise some similar methods to Tunnicliffe et al., observing the school groups visits and noting down topics of conversation of teachers, aquarium staff members and students.

Et

2.3.4 Environmental and conservation education in zoos and aquariums

Having proactively moved away from their original agenda of leisure and entertainment, towards one of conservation and education (Ballantyne et al., 2007; Ebersole, 2001), zoo and aquarium mission statements now tend to reflect these updated goals (Patrick et al, 2007). In a world where people, and particularly children are being observed to be increasingly removed from nature, both figuratively and literally (Bilton, 2010; Green, 2017; Waite, 2009), zoos and aquariums have the potenial to rebuild this connection. As a place where members of the public from a wide variety of backgrounds can observe wildlife up close, zoos and aquariums, are in a relatively unique position to foster public empthy towards animals and the natural world more generally. (Clayton et al, 2014; Tribe & Booth, 2003). This in turn can assist in encouraging visitors to take more environmentally positive actions (Falk, 2014). As with research into school trips to zoos and aquariums, there are also very few studies looking specifically at the role they have in educating their visitors about conservation and environmental issues more generally (Clayton et al., 2009; Tribe & Booth, 2003). The studies which have been undertaken provide a mix of findings.

Tofield et al.'s 2010 study, for example, used observations along with structured interviews and photo prompts to investigate visitors' use of the zoos; in particular their engagement with conservation-related signage and their perceptions of nature. It was found that the majority of visitors reported that the primary purpose of their visit was entertainment and that science learning as part of the zoo visit was limited. However, the study found that this did improve for school trips using pre- and post-visit activities with curriculum links. Conversely, Adelman et al. did find evidence, by means of interviews, observation and personal meaning mapping, of visits to the National Aquarium of Baltimore enriching visitors' conservation knowledge and awareness. In post-visit telephone interviews, however, they did not find any evidence of an increase in conservation behaviours post aquarium visit (Adelman et al., 2000).

Ballantyne and Packer's 2016 study, based on public surveys, found that the main priority for visitors to zoos and aquariums was still entertainment, in particular the aspect of socialisation and having a day out with family or friends. That is not to say that visitors were completely ignorant of the role of zoos and aquariums in conservation action and education. Approximately half of Ballantyne and Packer's participants stated their belief that zoos and aquariums had an important role to play in these areas, however they did not percieve this to be the main reason or main outcome for their own visits. These findings align with previous results by Dierking and Falk (2009), Linke and Winter (2011), Packer (2006) and Roe et al., (2014) who all found, across a range of different non-formal learning institutions, that entertainment and social interaction goals came higher than learning and discovery goals for public visitors. A number of authors have therefore proposed that to properly meet their conservation education goals, zoos and aquariums must work to close the gap between the instiution's overall goals and the visitor's own goals for their visit (Ballantyne et al., 2011; Cain & Meritt, 2007; Frost & Roehl, 2007; Grajal, 2013; Klenosky & Saunders, 2007; Tribe, 2001; Turley, 2001). Coming back to Packer's description of "*learning for fun",* it is of course possible that even if it is not their highest priority for their zoo or aquairum experience, visitors may still be learning about conservation "by stealth" as previous studies have shown that a social experience can facilitate learning during such visits (Packer & Ballantyne, 2004).

As my research site, the NMA, has a mission statement of '*driving marine conservation through engagement',* and with many teachers specifying that conservation and environmental issues are a topic they want to cover during their classes visit, I thought it pertinent to make conservation knowledge one of the cognitive assessment measures in my research. In this way I will also be adding to the existing literature by providing a rigorous, quantitative, medium scale study into how effective school trips to aquariums are in imparting conservation knowledge to young people.

2.4 Role of social factors in non-formal learning

As already alluded to, until recent years there has been very little research looking specifically at school trips from a sociological perspective (Archer et al., 2016). That is not to say that non-formal education venues were completely absent from sociological literature. There have been a number of studies concerned with the role such institutions can play in engaging audiences typically disenfranchised from science such as females and those from ethnically diverse and low socio-economic backgrounds (Dawson, 2014a; Fadigan & Hammrich, 2004; Rahm & Ash, 2008; Wheaton & Ash, 2008). However, these studies tend to concern family audiences, after school clubs or summer camps touching only very briefly, if at all, on school led trips.

Whilst studies looking at the widening participation in science in a non-formal manner do exist, the majority of research arising from such venues tends to focus on who is attending and what they are gaining from the experience, further excluding those who are already disengaged (Dawson, 2014b). In a structured literature review, Falk et al. found that of a potential 553 articles looking at non-formal science learning venues, only 27 looked at informal science education in terms of disenfranchised audiences (Falk et al., 2012; Dawson, 2014b). Of these 27 papers only one looked at low-income students and another one considered low-income families' interaction with informal science education.

With young people making up the most culturally-diverse group in the UK (Bellamy & Oppenheim 2009), this should therefore make them a key component in any efforts to widen participation in non-formal learning venues, so it seems somewhat remiss that school trips are currently under represented in the literature around this area.

2.4.1 Social influences during school trips

The recent Enterprising Science project, as discussed in detail in section 2.2.2 is an example of where school trips, and their role in enabling people from different backgrounds to access non-formal science learning institutions, was investigated. Most of the papers published as a result of Enterprising Science included elements of social research and looked at how such factors may affect children's school visits to non-formal science learning venues. The follow sub sections look at previous research into how three specific social factors may influence school trips; gender, ethnicity/culture and socio-economic status. As the Enterprising Science study was undertaken within a similar research period as my work, and encompasses all of these factors, it features heavily in the following sub-sections,

2.4.1.1 – Gender

Whilst many of the papers published from the Enterprising science project considered gender to some degree, three publications focused specifically on it.
Godec's 2018 paper, '*Sciency Girls*', used interviews and discussion groups with ethnically diverse, working-class, teenage girls to establish in what ways they identified and engaged with science. Whilst the girls did not report believing gender to be a factor in participation in science, analysis appeared to suggest that they tended to align themselves with the elements of science which could be viewed as traditionally female, such as the caring and nurturing professions, for example medicine and pharmacy. This could in turn be viewed as the girls excluding themselves, or indeed being excluded from, from other, more traditionally regarded masculine domains of science such as physical sciences and engineering.

Dawson et al.*'s* 2019 paper "*Selfies at the science museum*" explores 12- and 13-year-old girls' performances of identity through observation of their visit to a science museum. The researchers identified four key identities demonstrated by the participants during their visits; 'good girl students,' 'silent' participants, 'cool' (drawing on gender, 'race'/ethnicity and class) and another group which demonstrated performances of 'masculinity', but which included elements of race/ethnicity. Ultimately, what Dawson et al. found was that the science museum was not a space where these girls' identities as learners were valued, something that has been found important for learning to occur (Calabrese Barton et al., 2013; Thompson, 2014).

Archer et al.'s 2016 paper "I'm being a man here" was similar to the paper discussed above but focused on the performance of identity of 12- and 13-year-old boys during a science museum visit. In this case three main performances of masculinity are identified; 'laddishness', 'muscular intellect' and 'translocational masculinity' (performances that move across the social boundaries of gender, ethnicity and class) and the boys' engagement in the science museum experience are considered for each. This study found that each of the male performance identities, at least to some degree, lent themselves to engagement and/or learning, for example, 'laddishness' lent itself well to engagement with exhibits involving bravery or competition. Overall, the science museum space seemed to be better aligned to the performance identity of the boys, with male scientists being showcased and exhibits being designed in such a way that it better allowed boys to engage and showcase their science knowledge, something boys are far less likely to do in school.

As previous discussed, Wunschmann et al. 2017 also considered gender in their study which aimed to compare out-of-school (specifically in a zoo) and in school learning on reptile biology. In this study Wunsch found boys to do better in the treatment group than the girls, suggesting that the boys gained more from out of school learning arrangements. Given that girls are usually the higher achievers in a classroom environment, Wunschmann's results suggest that the genders may be differently disadvantaged by different learning environments and in turn, careful

selection of different learning environments could reduce gender disparities in learning. These results differ from other studies where, in the out-of-school group, girls performed better than boys (Bätz et al., 2010) or where there was no gender gap in the out-of-school group (Weßnigk & Euler, 2011).

Whilst gender is not a key focus of my research, my study does look to identify in what ways gender could be an influencing factor in the learning achieved during school trips. Learning achievement scores will be compared between male and female participants, along with any differences in prior experience of non-formal learning spaces which in turn, could be considered as differences in this specific form of cultural capital.

2.4.1.2 Ethnicity and resulting cultural differences

Extensive research has revealed patterns of achievement and attainment across ethnicity and race, but this remains a highly complex and contested area (Archer, 2008). Whilst this is an intersectional issue, bound closely with gender and social class, students from African-Caribbean backgrounds are, in general found to have the lowest achievements in examinations. Asian students tend to achieve as well as, if not better than white students of the same gender and social class, although this varies between different nationality groups (Archer, 2008; Archer & Francis, 2005; Gillborn, 1997).

Prior to the Enterprising Science study, studies on the experience of minority ethnic groups visiting non-formal learning venues tended to focus on family groups rather than school trips such as Dawson's 2013 study "*Not designed for us: how museums and science centres socially exclude low-income minority groups*". This study used focus groups, interviews and accompanied visits to non-formal learning institutions. It found that visits to non-formal learning venues could "*reinforce social disadvantage for some visitors*" as visitors from certain communities reported feeling "othered" in such environments (Young, 2000). Factors such as English language dominance (Ash, 2004; Garibay, 2009) and a lack of recognition of the role of other cultural contribution to science (Garibay, 2009) left participants (who consisted of groups from Latin America, Somalia, Sierra Leone and Asia)

feeling that this was not a space where they were welcomed, or where their culture was valued. These findings were echoed in Archer's 2016 paper "*Disorientating, fun or meaningful? Disadvantaged families' experiences of a science museum visit*" (part of Enterprising Science study) which found that an uneven social distribution of habitus and capital, primarily in the form of language and cultural barriers, meant that non-traditional families were disadvantaged in terms of gaining from a museum experience. These studies offer an explanation as to why ethnic minorities are, along with other non-traditional groups, underrepresented in visitor statistics to non-formal science learning science venues (Dawson 2014 & 2018, Archer et al., 2016).

Whilst none of the 21 Enterprising Science papers were specifically about the role of ethnicities and cultural differences during visits to non-formal science learning venues, the science capital of those from non-traditional and disadvantaged communities was a key focus for this project and so ethnic and cultural factors were discussed across many of the resulting publications. For example, in both Godec's 2018, and Dawson et al.'s 2019 gender focused papers - discussed in detail in the previous section - the potential influence of the ethnicity of the participants was explored as an intersectional factor along with gender.

Godec found that whilst femininity tended to be less compatible with a science identity, the desirability of science as a career, within some cultures could somewhat override this effect. Students from certain cultural backgrounds, South East Asian being a key example, face high parental expectations in their achievement in STEM subjects, as these are considered a pathway into respectable and well-paid career paths such as medicine (Springate et al., 2008). Such encouragement appears to manifest itself as higher participation and success rates in STEM subjects in South East Asian students of both genders (Archer et al., 2012; DeWitt et al., 2011).

In Dawson et al.'s observations of a science museum visit, they found that when female students from certain backgrounds demonstrated common cultural stereotypes such as loud and assertive behaviours, such performances were disciplined by educators rather than being recognized as being culturally

appropriate displays of confidence and a willingness to demonstrate their science knowledge (2019).

Like gender, whilst ethnicity is not a key focus of my research, my study looks to identify what ways this social factor could be influencing children's school trip experiences and subsequently, their learning. As well as comparing learning scores and prior experience level of children from different ethnic groups, teacher interviews will be utilised to attempt to pick into how cultural differences might be influencing the experience of children from different backgrounds.

2.4.1.3 Socio-economic status.

It has been posited that Socio-economic status is the most commonly investigated variable throughout educational research (Sirin, 2005). It has long been assumed to be an influencing factor in education, with most studies proposing a link between children from less privileged households and reduced academic achievement (Coleman et al., 1966; Rumburger & Willms, 1992; Sutton & Soderstrom, 1999). A 1997 study by Caldas and Bankston, based in the USA and using educational authority test results and demographic data, suggested there may also be a link between the overall SES of the school population and student achievement, with pupils from lower SES households appearing to benefit academically from being surrounded by students from more privileged backgrounds.

As with gender and ethnicity the literature on the role SES may play on visits to non-formal learning science venues has tended to focus more on family visits rather than during school trips and often forms part of an intersectional study along with other social factors. As previously discussed, research suggests that non-formal learning institutions are not 'inclusive' places, having 'standard' visitor profiles tending towards audiences from ethnically dominant, middle class and affluent backgrounds (Bell et al., 2009; Dawson, 2014a). Entrance fees to non-formal learning venues have been cited as a potential 'barrier' preventing low SES families from visiting science centres, museums, aquariums etc. but studies have shown that even when such charges were lifted from a number of UK based non-formal

learning institutions, such as the Science Museum and Natural History Museum in London, this was not found to diversify the general visitor demographics (Dawson, 2014a & 2018). When considering why the scrapping of entrance fees might not have opened up these experiences to visitors from low SES backgrounds, it is important to understand that such a move does not make non-formal learning visits completely free of charge. In most cases there would still be transport costs attached to getting to the venue as well as possible food costs and even feeling that gift shop purchases would be expected of them.

This lack of diversity in non-formal learning institution visitors has created a sociological concern that, as families higher up the socio-economic ladder are more likely to spend leisure time taking their children to non-formal learning institutions, any educational benefits attached to such visits have the potential to increase educational inequalities across different socio-economic groups. (Dawson, 2014a). This is particularly concerning when aligned to the findings of more general education studies which appear to suggest that in school educational activities increase learning rates within low- and high SES students in a relatively uniform way, making informal and non-formal learning experiences especially important in terms of opportunities where educational achievement gaps can occur (Alexander et al., 2007; Downey et al., 2004; Entwisle et al., 1994).

Such findings are often used in championing school trips, citing them as levelling the field and offering children from low-income households the same enriching, out-of-school experiences that those from higher SES families (Hooper-Greenhill et al., 2009). Whitesell (2016) describes school trips as "*critical informal learning opportunities"* for disadvantaged students as they occur during the school day and do not tend to require intensive family participation or resources. Dawson however recommends caution in overestimating the all-important long-term effects of such visits, highlighting that even countries with a long-standing history of school-trips to non-formal learning venues, still appear to only partial public participation in visits (2018).

Alon and Tal's 2015 study into student self-reported learning outcomes for field trips looked as SES status as one of their variables. They found that whilst students

from low SES backgrounds did not report significantly different outcomes, their reduced previous experience of such non-formal learning environments appeared to put these students at a disadvantage during subsequent trips. This idea is key to my research and is discussed in detail in the next section.

2.4.2 Role of prior experience of non-formal learning institutions

As has already been discussed, along with ethnic minorities communities, individuals from lower socio-economic households are under-represented in visitor audiences to museums, zoos, aquariums and other non-formal learning venues (Dawson, 2014b ; Feinstein & Meshoulam, 2014). As school trips tend to consist of children from more diverse backgrounds, more representative of the general community (Feinstein & Meshoulam, 2014), such visits have been mooted as somewhat of a panacea, a way to level the educational playing field between socio-economic groups.

Additional research in this area, however, points to the contrary, suggesting that prior experience of informal learning venues plays an important role in shaping how much learning is achieved during subsequent visits to similar establishments (Falk & Dierking, 2000). If this is correct, school trips could be exacerbating the problem, further widening the gap of educational inequalities, as children from middle class families will know how to behave and perform in such settings, getting more educational value out of the trip. Bringing this back to the theoretical framework, if visits to non-formal learning venues are the modern-day equivalent of the Beaux arts, and participation in them can be considered a form of capital, it is a logical conclusion that prior experience would be advantageous.

Along with the aforementioned 2015 Alon and Tal study, a number of other researchers have considered the role prior experience, or lack thereof, may play in influencing student visits to non-formal learning institutions (Green, 2017; Griffin, 2004; Jensen, 2014; Sattler & Bognor, 2017). A quantitative, survey-based study by Sattler and Bognor (2017) found that students who had previously visited a zoo before not only demonstrated a higher pre-school-visit knowledge score, but also post-school-visit score, when compared to classmates who did not have zoo

experience prior to the school trip. The authors attributed this apparent advantage to a level of familiarity with the learning environment, also described as the 'novelty effect'. Sattler and Bognor did concede however that prior experience could also be aligning with children who already have a particular interest in animals and so this could be the cause of the increased scores rather than the visits themselves.

The 'novelty effect' was introduced by John Falk and colleagues to as a potentially interfering influence on school trip learning where the newness of a location results in disruptive behaviours in students. One explanation and example of such behaviours could be anxiety of the unknown and students seeking support through interacting with each other which reduced their concentration and attention (Balling & Falk, 1980; Falk et al, 1978; Storksdieck et al., 2005).

As well as being attributed to potentially distracting emotions such as excitement, fear or feeling overwhelmed, the novelty effect could also account for differences in children's physical behaviour during trips. In his 1980 study, Gottfried observed that children participating in a school trip to a science centre randomly searched around for stimulation, which simultaneously provided them with an overview of the location, before they could engage into a specific task. Presumably therefore, children who have existing knowledge of a venue would be better equipped to know what they wanted to spend their time interacting with, allowing more time to actually engage with the exhibits.

It is worth noting that having prior experience of a venue does not depend solely on previous physical attendance as other familiarisation techniques have also been found to produce a reduction in the novelty effect. Falk found that school children who were provided with a road map for their upcoming visit to a zoo outperformed those who were not provided with such preparation activities. He attributed this to the unprepared children having to spend more time during their trip acclimatising themselves with the novel scenario they had been placed within, which diminished their ability to concentrate on the learning aspects of the trip (Falk, 1983). Familiarisation tools and their influence on learning are discussed in more detail in the next section of this literature review.

Whilst the studies I have looked at so far consider the potential negative effects of the novelty effect, others do believe that elements of the unknown can actually enhance the learning experience. In her 2017 study, which investigated the lived experience of children on a residential field trip, Green found the new environment and situation the children were placed in provided challenges which ultimately boosted their self-esteem and confidence. Luckner and Nadler (1997) looked to biology to explain the influence a new environment or situation can have on an individual proposing that "*a heightened sense of arousal by the novel and unfamiliar surroundings enrich an experience*". Applying this specifically into an aquarium context, it is possible that if a child has never been to an aquarium before and has never witnessed an eleven-foot shark in the flesh, exposure to this awe inspiring experience could arouse emotions, perhaps excitement or even fear, that could stimulate learning. For example, the child could be so engaged by the sight of the creature, they are inspired to want to learn more about it. The alternatively theory would be that this wonderous, novel sight acts as a distraction, preventing them from listening intently to the educator leading the guided tour. It is of course likely that both scenarios could be true depending on the nature of the child or indeed for the same child, if they were distracted during the trip but then went on to do their own research at home.

2.4.3 Awe and Wonder

Awe and wonder are terms closely associated with the unknown and novel and are commonly attached to a school trip experience. They are also now an OFSTED requirement of education more generally, falling under the Spiritual, Moral, Social and Cultural (SMSC) assessment criteria requiring teachers and schools to "providing opportunities in lessons for students to reflect on elements from which they can derive awe and wonder" (OFSTED, 2004). Given the OFSTED requirement, and the fact they have become 'buzz words' amongst educators, there is surprisingly little reference to awe and wonder in education literature and are absent from the English curriculum (Hadzigeorgiou, 2013; Piersol, 2013).

‘Awe’ and ‘Wonder’ and are often referred to alongside each other. The Oxford English dictionary defines wonder as “*a wave of surprise caused by something unexpected or unfamiliar”* and awe as “*a feeling of reverential respect mixed with fear or wonder*”. ‘Awe’ is a term most commonly associated with religion and has been defined as “*an overflow of powerful feelings that result from confronting everyday features of the world as a form of internal mystery” (*Egan et al., 2013: p.277*)* ‘Wonder’ however, was a frequent concern of the ancient philosophers with Plato describing it in terms of puzzlement, Descartes linking it to a “*sudden surprise of the soul”* and Aristotle and Aquiris understanding it as *“essentially curiosity of the natural, astronomical or scientific world ”* (Deckard, 2008; p.949). In the 2013 book *Wonder-full Education*’, Piersol distinctly defines and compares the two concepts stating that *wonder “embodies feelings of doubt, curiosity and amazement” (p.15), “extraordinary but still within grasp of comprehension”(p.43)* and *“awe is deep sense of appreciation…a sense of mystery that is unexplainable”(p.43).*

In terms of their role in education, both awe and wonder are cited as important cognitive tools, linking them to a drive for intellectual inquiry (Egan, 2005; Fisher, 1998; Pearce & MacLure, 2009). As inquiry is such an important part of the scientific process, it is easy to see why Fisher might describe science and wonder as “*two sides of the same coin*” (Fisher, 1998). The afore-mentioned book *Wonderfull Education* can be considered something of a seminal text on educational awe and wondering, bringing together a number of academics’ essays on the subject. Whilst each contributing author provides a unique perspective, the overall consensus appears to be that the current education system, and particularly an inflexibility in the curriculum, does not allow much room for awe and wonder in teaching and that children are, particularly in regards to the sciences, being left to feel that nothing is left unknown to be wonderous about, or left for them to discover. Across the board recommendations are made to educators to bring ‘awe and wonder’ into their teaching, particularly in science, to use it as a tool in teaching, as well as an outcome (Witz, 1996).

2.5 Role of educators and educational practices on school trips

Numerous studies have shown that the educator's role within a field trip is a highly influential one. From the selection of the location and practicalities of organising the trip, to their behaviour and attitudes on the day, the formal educator's role is extensive and crucial to the success or failure of the trip (Jarvis & Pell, 2005; Nabors et al., 2009; Price & Hein, 1991; Sørensen & Kofod, 2003). Within non-formal learning institutions such as zoos and aquariums, there is of course a second set of educators to be considered; the staff who deliver the institution's education content, also known as non-formal educators. Institutions will have various different names for these educators – guide, host, docent, crew member etc.– along with a variety in their status and roles - paid versus voluntary, specific education team member versus general staff member with some education duties. The common theme however is that these non-formal educators are liaising directly with visitors to impart knowledge or assist in learning in some other capacity.

2.5.1 Teacher attitudes towards trips

Through the lens of Goffman's sociological perspective "Presentation of Self" (1959), the role of teacher can easily be aligned with that of a performer, with their classroom a familiar stage where they comfortably take the leading role in the performance of teaching. A field trip presents the teacher with a less familiar stage, a far less settled audience and rival performers in the form of the institution staff. Interesting questions arise as to how these factors might challenge a teacher's attitude towards, and behaviour during field trips.

Research finds that formal educators, regardless of whether or not they see them as a valuable educational tool, are generally enthusiastic about school trips (DeWitt & Storksdieck, 2008; Ferry, 1993; Phillips *et al.*, 2007; Tal & Morag, 2009). A range of factors influencing teacher attitudes toward trips have been identified in past research including how much organisation is required, how well-prepared the venue is for receiving groups and how much autonomy over the trip they had (Price & Hein 1991; Tal et. al. 2005). Gupta et al. 2010 also introduces the idea that

teachers more general attitude towards trips are formed much earlier, with their own experience of undertaking trips consciously or unconsciously shaping how they view the importance or even necessity of school trips. In their work they use the specific example of China, where school trips to non-cultural venues are not a tradition in the same way as in the UK or USA, and so trips to informal science learning venues are not such an expected part of teaching practice. This would however appear to somewhat contradict Kisiel who suggests that teachers who went on less trips as a child want to lead more trips with their own students (2016).

Griffin and Symington (1997) reported some teachers as feeling intimidated and overwhelmed by management concerns such as losing children, damaging the reputation of their school and being unfamiliar with the location as well as by the prospect of students asking questions that they cannot answer. Studies by Kisiel (2005), Griffin & Symington (1997) and Tal et. al. (2005) all report an uncertainty felt by teachers as to what their role is during a field trip. Their usual presentation of front, comfortably performed in the classroom, is disturbed by the new physical setting but also by the new form of instructional practice expected of them.

Teacher training on how to conduct field trips is somewhat limited, with some teachers claiming never to have had any formal training on the pedagogy or practicalities involved (Anderson et al., 2006; Behrendt & Franklin, 2014; Gupta et al. 2010; Kisiel, 2006; Tal & Morag, 2009; Tal et al., 2014). Teachers can refer to textbooks for advice on running school trips, but these tend to focus on procedure rather than method and practice (Storksdieck, 2001). They are, therefore, likely to be learning 'on the job' – either during placements or in their first teaching positions. As such, teachers are likely to be influenced by more experienced colleagues, who may or may not be demonstrating good practice (Gupta et al., 2010). When this lack of training is coupled with the fact that primary school teachers report a lack of confidence in their ability in teaching science (Dorph et. al. 2011, Kisiel 2013), it is, perhaps, unsurprising that some studies report a high level of anxiety regarding field trips. Teachers have reported a desire to undertake training in school trips (Kisiel, 2016) and studies have shown that providing education in this area has a range of benefits, such as teachers being more inclined to organise school trips, increased knowledge of

non-formal learning resources, better affective learning outcomes and an improved understanding of how science subjects fit together within the curriculum (Tal & Morag, 2009). Suggestions have been put forward that training on how to conduct school trips should become a mandatory part of the student teacher curriculum (Gupta et al., 2010 Tal & Morag, 2009). Kisiel recommends that non-formal learning institutions have the potential to play a role in the provision of training in this area for teachers. This could be either as part of teacher training – as with the CLUSTER project, which linked the New York Hall of Science with a local teacher training college – or in professional development sessions for established teachers (2016).

Teacher attitudes have been found to be a particularly important factor in their students' experience of a trip. A study by Price and Hein (1991) found that the more engaged teachers were on their field trip, the more positive their attitude was towards the trip and consequently the more students appeared to benefit from the experience. This is supported by research by Griffin and Symington (1997) and Jarvis and Pell (2005) who found that pupils' attitudes regarding school trips tend to mirror that of their teachers, with students being more enthusiastic and engaged during school trips to science venues if their teacher was likewise engaged in the subject.

2.5.2 Teacher agendas for trips

Various research suggests that whilst teachers generally agree that field trips are valuable learning experiences, their agendas for visiting can be varied and complex (Anderson & Zhang, 2003; DeWitt & Osborne, 2007; Kisiel, 2005; Storksdieck et al.,2006, Tal & Steiner, 2006).

The most detailed of these studies, Kisiel's 2005 study "*Understanding Elementary Teacher Motivations for Science Field trips",* attempts to characterise field trips from the teacher's perspective through surveys (n=115) and in-depth interviews and observations (n=10). The author identifies 8 motivations for field trips; to "c*onnect with curriculum, provide a learning experience, promote lifelong*

learning, foster interest and motivation, expose to new experiences, provide a change of setting, provide enjoyment or reward, and satisfy school expectations". Of these, the strongest motivations were seen to be those which linked field trips to the curriculum, hardly surprising in a time where teachers are required to justify the cost of field trips both in terms of budgets and time away from the classroom (Anderson & Zhang, 2003, Kisiel, 2005, Eshach, 2007, Storksdieck, 2008).

However, there is also contradictory evidence suggesting that not all teachers recognise the learning potential of every field trip, seeing some as more for play than knowledge construction, as a 'reward' or just a 'nice day out' (Griffin & Symington, 1997; Sørensen & Kofod, 2003). Griffin and Symington (1997) found that teachers with lower educational motivations for visits, tended to have fewer explicit goals for their trips and did not attempt to link field trip content back to classroom curriculum. This is one way in which motivation for trips can be seen to be influencing practice, which we will consider in the next section.

Kisiel (2016) identifies commonality in teachers to whom he refers as 'frequent users' of non-formal science learning resources, and whilst he is investigating non-formal learning more generally, Kisiel does distinguish between school trips and other non-formal learning resources. He reports that frequent visits to centres did not necessarily correlate to increased use of other forms of non-formal learning and science learning resources. Kisiel describes how avid users of non-formal science learning resources are more likely to be from private schools, but that keen users from less prosperous schools don't let a lack of funding inhibit them and will find ways to navigate past such barriers. He does not find a teacher's length of service to be linked to frequency of use, and postulates that there is a specific type of teacher who tend to actively use such resources: an identity type which does not change over time. Interestingly, he also proposes that it may be teachers who lack confidence in their own science knowledge, rather than those with more scientific acumen, who become avid users, as they turn to such sources to compensate for their own perceived deficiency. Kisiel proposes such avid users could play an important role as a broker between formal and non-formal learning institutions: acting as a contact point, providing support and perhaps even training other

teachers in how best to run school trips and generally access non-formal learning resources (Kiseil, 2014, 2016)

My interviews aimed to establish individual teacher agendas with regards to their trip to the NMA and more general motivations for taking students on excursions. Interview data was interpreted with a view to determining to what degree habitus, the social norms expected by schools and teacher peers, played in framing teachers' outlook on this particular trip, and trips more generally.

2.5.3 Teacher school trip practice

Practice around field trips will vary depending on the role the teacher takes in the planning and executing of the trip. Tal and Steiner, (2006) categorises teachers into one of three levels of field trips involvement ranging from highly involved in all aspects of planning and delivery to passive, not participating in the field trip experience. Jarvis and Pell's 2005 study "*Factors Influencing Elementary School Children's Attitudes toward Science before, during, and after a Visit to the UK National Space Centre*" breaks these roles down further using observation to categorise adult supervisors of field trips, including teachers, into 5 types of behaviours; Manager (of timetable), Controller of behaviour, Facilitator (of games and activities), Explainer/Reader (of exhibits) and Role Model (demonstrating use of an exhibit rather than assisting children to use it themselves). Each of these roles will result in different field trip practices and, as has already been discussed, teachers tend to be most engaged and have a more positive attitude towards trips they have autonomy over (Price & Hein 1991; Tal et. al. 2005).

Research suggests that trip agendas should, and for the most part do, influence formal educators' school trip practices (Eshach, 2007; Kisiel, 2003; Storksdieck, 2006). Davidson et. al.'s 2010 case study of two teachers' school trip management, neatly showcases this phenomenon, highlighting the contrast between the practices of teachers who see the trip as an educational experience over those who view it as just a 'reward'. Educators with educational agendas at the centre of their trips are seen to demonstrate what is considered to be best school trip practice, i.e. detailed

planning, familiarity with setting (including student orientation), tying visits to curriculum-linked classroom activities, using structuring tools such as worksheets but also allowing individual exploration and discovery (Davidson et al., 2010b; Kisiel, 2003; Kisiel, 2006; Nabors *et al.*, 2009; Rennie & McClafferty, 1995).

Storksdiek (2001) reports that teachers are mostly aware of best practice in running school trips but that they come up against a number of challenges when it comes to the practicalities of arranging trips at the expense of trip pedagogy. Identified barriers to successful school trips include administration hurdles, insurance issues, curriculum inflexibility and lack of venue options, funding, transport, teacher training and experience. Time proves to be barrier in a number of ways in terms of finding a suitable date to be away from the usual curriculum studies and teachers finding time to prepare for the trip properly. Even bus availability can impact the length of available time attending a venue as buses are restricted to use after school drop off and before pick-ups. (Behrendt & Franklin, 2014; Kisiel, 2014, 2016; Gupta et al, 2010; Rennie, 2007).

2.5.4 Role of non-formal educators on trips

Literature is plentiful in the area of best practice for communication with visitors in informal learning institutions. Passive communication in the form of signage boards and exhibit labels are found to be the least effective form of interpretation, often being ignored by visitors resulting in them leaving uninformed, confused or even having formed misconceptions (Miller et al., 2004). Interaction with institution staff members, be it interpersonal as part of guided tours or one to one conversations, or indirect as part of talks or workshops, has been proven to be a particularly influential in terms of both the overall experience of visitors, and the subsequent learning that is achieved (Allen and Gutwill, 2001; Jensen, 2014; Tran, 2007).

Lindemann-Matthies and Kamer's 2006 study investigates the role of institution staff through the evaluation of a common museum tool, touch tables. This zoo-based study used questionnaires to compare the change in biology, ecology and

conservation knowledge of visitors who had access to touch tables to those who did not. All participants in the study had access to the usual static interpretation in the form of enclosure labels and poster but those who also had access to zoo staff manned touch tables appeared to learn more and were found to be more satisfied with their zoo experience. Whilst it was not a focus of the study the authors recognised that the strongest success factor in the use of the touch tables may have been the staff interaction that it provided to visitors. The authors profess the benefits of having a staff member or volunteer present to assist in the process of establishing cognitive links, current concepts and visitors' prior experience and knowledge.

There are some obvious key differences between informal, learning-institution-based education and formal, classroom-based education, beyond targets, grades and curriculum goals. Whilst a teacher has one class for many different lessons, a museum educator has many different classes for the same lesson; a fact which is bound to influence their teaching style. Museum education has, in fact, been criticised for being too similar to formal education: often taking the form of didactic, lecture-orientated sessions. This is something which might be explained by the high proportion of qualified teachers who are hired to manage museum education departments (Jensen, 1994; Storksdieck, 2001; Tran, 2007). Allen and Gutwill propose an alternative explanation, however: suggesting that museum educators may be allowing epistemologies and pedagogies familiar to them from their time as a school student to shape their own teaching. In their 2014 review of the training of non-formal educators, Allen and Gutwill also found that such non-formal education staff were often poorly supported as professionals and tended to operate in a relatively isolated manner, having only very limited opportunities to share their experiences and discuss best practice with their peers. It is, however, worth noting that their study focussed on part-time and/or volunteer museum docents and therefore their findings may not apply to full-time staff such as those who make up the NMA's education team.

In her 2007 review of teaching in museums, Tran is able to provide some examples of creative, unique forms of science teaching, which were distinct from traditional education. For the most part, however, she found museum educational practices to

be similar to school-based teaching approaches. Like Allen and Gutwill she recommends that non-formal educators build a stronger community and develop a shared professional language and pedagogy to best support their aims of affective, student-centred learning.

In the same study, Tran also identified differing agendas between formal and non-formal educators: with museum staff more interested in the aforementioned affective learning outcomes, whilst teachers tended to frame trips around cognitive, concept learning. Specifically, Tran identifies the aim amongst museum staff for students to go away with a better overall appreciation of science. She reports of non-formal educators viewing trips not as stand-alone, one-off visits, but instead as part of a bigger continuum of lifelong visits to such institutions.

A number of studies have considered the relationship between the informal and formal educators during school trips. Kisiel (2010, 2014) describes the role of the intuition staff members as "*content creator"* compared to the management type of role teachers take on during a school trip. He also emphasises the need for good rapport and communication between the parties if school trips are to be successful learning vehicles, with agendas for both parties being the same, or at least overlapping. Both Gupta et al. (2010) and Kisiel (2014) discuss challenges in this relationship such as power struggles that can occur with both the teachers and the non-formal institution staff believing themselves to be in the main authoritarian during a trip. Gupta states a belief that it is possible for each of these stakeholders to have their own individual goals but that there must be common motives and a "*collected endeavour of teaching science in an engaging way*" for trips to be successful, particularly with students on school visits.

2.5.5 Guided vs. non-guided experiences

One of the most common ways non- formal educators interact with visitors, and particularly with school groups, is through guided tours. Research finds guided tours, with trained interpreters, to have a particularly transformative effect on visitors, proving to be a powerful tool in assisting them to make connections

between exhibits, cognitive outcomes and real-life applications (Schwan et al, 2014; Visscher et. al. 2009; Weiler & Smith 2009). It is worth noting however, that some may reason that the structure that guided tours demands may actually move these experiences out of the realm of non-formal and informal learning and into formal learning as they are no longer voluntary self-exploration, especially if they involve a lecture like structure (Cox-Petersen et al, 2003; Rennie, 2007).

A seminal 1983 study by Stronck aimed to evaluate the role of informal educators through comparison of knowledge assessment survey scores and attitudinal questionnaires between guided and unguided school groups visiting a museum. Whilst greater cognitive achievement was found in those who took part in the more structured, docent-led tours, attitudes towards the museum experience as a whole were found to be more positive in the groups on the less structured, teacher-led tours. Consequently, Stronck recommended that the teacher's agenda should guide their selection of tour type with guided tours only advocated where learning outcomes are the aim of the school trip.

Jensen's aforementioned 2014 study supports these findings in a zoo context with 41% of educator-supplemented visits, as opposed to 34% of unguided visits, demonstrating an increase in conservation biology related learning. As this study included pre- and post-evaluation, Jensen was able to record where there had been a negative change in knowledge, providing further evidence in support of guided tours, with negative changes being more prevalent in the unguided groups.

Cox-Petersen et al. (2013) however directly contradicts Stronck's findings. This naturalistic study aimed to establish what students gained out of guided tours and involved observation of school groups along with interviews of teachers, students and museum docents. As well as being asked about their enjoyment of tours, participants were asked to report on what they had learnt, with responses being coded as a high level of learning if they integrated concepts and provided appropriate details. Contrary to Stronck's study, enjoyment and cognitive achievement were most associated with the opposite tour types. Interview data revealed satisfaction levels of museum staff guided tours to be high, with 92% answering positively to whether they enjoyed touring with a guide, but science

learning was judged to be higher in those taking teacher led tours. Observation of the staff led tours revealed 75% of them to be lecture orientated, providing very little opportunity for students to make decision or work collaboratively. Tours led by teachers tended to be more exploratory and involve more free exploration time for the children.

My own study draws heavily from methodological elements of both Stronck and Cox- Petersen et. al.'s studies using both knowledge assessment scores from questionnaires with students and pre and post visit interviews with the educators, formal and non-formal, to assess cognitive changes and attitude shifts from the differing tour types.

Heimlich & Meyer (1999) go some way to corroborate Cox-Petersen et al.'s findings with regards to the practices of informal learning staff. Postal surveys with 131 park and zoo educators revealed there to be incongruences between the beliefs and practices of such informal educators. Whilst these staff believed themselves to be playing the role of enablers (low control and high inclusion with their audience), they were not demonstrating the use of enabling methods and were instead using high control and low inclusion styles of communication. Both the Cox-Petersen et. al and Heimlich and Meyer studies therefore recommend a 'best of both worlds' approach with the continued use of docents in non-formal education but advising a shift in their presentation style towards facilitation rather than lecturing, and increased use of enabling learning methods such as personal inquiry and social learning processes.

2.5.6 Role of pre- and during- visit materials and activities

Whilst a field trip may be a one-off occurrence, constructivist-learning theory advocates that any resulting learning does not occur in isolation. There are many factors that can affect the success of the learning outcomes from a field trip, but prior knowledge of the concepts being presented has been noted to be particularly influential (Anderson, 1999; Storksdieck, 2006). Some prior knowledge will of course be incidental, but where it is intentionally set up in advance of a field trip with the intention of familiarising students with concepts they will encounter, this

can be referred to as pre-visit lessons or activities. Similarly, intentionally continuing learning outcomes after the trip has ended can be referred to as follow up or post-visit activities and has been found to be an important way to link visits to curriculum learning (Anderson et al., 2000; Ballantyne et al., 2007; DeWitt & Storksdieck, 2008; Tofield et al, 2003).

Given the widespread subscription to constructivist theories of learning, it is perhaps surprising that more empirical studies have not been conducted into the effectiveness of such pre and post visit practices. An example of a paper that does look at trips from this perspective is presented by Hauan and DeWitt (2017). This study explores the educational impact of well-designed visit support materials through monitoring of behaviours conducive to learning during trips, such as encouraging group work, reading signage, completing tasks and interacting with exhibits. This deficit in the literature may be in part down to lack of professional practice, as although it is now common for informal learning institutions to offer some kind of pre-prepared material to supplement school visits, uptake of such materials is relatively low. Reviews of professional teaching practice suggesting that post-, pre- and even during- visit resources are frequently requested but in fact rarely implemented. (Cox- Petersen & Pfaffinger, 1998; Kisiel, 2016; Storksdieck 2006). This may be explained due to teachers having lack of time to read and implement these materials, but it is also possible that such materials are not even reaching teachers where school administration staff make the booking for the trip (Kisiel, 2014). It is, however, still in the informal learning institute's interest to produce resources that teachers find useful and want to use with their students, as the success of trips is reflected in the likelihood of return trips, not only by teachers but also by students outside of school trips (Gupta et al., 2010; Storksdieck, 2001).

The concept of linking field trip content into the classroom is not a new one. Gennaro's 1981 seminal study aimed to evaluate the overall learning experience from a field trip to a museum and how this could be improved through the advance preparation of students to the concepts they would encounter. This was a relatively small-scale study tracking five classes all from the same school as they undertook a field trip to a science museum and in particular to an earth sciences film experience. Participating students were split into treatment and control groups with

only the treatment group receiving pre-visit lessons tailored to the content of the movie. Both groups were subjected to pre and post testing in the form of multiple-choice surveys completed at the start of the study (before any pre-visit activities were conducted on the treatment group) and then immediately after the museum visit. Statistical analysis showed the treatment groups to score significantly better in the post test scores than those who did not receive any pre-visit instruction, being able to answer 7.7 more questions (15% of the test). Interestingly, a test group who were only given a basic introduction of the centre and what their visit would entail, rather than any content related information, also scored higher than those with no pre-visit interventions. This aligns with recommendations made by Rennie who believe that student preparation should be two-fold, to set learning objectives and introduce subject content, but also to orientate the venue and set expectations for students around what they will experience from a physical and timetable point of view (2007).

2.5.6.1 Use of worksheets during school trips.

An option open to schools as an alternative to staff member guided tours, are visit-supporting materials designed to assist groups to 'self-tour' non-formal learning institutions. Whilst these can be created by the teacher themselves it is now commonplace for non-formal learning institutions to supply these to visiting school groups. In aquariums, for example, such materials might be used to encourage school groups to travel a particular route around the venue or to explain specific exhibits or concepts. Visit-supporting materials may be created solely for the teacher's use or can include materials intended for the students themselves, such as worksheets.

Whilst worksheets are not necessarily appealing to the students, who often view them as tiresome and detracting from their trip experience (Krombass & Harms, 2008; Rix & McSorley, 1999), they are commonly utilised by teachers who believe them to be an effective, and sometimes even necessary, educational tool (Hauan & DeWitt, 2017; Kisiel, 2003; Mortensen & Smart, 2007). Research, however, is divided in terms of how effective worksheets actually are in terms of enabling the learning process during trips.

Mortenson and Smart (2007) reported an increase in curriculum-linked conversations, while Krombass and Harms (2008) noted an increased knowledge on a specific concept – in this case biodiversity – when worksheets were applied during trips to museums. A more recent study by Hauan and DeWitt (2017) tested a range of different during-visit materials, including worksheets, and investigated how each influenced verbal and non-verbal behaviours in students and their development of conceptual understanding during a science centre visit. They found that providing assignments, in the form of exhibit interaction sheets and conceptual flow chats, generated complex discussion between students as they attempted to navigate the tasks and corresponding exhibits together, something which they attribute with having increased conceptual learning outcomes. This corroborates work by Klopfer et al. (2005) and Yatani et al. (2004) who both found that including elements of problem solving promotes visitor engagement, although in both cases this was achieved through the use of personal electronic devices . It also aligns with the findings of Rennie (2007) who recommends the use of group worksheets to capitalise on the social dimensions of learning; recognising that, whilst learning is a personal process, it is rarely done alone and frequently involves interaction either with other people or socially-constructed materials.

However, in their 1999 study based in a science centre, Rix and McSorley (1999) found some evidence, albeit relatively weak, to suggest that the use of worksheets actually reduced understanding of some exhibits. In their observations they found children to be pre-occupied with '*finding the right answers'* and noted that the physical sheets themselves, along with the pencils used to fill them in, inhibited the ability to get hands-on with the exhibits. This would align with the fact that some teachers report using worksheets as a way, not necessarily to engage students with particular exhibits or concepts, but to keep them focussed on the trip through collecting facts (Hauan & DeWitt, 2017; Kisiel 2003, 2007). What is undisputable is that the use of worksheets moves trips further away from informal, self-led exploration and free-choice styles of learning (Falk & Dierking, 2000). There is also a school of thought that espouses the virtue of worksheets as a levelling tool: ensuring that all students have a similar trip experience (Behrendt & Franklin, 2014; Kisiel, 2007).

2.6 Methodological approaches for assessing pre-visit activities

Work by Anderson and Lucas (1997) demonstrated that pre-visit activities could be relatively simple but still have a positive effect on field trip learning. This study took a specific look into the usefulness of orientation of location as a pre visit activity for a field trip to a science centre. Through comparison of treatment and control groups, they found that simple pre-orientation sessions; introducing the physical space, a brief overview of science centres generally along with a detailed itinerary for the visit, had a positive outcome on the learning achieved. The authors propose that such orientation sessions reduce the novelty value of the experience preventing cognitive learning from being overshadowed by curiosity behaviours such as exploration. This study is one of very few examples of studies which could viewed as including a sociological element in their analysis of school trip learning, in this case the role of gender, which was found to have no particular influence on the learning achieved where pre-orientation was considered. This particular study did not undertake any kind of pre-visit testing as the authors wanted to avoid "sensitizing students to the exhibits" (Hartley & Davies 1976), something I had to account for in my own research design and during analysis of data

A 2000 study by Lucas is particularly unusual in that it considers the use of both pre and post visit materials. In this naturalistic enquiry, which aimed to investigate and document good professional practice in field trips, Lucas performed an ethnographic observation of one teacher's experience of managing a field trip to a science centre including her extensive preparation and follow up activities. Semi-structured interviews with both the teacher and a cross section of her class, aimed to evaluate the success of the field trip and associated activities, measuring not against specific learning outcomes but against the agenda for the trip that "*students should extend their knowledge about science and technology and have fun at the same time".* Again, this was a small-scale study looking at just one class, attending a single visit field trip with, what the author admits, is a particularly engaged and proactive teacher. In reality, few teachers would have the time, resources or curricular freedom to carry out such extensive pre and post trip practices as this one did, having established a small-scale student-built science centre in the classroom, a fact that is recognised by the author. This study met its aims in terms

of presenting a case study to support the conclusions of previous research into best practice in field trip learning, including the use of visit-linked pre and post classroom activities. It did not however attempt to quantify the level of learning achieved during the field trip, or to attribute a proportion of any learning to the implementation of the pre and post visit lessons, in the same way that my own research does.

Anderson et. al.'s 2000 study focuses specifically on integrated post-visit activities and how these relate to subsequent learning and knowledge construction after a visit to a science centre. Semi structured interviews were conducted; pre-science centre visit, post-visit and once again after related class work was conducted. Before each of the interview events, students were asked to create a concept map related to the topic on which their visit to the centre was themed. Both the science centre visit, and the delivery of the post-visit materials was also observed by the authors. Analysis of interviews and particularly the development of the concept maps revealed that the post-visit activities did have an effect on learning. Once again this was a fairly small study involving one class, from a school in an affluent area, going on a single trip. As in, Lucas's study, the teacher was identified as having a strong interest in science so it this particular case study may not be seen as representative of the general population of school groups using a science centre. The authors commented on the potential for the data collection techniques, in this case mind maps, having themselves contributed to the construction of knowledge, something I also had to consider in the analysing of my student survey questions and drawings. Most relevant to my own study however is Anderson et. al.'s acknowledgement that knowledge transfer does not always occur in the way that has been intended by the teacher or science centre staff and that misconceptions can easily occur in such free choice learning venues. In this study, the authors attempt to record these alternate transfers of knowledge and propose an additional benefit of follow up sessions being to provide a vehicle for checking for, and correction of such misconstructions. As previously discussed, Jensen's 2014 zoo study also looked for misconstructions in knowledge and I have applied this in my own scoring system for the children's drawings by allowing for negative marks to be applied to examples of where knowledge misconceptions had occurred.

The afore mentioned 2010 Davidson et. al study, focusing on teachers' perspectives and beliefs about field trip learning, also considered the role of pre-and post-visit materials. The teacher who saw the trip as a reward with '*some learning*' occurring as a by-product, made no attempt to link the visit back to classroom learning whilst the other school used the trip as an integral part of their classroom-learning unit. As part of their recommendations for best practice for field trips, Davidson et. al. advocates the implementation of both linked pre and post visit work. Storksdieck (2006) similarly advocates for the use of pre and post-visit materials but issues a warning that students often do not recognize when they are receiving follow up activities, failing to make the connections between classroom and field trip learning unless it is explicitly pointed out to them (Anderson et al., 2002; Slavin, 2003).

Whilst recognising that both pre- and post-work could be influential to the students' overall experience, the present study has a particular focus on the level of pre-visit work undertaken by participating students. During interviews teachers were asked to report in-depth, on any aquarium related work that their class had undertaken before the visit to the NMA. In the post-visit interviews, they were also asked to comment on their intentions to carry out follow up classroom work but in less detail. This particular focus on the pre-work is due to this study aim of investigating the role of prior experience on a child's learning. Whilst pre-work can be considered a form of prior experience, post-work would of course not be. From a more practical perspective, it was also important to consider how pre-work may have directly influenced children's survey answers. Future studies in this area may wish to include a longitudinal element, performing questionnaires on children months after the institutional visit. In this case, establishing the level of post-visit work in the classroom would be vitally important.

Chapter 3 – Methodology

3.1 Introduction to Methodology

Where Chapter 2 gives an overview of the existing literature around school trips, their educational impact and their potential role in the reproduction of educational inequalities, this chapter moves on to provide a detailed account of the methodology for this study: the context, research tools, participants, research sites, quality assurance criteria, data analysis procedure, limitations and ethical issues.

3.2 Epistemological overview

Coming from a background in the natural sciences, it was instinctive for me to begin the process of designing my methodology with my hypotheses - or research questions – and build out from there. Selection of research tools was based on which would most effectively address the hypotheses being investigated, rather than which would align best with a particular epistemology. Such an approach, putting the research problem front and foremost and structuring methods and theory around this framework, is of course not exclusive to the natural sciences, having been championed by Mills in his 1959 seminal text, *The Sociological Imagination* (Mills, 2000). Whilst keen to utilise my previous research experience and skills, consisting almost exclusively of quantitative practices, I also understood that I needed to be open to use of qualitative tools if these were the best fit for my research questions. Complimentary use of qualitative and quantitative methods does not just provide greater coverage within a study but can also increase the potential for impact, with facts and figures convincing the reader whilst qualitative stories make the findings more memorable (Gorard & Taylor, 2004). Therefore, a mixed methods approach was the most suitable choice for my research, allowing me to utilise my existing researcher skills whilst simultaneously developing new ones and addressing my research questions in both breadth and depth.

My background in the natural sciences also influenced my epistemology, in as

much as I did not believe that I had one. The idea of an epistemology influencing and shaping my research was completely foreign to me. I certainly would have fallen into Mills' category of natural scientists "*quite unaware*" of their role as a "*philosopher of physics*" (Mills 2000: p.58). Natural science students are taught to search for unambiguous fixed truths, that there is no place for feelings or opinions, and that research must be completely neutral, and value free. However, it would be untrue to say that there is not an embedded philosophical system underpinning the natural sciences, the rationalist, empiricist paradigm of positivism with its…

"*deterministic philosophy in which cause probably determines effect or outcomes*" (Creswell et al., 2003: p7).

that underpins their work. Accordingly, they are never taught to question its relevance or the influence it could be having on their research.

Gidden's concept of double hermeneutics, the theory that social science concepts have a two-way relationship with society influencing the very practices that they are attempting to observe, explains why paradigms should never be similarly overlooked within the social sciences.

"*The findings of social sciences very often enter constitutively into the world they describe*" (Giddens, 1984: p20)

Whilst it is probably true to say that being a realist over an idealist would have little to no influence on recording the speed of a Tiger Shark or the Vitamin C content of a fruit, it could certainly influence the approach taken to studying that altogether more hazardous creature, Homo sapiens. Huffman explains, why as humans studying other humans, we can never truly be removed from the 'experiment' and so cannot be completely objective, value free and neutral.

"When studying humans, there is no "laboratory" apart from the world. Social research is always done with people and their humanity can never be isolated" (Huffman, 2013: p.5)

The values and potential biases I bring to my research is something I address in my reflexive positionality statement in the following section.

To use qualitative methods in my research, even in combination with quantitative tools, was to distance myself from ingrained positivist believes. Positivism and qualitative tools are not natural bedfellows; they do not produce nice neat numerical data, instead being based on opinions, thoughts and feelings. The deeper level of interpretation required in qualitative data analysis leaves it more open to researcher bias, something that positivism does not tolerate. The real crux of the dissonance between positivism and qualitative methods, however, is that there are no real objective facts to be discovered when it comes to the social world. People are individuals. Their feelings and experiences are unique, meaning there are no ultimate social truths to be uncovered.

As the paradigm of choices (Patton, 2002), pragmatism is the framework most commonly associated with mixed methods research (Feilzer, 2010; Johnson & Onwuegbuzie; 2004; Maxcy, 2003; Somekh & Lewin, 2005; Teddlie & Tashakkori, 2009). From a philosophical perspective, pragmatism accepts that whilst there are likely to be multiple relative truths, rather than fixed objective ones (Dewey, 1925), you can still work towards solving practical problems in the "real world" (Creswell & Clark, 2017). Such a notion of utility and usefulness calls for reflexive practice in pragmatic research, asking questions such as '*what and who is this for*?' and '*how do researchers values influence the research*'? (Feilze, 2010).

Methodology wise, pragmatism focuses on the research problem being explored, allowing the research questions to form the heart of the study (Creswell et al., 2003, 2011; Miller, 2006; Tashakkori & Teddlie, 1998) and for methodological tools to be selected based on their ability to answer these questions, regardless of wether they produce quantitative or qualitative data (Robson, 1993). The flexibility in pragmatic research also allows for the critique and revision of methodological choices as a research project progresses (Creswell & Clark, 2007; Feilze, 2010).

Pragmatism is, of course, not a universally accepted framework for mixed methods research. Hall (2012) argues that pragmatism fails to provide a "coherent rationale

for mixed methods due to its lack of a clear definition of 'what works', instead recommending Bhaskar's critical realism approach, one that relies on independence of reality from the human mind. Others turn to the transformative paradigm, particularly in research around social justice and marginalised peoples (Bhaskar, 2012; Creswell et al., 2003) It is of course also possible for mixed methods to be used, however problematic, alongside any of the paradigms (Mackenzie & Knipe, 2006) and there has long been philosophical debate into whether it is possible for the paradigms themselves to be mixed within a single research project (Creswell, 2011). The purist's stance (Rossman & Wilson, 1985) claims it to be impossible under the "incompatibility thesis" (Howe, 1988). Others however take the opposing stance suggesting that multiple paradigms can be applied in mixed method studies so long as each is honoured and applied at the appropriate stage of the research design (Creswell & Clark, 2007; Greene & Caracelli,1997). Under such a stance I could retain my engrained positivist paradigm for my quantitative work but move to an interpretivist or constructivist paradigm where my qualitative methods were concerned. Having only recently been introduced to the concept of paradigms, I wanted to take a relatively straightforward approach and have one overarching framework which could be applied at all stages of my data collection, analysing and interpretation, rather than wrestling between two or more paradigms. For this reason, I deemed pragmatism to be the best fit for my research.

Shifting from the natural to the social sciences also required me to analyse my own ideas around what knowledge is and how it is produced. Social theorists such as Foucault and Bourdieu believe knowledge and power to be inextricably linked, with those who have knowledge, be that individuals or institutions, holding power, and simultaneously being the ones to dictate what is accepted as truth, i.e. what is considered knowledge. These 'regimes of truth' are constantly defined, redefined and reinforced through powerful systems within society such as education, politics and the media. This means that the battle for truth is never absolute, and instead you are simply aiming to understand whatever is dictated to be the current accepted regime of truth (Foucault & Rainbow, 1984). This version of knowledge production is actually not too far removed from the natural sciences view which, under Karl Popper's system of empirical falsification,

involves attempting to prove the null hypothesis, i.e. proving that a proposed theory is *not* false. In this model too, nothing is ever accepted as objective truth, just the current best fitting model to explain a certain phenomenon (Popper, 2005).Where I have had cause to draw from the social theorists' understanding of knowledge is in considering my own place as a researcher and the power and status I may have, which may influence the knowledge I am producing. As a long standing and well-respected practitioner in the field of non-formal science learning, I have both power and status, and so it was important that with my new 'researcher' hat on, I attempted to minimise the effect this status may have on influencing my study. The checks and balances I undertook in my attempts to do this are discussed in the next section.

3.3 Statement of reflexive positionality

Having worked as a practitioner of informal and non-formal science learning for over a decade, including several years spent working in educational equity programmes, it is important that I recognise and disclose my 'insider status' from the outset. One of the driving forces for undertaking this research was the first-hand experiences I have amassed indicating the important role that non-formal learning has to play within the spectrum of a child's educational experiences. I believe I have witnessed how vast the knowledge and experience divide can be between pupils from different socio-economic groups and how non-formal education experiences can, with varying degrees of success, be used as a tool in addressing this gap. It was this belief that urged me to research this kind of learning with the aim of both contributing to sociological knowledge in the field of non-formal education but also to influence the practice of fellow educators, formal and informal alike. By bringing my prior life experience to bear on my intellectual work I follow the advice of C.W. Mills…

"*You must learn to use your life experience in your intellectual work: continually to examine and interpret it. In this sense craftsmanship is the centre of yourself and you are personally involved in every intellectual product upon which you may*

work" (2000: p.196)

I recognise, coming from a science background, that there are those in other academic traditions who may question the potential biases this creates. It would be naïve and dishonest of me to say that I could approach this research in a positivist, value-free way; it would be impossible to completely overcome such an inherent bias. It was therefore crucial to be reflexive throughout the research process in terms of my positionality, recognising my impact as a researcher on the research process. Every endeavour has been made to acknowledge and address biases throughout my work whilst attempting to remain as open-minded as possible.

Attempts have been made to mitigate against some researcher bias where it was possible to do so through the design of the methodology. For example, the use of blind scoring to prevent conscious or sub-conscious bias influencing my interpretation of the children's pre and post-visit drawings in such a way that it could falsely raise the post-visit score in a reflection of my inherent belief that non-formal experiences have a role on child's learning. This will be discussed in more detail throughout the remainder of this methodology chapter.

3.4 Justification of approach and overview of data collection methods

As outlined in section 2.3.1 of the literature review, children learn in all three learning domains during school trips (Hutson et al., 2011; Rennie, 2007). I, however, have chosen to focus my attention on the role trips play in building conceptual scientific knowledge. Affective, psychomotor and cognitive learning all fall within the embodied aspects of cultural capital, but it is the last of these which is most associated with institutionalised cultural capital (Bourdieu, 1986). Academic credentials such as rankings and qualifications hold the most importance in terms of perceived success in our education system (Claussen & Osborne, 2012).

Whilst the hidden curriculum is arguably more useful in everyday life, the education system as it stands still measures conceptual knowledge through tests

and exams. Qualifications are not awarded based on our values, interests or attitudes or on our psychomotor skills, but instead focus on our memorisation of facts and understanding of processes (Shepard, 2008). It is the children who are judged to have the most cognitive / conceptual knowledge who go on to be placed within the top sets in school, and who are subsequently taught the most knowledge in that subject area. It follows, that it is these children who become eligible to sit exams on a particular subject; exams which will earn them qualifications that enable access to further education and better positioning within the employment market. Of course, not every child will, or indeed should, go on to study and work in science and so, for some, an outcome of increased appreciation and interest in science is actually more useful in the long-term than conceptual knowledge. However, gains in the affective realm are rarely assessed, and do not, in and of themselves, translate into access to advanced educational pathways in the same way that cognitive knowledge can. This, coupled with the fact that teachers' justifications for school trips are now almost entirely based on how they support curriculum learning, is why I have chosen to focus on cognitive learning occurring during trips and how social factors may influence this form of learning.

As discussed in the previous section, embracing a pragmatic methodological principle enabled me to use a combination of quantitative and qualitative research methods to most effectively address each of my research questions. However, it is recognised that my positivist background likely skewed my interpretation towards quantitative methods overall. Ultimately I tried to let my research questions and theoretical framework shape my methodology.

The overarching research question, "*Are school trips to non-formal learning venues a potential source of replication of educational inequalities*?" is shaped by the theory of social reproduction in education. This is the idea that education is not a level playing field, and that individuals from privileged backgrounds have greater access to, and more engagement with education. As a consequence, they are more likely to go on to secure more lucrative and prestigious employment, which enables them to ensure their own offspring have educational privileges, and so the cycle of advantage continues. My overarching question posits how school

trips might fit into the social reproduction model, using three supporting questions to investigate this issue.

Question one, "*What role do social factors such as ethnicity, gender and social class have on learning during such trips and do teachers recognise, and mitigate against, inequalities in this area*?", focuses on how social factors might influence the cognitive changes occurring during trips. As demonstrated in diagram 3.1, this is executed through the comparison of learning measures from pre and post-visit questionnaires, along with demographic information. Supporting question one also uses interview responses, to review teachers' awareness and concerns around issues of inequalities during trips.

Supporting questions two and three are both founded on a specific area of social reproduction, that of cultural capital. Cultural capital proposes that those with more experience of learning in non-formal activities may have an advantage in future learning events.

Question two, "*How does prior exposure to such venues affect subsequent experiences and learning processes for students on school trips to an aquarium? How might prior experience act as a form of cultural capital, underpinning differential learning outcomes from the aquarium experience?",* operationalises cultural capital by testing if learning occurring during trips varies with an individual's level of prior experience of non-formal learning venues. As with supporting question one, learning measures from pre and post-visit questionnaires are used to produce learning scores, which are compared against self-reported levels of visitor attraction experience.

Question 3, *What role do teachers' practices play during school trips in relation to meaning making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capita*l?", focuses on the teacher's role during trips, and how their decisions around the delivery of this, might play a part in social reproduction, influencing children from different social backgrounds, and with different levels of capital in unequal ways. As shown in

diagram 3.1, answering this question requires the use of questionnaire learning measure scores and teacher interviews.

Quantitative questionnaires provided the central data for the study with every participating student completing a pre and post aquarium-visit survey. Preliminary aquarium observations and qualitative interviews with teachers as part of the pilot study acted as sequential contributions, informing the production of the student questionnaires. Teacher interviews, both pre and post visit provided additional coverage, clarifying and building on information provided within the surveys (Morgan, 2013). Each of these methods is discussed in detail in dedicated sections within this chapter. Figure 3.1 demonstrates how the three supporting questions connect to the overarching research question and which methods are used to answer each supporting question. Blue is used to represent observational data, green for questionnaires and yellow for interviews. Pink lines demonstrate the connection between pilot observation and the production of all the methodological tools. Blue lines show which tools addressed which research questions.

Figure 3.1 Diagram of connection of research questions and methodological framework

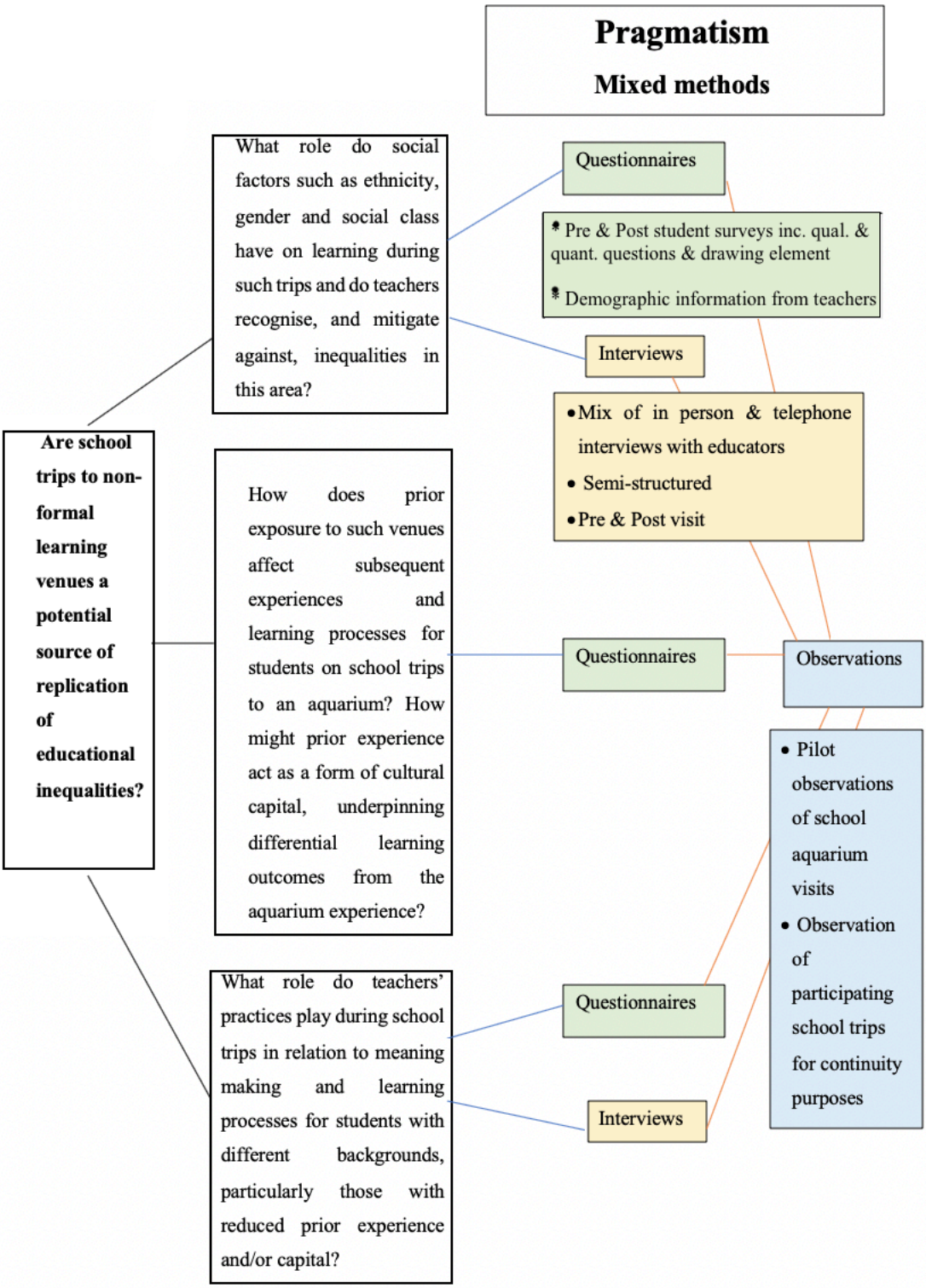


Figure 3.2 Diagram of connected methods

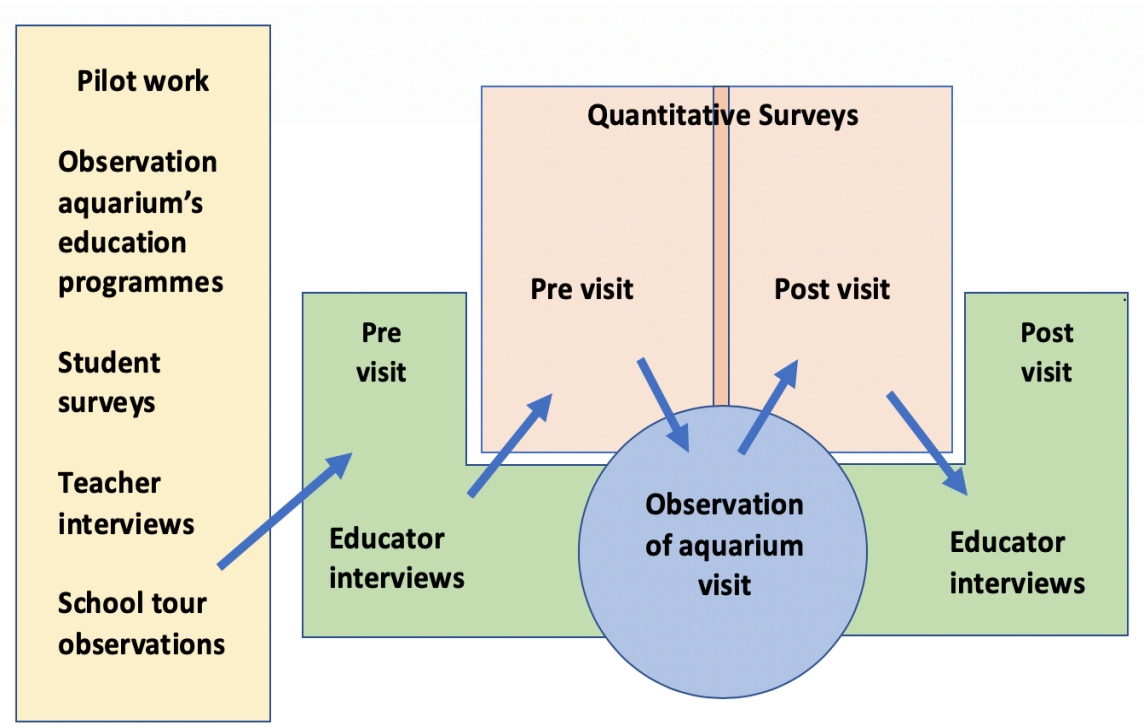


Figure 3.2 above explains how the methods fitted together with the chronological order of their use represented by the directions of the blue arrows. The pilot work involved observations and interviews which informed the development of the first version of the pre and post surveys, also trialled during the pilot stage. The main data collection consisted of student surveys and educator interviews pre-visit, observations during the aquarium trip, and post-visit interviews and surveys.

It is important to acknowledge that the mixing of methods, whilst increasing in popularity with researchers (Johnson et.al., 2007), is not universally accepted as good practice. Critics talk of its potential to produce "*disjointed and unfocussed research*" (Mason, 2006, p.9) with quantitative and qualitative data often being presented "*totally or largely independent of each other*" (Bryman, 2007, p.8). I believe however, that by applying my methods in the corroborative way described above, using separate methods to answer distinct but intersecting questions, I address such concerns and validate my decision to use mixed methods in my research. Ultimately, in implementing methodological triangulation in the form of observations, interviews and questionnaires, I have attempted to avoid the

limitations of using any individual method alone, to most thoroughly investigate my hypotheses and increase the validity of my results (Tindall, 1994).

3.5 Research Site: The National Marine Aquarium

As this was, from its conception, a collaborative project between the University of Warwick and the NMA, data collection was always intended to take place at the later institution.

The NMA, the largest aquarium in the United Kingdom, opened in May 1998 at Sutton Harbour, Plymouth, paid for through a mix of lottery funding, donations and private funding. The aquarium, which holds charitable status and is a member of the British and Irish Association of Zoos and Aquariums (BIAZA), now operates almost entirely on income from ticket sales topped up with income from the café, gift shop, consultancy work and private functions, along with some European and Heritage Lottery funding.

When the NMA opened, it was the first aquarium in the UK set up specifically for the purposes of conservation, education and research rather than for entertainment or profitable purposes. This is reflected in the aquarium's mission statement '*driving marine conservation through engagement',* something they attempt to achieve through *"engaging visitors with the amazing marine environment in a fun and experiential way, with the aim of encouraging them to value and want to protect marine wildlife and habitats*" (NMA, Mission statement, 2011)

The aquarium attracts over 300,000 visitors a year who in addition to touring the display tanks also have the option of taking part in additional talks, workshops, films and live shows on offer at regular intervals through the day. The aquarium consists of five main zones: Plymouth Sound, Eddystone Reef, Atlantic Ocean, Biozone and the Great Barrier Reef. Within each of these themed areas there are sub-zones including; Ocean drifters (a jellyfish exhibit), Ocean Lab (a behind the scenes viewing area for the conservation and life support work going on in the aquarium), Jawsome (an interactive exhibition on sharks and rays) and the

Community Sea grass Initiative exhibition (a display of creatures living in the UK's sea grass beds including seahorses and pipefish). In addition to this there are a number of breakaway areas used for public and private events, including school visits: Aqualab (specifically designed for practical workshops), the Science Theatre (a raked auditorium hosting interactive shows for up to 100 people), the creative centre (a traditional classroom set up primarily for arts and crafts activities) and the TV studio (where visitors can undergo media themed workshops).

Whilst the NMA is the biggest individual aquarium in the UK and boasts the largest single viewing panel in the country, arguably the best-known aquarium name is that of the Sea Life Centre: a chain of aquariums with 11 locations throughout England and Scotland. Sea Life Centres are the self-proclaimed largest aquarium brand in the world, with a total of 49 aquariums located around the globe. They form one branch of the Merlin Entertainment group, who also operate other visitor attractions such as Madam Tassaud's, Legoland and Alton Towers. The various Sea Life Centres appear to all be based on a somewhat standard format with similar exhibits. They do, however, demonstrate some variation between locations, especially where an existing aquarium had been purchased: for example Sea Life Centre's buy-out of the world's oldest operating aquarium in Brighton (originally opened in 1892).

My personal experience of visiting various Sea Life Centres suggests that, whilst they do host school trips and have dedicated education and conservation programmes, overall there is much more of an 'entertainment' focus than found at the NMA. As well as the standard tanks and underwater viewing tunnels, Sea Life Centres tend to have additional content not normally associated with aquariums. Family-friendly attractions such as 'real-life' mermaids swimming in tanks, playgrounds, mini-golf courses and decidedly un-aquatic desert-dwelling meerkats can be found at some centres. Even within the main aquarium, Sea Life Centres tend to have more interactive, hands-on content such as digital touch screens, glass-bottomed boat rides and in one case even a whole-body immersion *Night and Day Ocean Simulator*. In comparison, the NMA has very limited examples of such interactives, mainly being restricted to the newly-developed 'Jawsome' exhibition.

Instead, the focus appears to be reserved for observation of the tanks and animals themselves, with only traditional signage found in most of the aquarium zones.

In this way the NMA is comparable with what is arguably the world's most famous aquarium, Monterey Bay Aquarium in California. Here also the focus is primarily kept on the live exhibits and, like the NMA, there is a strong regional focus to its content. For example, Monterey Bay was the first aquarium to host a living kelp forest: a habitat that naturally occurs in the sea immediately outside the aquarium building. The NMA and Monterey Bay are both not-for-profit organisations, with any income generated being channelled back into the aquariums and their respective conservation programs. Monterey Bay is, in fact, world-renowned for both its education and research programs, as well as its conservation efforts, particularly in the area of raising awareness of sustainable seafoods. Where the NMA and Monterey Bay do differ is the former's strict policy to minimise human interactions with its animals. The NMA is unusual in that it bans activities which are commonplace in other aquariums, including Monterey Bay and Sea Life Centres, such as diving with sharks and touch pools where visitors can stroke small sharks and rays or handle invertebrates. With its minimised animal interaction, and limited interactives, it could, therefore, be argued that the NMA is one of the least hands-on aquariums in the world. This is particularly interesting given that most visitor attractions appear to be moving in the opposite direction and are aiming to increase the interactivity of their exhibits.

3.5.1 The NMA's education programs

Around 30,000 school students per year take part in the NMA's '*Just Add H2O'* learning program, a suite of tours, workshops and outreach activities all aligned to the aquarium's core objective of delivering conservation through engagement. Each educational activity is developed in association with local teachers and is designed to complement the national curriculum, aiming to *'deliver a fun, interactive learning experience outside the classroom'.*

All visiting school groups tour through the aquarium displays but also have the

option to add on shows and workshops to their general entry ticket. The cheapest package is referred to as an explorer visit, with students being moved around the aquarium by their teacher, as opposed to touring with a member of aquarium staff. During the research period an explorer ticket cost £5.25 per student. The most popular package is the aquarium staff guided tour, referred to as an interactive visit. Interactive tours were charged at £6.00 per student at the time of the study. Two additional tour options are available, the Mermaid Challenge, a self-guided visit with a 'meet the mermaid' experience designed for very young visitors (£5.75) and the Immersion Day, a full day of activities (£8.00). Neither of these later two types of tours were applicable to the participants in my research. The number of free accompanying adult tickets supplied to school groups is dependent on the age of the children. For the participants of this study, in key stage 2, the ratio was 1:7 free adults per children's tickets purchased. Support workers for students requiring 1:1 assistance are also admitted for free. Any additional adults charged at £6.50. All of the school ticket packages offer a substantial discount from the standard public prices of £15.95 per adult and £11.95 per child (prices are correct for the research period).

One-hour workshops can be added onto tours at the cost of £1.50 per student and 30-minute science shows for £1.00 per student. Workshops are curriculum linked to the participating age group and subjects vary around science, art, numeracy, literacy and media studies. Out of the six UK schools participating in the study three booked an additional workshop and none requested a science show. Further details of this are provided within the school descriptions.

3.6 Participant sample design and procedure

Work began on this research project in late September 2014 with pilot data being collected in July 2015 and June 2016 and primary data between November 2016 and June 2017. From early in the research process a decision was made to work only with schools already planning a visit the NMA, as opposed to recruiting schools to visit, specifically to be part of the research. This decision was made based on a mixture of logistical, financial and ethical reasons. Of course, this does

mean that I was only working with students and/or schools who had the ability to pay, or were able to source funding to cover, the entrance fee plus any associated travel costs, an issue which is discussed in more detail in Chapter 7.

Actively recruiting schools, particularly schools from a lower socio-economic background would have required some kind of financial incentive, free or discounted entry to the NMA for instance. Given the not-for-profit nature of the NMA this would have been problematic from a resource perspective, but it would also have had ethical implications in terms of how to select the schools to benefit from such a valuable incentive. Being selected could also have put pressure on less advantaged schools, who would otherwise have preferred to refuse participation, to take part in the research so that their pupils would benefit from the free or discounted experience. It may also have skewed their interview responses, with school staff potentially feeling less able to be critical about their aquarium experience.

The decision to work only with schools with an existing aquarium booking may also have had an impact on the diversity of the sample population. Initial concerns that it could dramatically skew my data towards schools and pupils from more economically advantaged areas only, but thankfully the six recruited schools did come from across the Multiple Deprivation Index in the 2nd, 4th, 6th, 8th, 9th and 10th deciles*. It is of course possible that the selection bias of 'ability to pay' caused the lack of representation of schools from the 1st deprivation decile and could explain why 75% of my schools were in the top half of the range of deciles. Not being able to target sample for students from different backgrounds definitely proved problematic for some of the variables I intended to investigate, particularly ethnicity and nationality.

**Multiple Deprivation Index deciles - 1 being the most deprived 10% of national population and 10 being the least deprived 10% of Lower Layer Super Output Areas across England (English Indices of Deprivation, 2015).*

With 97.2% of the citizens of Devon, the county in which Plymouth lies and the primary catchment area for schools visiting the NMA, identifying as White, and

94% reporting as having been born in the United Kingdom (Devon.gov website, 2017), it was hard to meet minimal numbers for statistical analysis – this is discussed further later in this chapter.

3.6.1 Selection criteria - age of participants

As I wanted to directly measure stability or change in pupils' attitudes and knowledge through the administering of questionnaires, the age of the participants was restricted by their ability to undertake such a task. Whilst it is commonplace in visitor evaluation for parents or teachers to be asked to comment on the impact an experience is having on a child, the use of such proxies decreases validity of the data as their answers rely on guesses, assumptions and subjectivity and may be influenced by bias (Jensen, 2014). Given that participating students would be required to complete a pre and post-visit questionnaire, including a drawing element, a minimum age of seven years was deemed to be appropriate. This was based on my own prior experience working with primary school aged children, but also on the findings of the three afore-mentioned studies that provided a foundation for my own research. Bowker (2007) undertook his surveys and drawings with 7-9- year olds and Jensen (2014) worked with 7-15-year olds. Cainey et al.'s (2012) participants were as young as 4 years old but they were only required to undertake a drawing with no additional written element.

The most suitable age range of participants was put to the test during the pilot questionnaires in June 2016, which included students from upper key stage 2 (year 6, age 10-11 years) and from lower key stage 3 (year 8, aged 12-14 years). In general, the older students did not engage with the drawing element in its intended manner, certainly not to the same degree that key stage 2 students did. When asked to draw a *"shark in its habitat"*, many of the Year 8 students included examples of anthropomorphism in their drawings, representing the sharks and other marine creatures as political characters such as Boris Johnson and Donald Trump. This common theme across the pilot drawings may be explained by the highly political climate in the UK at that time with the imminent EU referendum and intense press coverage of the US election campaign. It must also be considered that, due to limitations in the space available to administer questionnaires with this particular

group, the participants were in very close proximity to each other and so could easily, if they wished, view what their classmates had drawn which may account for the repetition in theme across this class's drawings. Whilst these cartoon style satirical drawings were incredibly interesting and could in themselves have made an extremely enlightening research project, it would have been impossible to analyse them in a meaningful way for the objectives of the present study. The pilot was relatively small (n=71) and so comprised of only a very limited sample size from this older age group (n=42) and so it is entirely possible that other students of the same age would have taken the drawing task more seriously and taken less creative licence. However, as the key stage two students had engaged with the drawing activity in the intended manner, a decision was made to limit participation to key stage 2 (Years 3-6, aged 7-11 years). This age group were deemed old enough to complete surveys relatively unassisted, but still young enough to be engaged in the drawing tasks, which may be perceived as 'childish' to older students. Any future studies could look to expand the age range they were working with by taking measures such as having adults scribe written answers for young children (6 years and below) and substituting the drawing element for older children (12 years and above) with a different task.

3.6.2 Selection criteria-type of aquarium visit

As one of the aims of my study was to assess the educational impact of taking a guided tour, the original intention was to work with an evenly balanced number of classes participating in guided and non-guided visits. I had also planned to work exclusively with schools booking a tour-only package i.e. not complementing their trip with an additional workshop or show. The rationale for this decision was that, given the wide variety of workshops and shows available, removing this factor from the study would keep more uniformity between the experiences of participating schools and prevent the content of the shows/workshops from skewing the knowledge assessment aspect of the questionnaires. It became apparently early in the fieldwork period however, that these criteria would need to be relaxed if the required number of participants was to be met. With around 60% of the age appropriate schools electing for a workshop and/or show, it would have been too restrictive to remove these schools from the pool of potential participants.

Initial concerns in uniformity between school's experiences were alleviated through the methodological choice of direct comparison of individual's pre and post questionnaires rather than a comparison of amalgamated pre and post group. This direct comparison method embraces a constructivist view of learning, acknowledging and allowing for individuals entering into the research with differing levels of knowledge and prior experience.

3.6.3 Sampling

A sample size of approximately 200 students from at least 6 different schools was expected to be sufficient for effective statistical analysis and to ensure enough diversity across the variables under investigation. With the NMA hosting an average of 700* organisational education experiences per year, the initial expectation was that recruitment would be relatively simple, with a large enough pool of suitable schools to allow for random sampling within it. Reality however proved to be far from expectation. The 2016 to 2017 school year as a whole proved to be particularly quiet for the NMA with only 133 school visits booked during the 8-month research period. Once the relatively simple research criteria-participating schools must have self-elected to visit the aquarium during the research period and be bringing at least one key stage 2 class – was applied, the number of eligible schools declined drastically. This, coupled with a high refusal rate, resulted in the proposed random sampling technique being replaced with every eligible school being approached until the required number of participants was met. To meet the target of six schools, the fieldwork period also had to be extended from a planned six months to eight-month time frame. See table 3.1 for a full breakdown of school bookings during the research period.

** This figure is based on in-house and outreach bookings from primary, secondary and tertiary education institutions and includes home school groups and classes from overseas schools. It is based on the number of unique bookings with some institutions being counted more than once if they have made repeat bookings with the NMA within the same school year.*

In the end 39 suitable groups were identified during the fieldwork period. It is

worth noting however, this figure was not known at the start of the fieldwork as new bookings were coming in over the entire research period, often at short notice. Out of these 39 schools some had to be discounted due to time constraints. As full observation of each trip was required, I could only work with one school per day meaning that some schools, who had booked for the same day as another confirmed school, had to be omitted. Similarly, some had to be discounted as they were visiting on a day that I was scheduled to be at another school delivering the pre and post questionnaires. In addition, there were also some dates that I could not be at the aquarium due to limitations in my personal availability. The remaining schools were approached in chronological order until the required number of 6 schools was reached.

Out of the 39 schools bringing KS2 students, only six had opted for an unguided, explorer tour. These six schools were effectively target sampled, separate to the chronological approach taken with the guided schools. Whilst two out of these six schools agreed to participate, one of these - school F, was in fact bringing 2 groups to the NMA, one on a guided, and one on an unguided teacher-led tour. As no KS2 groups had booked in for unguided sessions in July 2017, followed by no school bookings in August and early September because of the school holiday period, a proposal to further extend the fieldwork in the hope of securing more explorer schools was disregarded.

Table 3.1 Statistics for NMA school visits 1/11/16-30/06/17

Total no. of visiting schools (primary and secondary)	133
No. of schools visiting with K.S.2 students No. of schools discounted due to limitations in researcher availability	39 6
Total no. of schools approached - Aquarium staff member guided schools - Teacher guided schools *(please note that one school falls into both the above categories)*	29 24 6
No. of participating schools No. of participating classes No. of participating students Male students Female students No. aquarium staff member guided groups (n=162) No. teacher guided groups (n=85)	6 10 255 122 133 7 3
Refusal rate	79%

The aquarium's Schools Officer confirmed that the number of schools taking explorer tours has decreased in recent years due to the relatively low cost of upgrading to a staff member guided tour, 75 pence per child. This may also have been exacerbated by the relatively low school attendance during the research period. When it is busy, available interactive spaces tend to fill up first, leaving remaining schools with only the option of an explorer tours. As it stands, during the research period, no schools would have been forced into having an explorer

tour due to lack of guided tour availability. The School's officer also confirmed that where interactive spaces are available, she actively attempts to 'upsell' to schools during the booking process, explaining to them the perceived benefits of having a staff member show them around the aquarium. To have prevented this 'upselling' for the period of the research would have had implication in the everyday running of the aquarium, with fewer paid staff hours being required for explorer tours and less income for the aquarium, which is a registered charity. It may also have had ethical implications as some schools could have missed out on the guided tour due solely because of the lack of 'upselling' and in turn would miss out on any associated benefit, cognitive or otherwise, of having a staff member lead their aquarium experience.

The deficit of suitable explorer tours may also be attributed to the age group selected for the study. In terms of NMA school bookings, unguided experiences tended to be a more popular choice for groups of very young children (foundation stage, ages 2-5 years) who, due to the higher supervision ratios for this age group, have more adults attending with them and so are able to break into small groups to tour the aquarium. Based on their belief that a two-hour tour is too intensive for their youngest visitors; the aquarium recommends an explorer tour with an optional mermaid experience for KS1 students. Unguided visits are similarly a popular choice for older students (key stages 4 and 5, ages 14-18 years), who tend to have a workshop or show experience tailored to the academic subject they are visiting with (science, geography, media studies etc.) but are otherwise deemed old enough to move more freely around the aquarium.

Whilst an even split of guided and unguided groups would have been preferable, the number of participants in each group was sufficient for data analysis and to allow for any statistically significant differences to be identified. In future studies, widening the age-range of participants via the methods suggested above may widen the non-guided population and allow for a more balanced data set when analysing the impact of guided tours.

During the field work period it also became apparent that there was not a great deal of diversity in the sample, particularly when it came to participants from ethnic minority groups and those for whom English was not their first language. Whilst

this is a serious limitation of the study, it was perhaps predictable given the population demographics of the catchment areas of the aquarium. Whilst there was *just* enough diversity in the sample population to run statistical analysis for each of the variables, it would be advisable in any future studies to choose research sites within more diverse communities. This is discussed in more detail in the data analysis section.

3.6.4 Recruitment and negotiating access

The Schools Officer for the aquarium provided me with direct access to the aquarium's bookings database so I could identify and contact schools meeting the research criteria in the steps outlined below.

- Booking contact for school emailed, including a brief project description and a request to take part in research
- Researcher follows up email with call to the school to gauge interest in participation
- Interested schools sent more detailed participant sheet and offered opportunity to discuss the project further by phone or email.
- Schools agreeing to participate provided with consent forms and logistics for delivering pre and post surveys arranged.

The time frame for the recruitment / refusal process varied greatly from school to school dependent mainly on how quickly school staff responded to communications and the speed of the approval process within the school. Whilst I attempted to make the initial approach with schools a minimum of two months before their trip date. This was not always possible due to the short notice with which some schools and/or confirmed their trip. Some schools were only able to confirm attendance, and therefore confirm participating in the research, a week or two prior to the visit when they knew that sufficient payment and consent forms had been returned to make the trip viable. This was particularly true for the groups booked on the explorer tours and may explain why these particular schools, who had concerns about getting money in from the children's families, had opted for the cheapest possible aquarium package. In general, the less time there was

between a school expressing interest in participation and the date of their visit, the less likely the research was to go ahead as the logistics of arranging consent forms and delivering pre-surveys became more difficult.

Schools cited various reasons for declining to take part in the study such as difficulties in obtaining consent for students and not wanting to put extra work onto the teaching staff arranging the trip. More than one school also had concerns about adding a 'work' element to a trip that was being booked purely as a 'fun' activity. With a refusal rate of 79%, it is possible that the results of this study will be skewed by non-participation bias. As those likely to refuse participation are, as a group, likely to differ from those who choose to do so, this can lead to bias in the data. (Dale, 2006). Non-participation bias is a common problem for survey data but here could apply to the whole study with certain types of teacher and school perhaps more likely to agree to take part in the research. An example of this would be one of the teachers who was initially hesitant to take part due to concerns of student's abilities being 'unfairly judged' due to them not having done any aquarium related pre-visit work. After reassurance this teacher did eventually agree for her class to participate but this scenario neatly demonstrates how participants more generally may have been skewed towards particularly engaged, proactive teachers who had a particular interest in aquariums, marine life and science more generally. Interviews with the teachers will attempt to establish a baseline for each of their engagement with the trip and with science/ marine life etc. and this will be accounted for in the analysis and discussion. Such non-participation bias will still have the potential to make the findings less reliable and generalisable and this should be considered in any attempts to transfer findings of this study.

3.7 Research Participants

3.7.1 School A

- Larger than average academy school.
- One of two state funded primary schools in market town in East Devon
- Multiple Deprivation Index for area - 8th decile*

- Children from mainly White British Heritage
- Below national average number of students with English as an additional language
- Below national average number of students with disabilities and special educational needs
- Below national average number of pupils eligible for pupil premium
- Below national average eligibility for free school meals
- OFSTED rated – Good

*Multiple Deprivation Index deciles - 1 being the most deprived 10% of national population and 10 being the least deprived 10% of Lower Layer Super Output Areas across England.

Table 3.2 Overview of trip - School A

Tour Type	Interactive Tour (aquarium staff member guided) No additional shows and workshops
Students attended	2 x Year 5 classes* (8 -9- year olds)
Adults attended	2 class teachers 2 teaching assistants
Length of visit	Total time in aquarium building – 3 hours Time with exhibits - 2 hours of touring with staff member

** Whilst both of School A's year 5 classes attend the trip, only one of the class teachers, Mr D, agreed for himself and his students to participate in the study.*

Mr D's whole class took part in the trip with some students using pupil premium funding to help cover the cost. In his pre-visit interview Mr D confirmed that he personally had chosen to take his students on the trip to the NMA and that his decision had been made to support their current class topic of 'Oceans and Coasts' and because *"I like to take them to see the animals*". He also confirmed that whilst this would be this particular class's first trip to the NMA, he takes his year 4 classes

every year. Whilst he thought a lot of his class would have visited an aquarium before due to their close proximity (approximately 15 miles) to a small seaside aquarium, he stated that he had asked and only one of the children had reported having been to the NMA before. Mr D explained that he chose a guided tour as he felt that *"the children get the most from that kind* (guided) *of tour"* and that whilst he has included workshops in past visit he felt that "*they* (the children) *were just itching to get going and look around"* rather than sit in a classroom during the workshop so no additional activities were booked onto this tour. He confirmed that this trip, like all their trips, had to be linked to the curriculum and that they had made a request to the aquarium that their tour focus on habitats and the species that live in them. Drawing from his previous experience, Mr D found the aquarium trip a useful tool to "*enrich learning*" with students coming back "*know* (-ing) *about things and more enthusiastic about researching topics".* Overall Mr D appeared to be positive about this trip and school trips more generally and provide a "*good chance for them* (students) … *who have never had the opportunity to go and visit these places*".

3.7.2 School B

- Average sized, voluntary aided, Church of England Junior School
- One of 3 state supported primary schools in seaside town in North Devon
- Multiple Deprivation Index for area – 2nd decile
- Children from mainly White British Heritage
- Below average number of students with English as additional language
- Above average number of students with disabilities and special educational needs
- Above average number of pupils supported by pupil premium
- Above average eligibility for free school meals
- OFSTED rated – Good

Table 3.3 Overview of trip - School B

Tour Type	Explorer (teachers led trip) No additional show or workshop
Students attended	2 x Year 5 classes (8-9-year olds)
Adults attended	2 class teachers 1 teaching assistant 2 parents
Length of visit	Total time in aquarium building – 3.5 hours Total time with exhibits – 2 hours

School B requested that both Year 5 classes participate in the research activities, therefore both year 5 teachers, Ms F and Mr O were included in pre and post interviews. In these interviews the staff confirmed that this would be the school's first experience of the N.M.A. after a failed attempt the previous school year due to lack of funds from the children's families. Both the teachers had however visited the aquarium before as member of the general public. The staff confirmed that this year the families had all been able to cover the cost of the trip, so all students were attending without any subsidy from the pupil premium funds. The location of the trip had been selected by the year 5 teachers personally to align with their half-term learning topic – 'Water World' and the trip was being left until nearer the end of term *as "a finale", "an enrichment activity", "something to hang their learning off" and to "bring it altogether and see it for real".* Mr O and Ms F estimated that approximately a quarter of the children in their year group would have been to the NMA before. This was based on Ms F having directly questioned her class on this matter. She went on to say, "*I could have actually guessed which kids would have been before".* School B had elected to take the cheaper option of a self-led, *'explorer'* style tour with no additional shows or workshops. This was partially to keep costs down but also to "*maximise the time amount of time they are seeing the animals",* they didn't want to be "*stuck in a classroom*" like they had been on a previous trip to a local zoo.

Both teachers stated that they were looking forward to the aquarium trip and that they enjoyed taking their students on trips more generally seeing them as a "*fun*", "*one of the most important parts of their education*" and "*particularly important for students from here … some don't go to places*". They also talked about what an engaging experience trips were for the students and that they are a "*massive leveller*" "*engaging those kids that aren't achieving every day in class*".

3.7.3 School C

- Large primary school in an affluent town in Hampshire
- One of 38 state maintained primary schools within a 3-mile radius of the school.
- Multiple Deprivation Index for area – 10th decile
- Children from mainly White British Heritage
- Below average number of students with English as additional language
- Approximately average number of students with disabilities and special educational needs
- Below average number of pupils supported by pupil premium
- Below average eligibility for free school meals
- OFSTED rated – Good

Table 3.4 Overview of Trip - School C

Tour Type	Interactive Tour (aquarium staff member guided) Drawing workshop
Students attended	2 x Year 6 classes (10 -11-year olds)
Adults attended	2 class teachers 3 teaching assistants
Length of visit	Total time in aquarium building – 4 hours Time with exhibits – 2 hour guided tour 1-hour workshop

School C visited the NMA as part of a weeklong residential trip to Plymouth. The school's head teacher, Mrs G, was interviewed as she was leading both the trip to the aquarium and the residential experience overall.

Mrs G told me that the NMA was an important part of their year six residential trip as it allowed her students, who come from a semi-urban area, access to marine experiences they wouldn't otherwise have. This would be her 9th year taking students from School C to the N.M.A, but the annual trip had in fact begun before her arrival at the school. Like past years they had again elected to have an interactive, staff member guided tour along with workshop – on this occasion an art / design lesson. They always elect for a guided tour as she believes the aquarium staff to be experts with a vast amount of knowledge who can do a much better job of guiding the students and answering the student questions. She sees herself and other accompanying teacher's role during the trip to be more like facilitators, pointing things out and encouraging children to participate as well as carrying out behaviour control.

Mrs G confirmed that all School C's trips are linked to their 'creative curriculum' based on children's experience and interests. In this case the visit to the aquarium would be extended into the classroom post trip with students undertaking a project on marine habitats. She stated that she didn't like to do too much pre-work on the NMA visit as she doesn't like to spoil the surprise element of the experience but did confirm that most of her participating students would have attended another aquarium six years ago as part of a reception class (age 4-5 years) trip.

During the interview Mrs G also expressed her concern that "for lots of reasons, financial and otherwise, many students don't get taken out by their parents at weekends and so children get lots of their information from internet and TV now". She confirmed that some of her pupils "absolutely rely" on external visits as their only opportunity to experience venues such as zoos, aquariums etc. but that the trips themselves were becoming "harder and harder financially" for parents with the school increasingly to either partially or fully subsidise trips for some students. She confirmed that pupil premium money, along with funding from a local church

meant that no students were missing out on the trip.

Mrs G was very positive about school trips overall. As well as gaining knowledge through fact-based learning and making learning "real life and hands on" she sees the trips as an important part of the curriculum such as learning new skills and working collaboratively. She particularly enjoys seeing a different side of the children and learning more about them and their capabilities out of school environment.

3.7.4 School D

- Smaller than average Church of England Primary School
- Only school in a small seaside resort town in South Devon
- Multiple Deprivation Index for area – 6th decile
- Children from mainly White British Heritage
- Below average number of students with English as additional language
- Broadly average proportion of students with disabilities and special educational needs
- Below average number of pupils supported by pupil premium
- Below average eligibility for free school meals
- OFSTED rated – Good

With fewer than 100 pupils on the school roll, School D's children are taught across 3 composite classes; Class 1- early years and year one, Class 2-years two, three and four, and Class 3-years 5 and 6. School D's visit was funded via a donation from a local foundation that requested that the money be used to give the children an "*educationally beneficial and fun day out*". The donation covered full costs for every child in the school to attend the trip, however surveys were only executed with the children from KS2 (41 students).

Table 3.5 Overview of trip – School D

Tour Type	Interactive Tour (aquarium staff member guided) Mermaid tour and craft workshop for younger children Aqualab science workshop for older children
Students attended	Whole school trip Class 1 – 23 students (4-6 years old) Class 2 – 31 students (6-9 years old) Class 3 - 21 students (9-11 years old)
Adults attended	3 class teachers 2 teaching assistants 1 administration staff member 2 parents
Length of visit	Total time in aquarium building – 3 hours Time with exhibits – 2 hours touring with staff members 20-minute workshop (hour long workshop was cut short due to mix up with bus times)

Interviews were conducted with the Class 3 teacher, Mrs W, who was acting as lead teacher for the trip, and Miss T, an administration staff member responsible for bookings and logistics. Interviews revealed that the NMA had been selected collectively by the school staff as the most suitable venue for a whole-school trip. Whilst the school had run trips to the aquarium in the past, this had not been the case for a number of years and none of the children partaking in the study would have previously visited the NMA as part of a trip with this school. Miss T and Mrs W did however believe that most of the children would have attended the NMA before on trips with families and friends. This was based on discussions with the children and the fact that Plymouth was a popular day trip for families from the local area (approximately 25 miles). The school had elected for interactive, guided tours, believing the aquarium staff to have the appropriate expertise, "*freeing us bolster the children who need a little extra support*" and "*making sure that all the*

children are getting the most that they can out of it".

Mrs W did not seem as enthusiastic about school trips as some of the other respondents, replying simply that she felt "*fine"* about leading the trip and bemoaning the amount of risk assessments that were required. She did however state her belief in trips being an educational experience, helping to "*contextualise their learning*" and giving students something to "*hinge their learning around*". She confirmed that under normal circumstances trips would be linked to classroom learning, and specifically to the class topic being covered, but as this trip had to cater to such a wide age range, this was not possible for the NMA trip.

3.7.5 School E

- Average sized primary school in village outside Southampton
- Only primary school in this small village
- Multiple Deprivation Index for area – 9th Decile
- Children from mainly White British Heritage
- Below average number of students with English as additional language
- Above average number of students with disabilities and special educational needs
- Below average number of pupils supported by pupil premium
- Below average eligibility for free school meals
- OFSTED rated – Good

Table 3.6 Overview of trip - School E

Tour Type	Interactive Tour (aquarium staff member guided) Aqualab science workshop
Students attended	2 x Year 6 classes* (10-11-year olds)
Adults attended	2 class teachers 2 teaching assistants
Length of visit	Total time in aquarium building – 4.5 hours Time with exhibits – 105 minutes of touring with staff member 1-hour workshop

**School E was also visiting the NMA as part of a residential trip for its year 6 students. Each of the two year-six classes visited the aquarium on different days but I only collected data from the first visit.*

Mr M, Head of year 6, took part in the pre and post interviews as he was organising and attending both trips. Interviews revealed that "*99%"* of School E's trips were curriculum linked and that he as the year leader, had selected the aquarium to visit as it was a *"good opportunity to go and see some of the things in real life"* that tied in with their year 6 project topic of 'Oceans'. The planned implementation of both pre and post trip activities were discussed with students being asked to "*research different ocean creatures… to be on the lookout* for" in the aquarium and then to produce a "*fact file on their chosen creature*" as a follow up to the trip. Mr M confirmed that he had led a trip to the N.M.A. previously and that the children on this trip had not been taken to an aquarium before as part of a trip with School E. He suspected that about half the students would have been to an aquarium before as there is one within half an hour of the school. The school had elected for the staff guided tour as he felt they were of particularly good quality at the N.M.A and that there was "*only so much you can take from an information panel next to a tank*". He also believed that it was important to have a staff member who could answer children's questions and tell them "*what they really wanted know, not just*

the generic stuff". This was their second year having a workshop alongside their tour and was selected to provide a "hands-on" element to the trip.

Mr M was enthusiastic about the trips believing them to be valuable experiential learning opportunities creating "*awe and wonder*" and "*interest and intrigue*" and bringing "*learning to life*". He also believed school trips generally to be particularly important for the kids on the school roll who "*don't get these kinds of experiences without going on school trips*"

3.7.6 School F

- Average sized primary school in market town in West Berkshire
- One of 17 state maintained primary schools in the town
- Multiple Deprivation Index for area – 4th Decile
- Children from mainly White British Heritage
- Below average number of students with English as additional language
- Below average number of students with disabilities and special educational needs
- Below average number of pupils supported by pupil premium
- Below average eligibility for free school meals
- OFSTED rated – Good

School F visits NMA every June as part of their year 5 residential trip to Devon. Each of School E's year 6 classes attend the residential separately, with one class visiting Monday to Thursday and another Friday to Monday, resulting in one class visiting the aquarium on a weekday and the other on a Saturday. As the aquarium's education team do not work over the weekend, the Saturday group from School F are forced to undertake a self-led explorer tour, whilst the weekday group undertakes an aquarium staff member guided, interactive tour.

Table 3.7 Overview of trip -School F, weekend group

Tour Type	Explorer (teacher led tour) No additional workshops or shows
Students attended	1 year 6 class (10-11-year olds)
Adults attended	2 teachers
Length of visit	Total time in aquarium building – 3 hours Time with exhibits – 1.5 hours

Table 3.8 Overview of trip – School F, weekday group

Tour Type	Interactive (aquarium staff member guided) No additional workshops or shows
Students attended	1 year 6 class (10-11-year olds)
Adults attended	2 teachers
Length of visit	Total time in aquarium building – 3 hours Time with exhibits – 2 hours

Mrs B, the deputy head, was selected for interviews as she has attended and led both classes residential trips for a number of years. Interviews revealed that the NMA trip was now a regular fixture in the overall residential trip schedule as an alternative to rock pooling which, on previous years, they had been forced to cancel due to inclement weather conditions. Mrs B confirmed that whilst school trips are usually closely related to class work, the residential trips are treated as more of a "*stand-alone*" event, but that this class had undertaken topics such as '*Go with the*

flow' about the water cycle and general animals and habitat topics that would relate to aquarium themes. Mrs B expected that around a quarter of the students would have been to the NMA before, this was based on the result of a show of hands of students from previous years when asked "*Who has been here before*?" when first arriving at the NMA. Had the choice been available, Mrs B would have preferred for the Saturday group to also have a guided tour as she felt that the guided groups got a "*better quality of information*" and that the guided group "*would remember the information better, without a shadow of a doubt*".

Questioning disclosed that pupil premium was covering the full cost of the trip for a number of pupils meaning that no pupils were not attending for financial reasons but that one pupil, from an Indian background was not attending for what she deemed to be cultural reasons as his parents did not see value in school trips and felt the time was better used undertaking private tuition.

Mrs B was particularly positive about school trips advocating them as important "*real experiences*" for students, helping them to "*learn in a different way outside the classroom*". She was particularly pleased to have opportunities to get them outdoors as School F has no playing fields, only a single tree and limited wildlife. She stated her belief that the children seemed to go "*from home to their school and rarely get to see anywhere else*" and that school trips gave them a chance to "*see a more natural environment than a classroom*".

3.8 Interviews

In order to construct a full, in-depth understanding of educational visits to aquariums, from both the school and the institution's perspective, qualitative interviews were conducted with staff members from the visiting schools and the research site.

The intention of the interviews was to obtain factual information through witness accounts and to encourage self-analysis amongst participants (Hammersley, 2003). Whilst the first of these aims, the gathering of facts, could potentially be achieved

via a questionnaire, the collection of the deeper, reflective data required the more flexible and open-ended approach that an interview provides. Semi-structured interviews allowed for a reflexive approach, as well as scope to follow unexpected twists in content whilst retaining some conformity between interviews (Gillham, 2000). Copies of the interview schedules are included in Appendix 1.

3.8.1 Pilot interviews

As part of the pilot research in June 2015, four teachers were interviewed prior to their class's aquarium visit with their trips also being observed. These interviews provided a foundation for the next round of pilot work in June 2016, which included a pre and post matched interview with one teacher whose class was also surveyed, and their trip observed. Both sets of pilot interviews allowed for the trialing of questions in terms of the relevance and the extensiveness of the answers they generated and the most efficient ordering of the questions. This information went on to inform the production of the interview schedule for the main body of research.

3.8.2 Formal educator interviews

For each of the schools participating in the main body of study, pre and post-visit interviews were conducted in person or over the phone with at least one class teacher, resulting in 12 interviews with 7 different school staff. An overview of who was interviewed at each participating institution is provided in table 3.9.

Table 3.9 Overview of Interview Participants (primary data collection)

Institution Name	**Individuals interviewed**
School A	• Teacher-Mr. D, pre-& post-visit • Aquarium host-Miss P, pre-&post-visit
School B	• Teachers -Mr. O & Ms. F-joint interview, pre-& post-visit
School C	• Teacher-Mrs. G, pre-& post-visit • Aquarium host–Miss T, pre-& post-visit
School D	• Teacher–Mrs. W pre-& post-visit • Aquarium hosts–Miss T & Miss F, pre-& post-visit
School E	• Teacher-Mr. M, pre-& post-visit • Aquarium host–Mr. H, pre-& post-visit
School F	• Teacher-Mrs. B, pre-& post-visit • Aquarium host- Miss T, post-visit only
National Marine Aquarium	• Head of Discovery and Learning

3.8.3 Interview content

Teachers were asked to report on their professional practices around school trips, prior experience of trips (both the teacher and their current class's), what relevant training they have undergone, motivation and agenda for booking the trip, which type of aquarium tour-guided or unguided-they had elected for and why and general logistics of the trip. Teachers were also asked to self-reflect on their own attitudes towards, and expectations of, the aquarium visit and on trips more generally and self-analyse as to whether or not they believe that their role as a teacher, or their teaching style, changes during such visits. Finally, teachers were asked about what actions they would take, if any, to address the potential non-formal learning knowledge/experience gap between their pupils. Follow up interviews aimed to establish how successful they thought the trip had been and if it matched up to the expectations, they reported in the pre-visit interviews.

Where participating schools opted for a guided tour, the allocated aquarium staff member, the non-formal educator, leading the visit was also interviewed before

and after the tour. These interviews were conducted in a private room within the aquarium. Five out of the six of the participating UK schools had at least one of their classes take a guided tour resulting in 9 interviews with 3 different aquarium staff members (as outlined in table 3.9). In these non-formal educator interviews, I asked similar questions as those posed to the teachers, their attitude towards school tours, what their agenda was for this particular tour and what role they see themselves playing. Informal educators were asked to comment on what they *believe* the teacher's agenda for the trip is and what role they imagine the teacher playing during the tour and how well expectations aligned with the actual experience of the tours. As with the teacher interviews, semi-structured schedules were used in a dynamic way with previous interviews informing the content for the next.

3.8.4 Restrictions / Variations

One participating school, School F, had two classes take part in the study, one undertaking a guided tour and the other on an unguided, teacher led tour, on a different day. As the same teacher was involved in organising and running both trips, the teacher was interviewed before the first trip and again after the second trip.

In the case of School E, the lead teacher, Mr M, who had been interviewed before the visit, was ill on the day of the visit and so unable to attend the aquarium. After deliberation and consultation with the school, it was decided that Mr M would still undertake the post-visit interview but that he would first consult with one of the teachers who had attended the trip. His non-attendance did render void some of the interview questions, mainly those around personal opinions or practices, but still allowed me to complete the full picture for the aquarium experience of the school group as a whole.

Unfortunately, due to a last-minute staffing substitution, a pre-visit host interview was not possible for School F's visit.

3.8.5 Additional interview

To provide additional context and provide an overview of the aquarium's educational aims and an interview was conducted with the NMA's Head of Discovery and Learning.

3.8.6 Data entry

Interviews were transcribed as soon as possible after the event with initial, informal analysing of data occurring during the transcription process. This initial analysis then informed revisions on the questions for the remaining interviews resulting in a dynamic, semi-structured interview schedule.

On an on-going basis throughout the fieldwork period I was formally analysing interviews. Due to the relatively small number of interviews conducted, it was possible to analyse these manually rather than using a qualitative analysis software such as NVivo. The analysis was part inductive, looking for emergent themes via thematic content analysis, and part deductive, analysing against my established framework to test my preconceived theories (Braun & Clarke, 2006). It involved repeated readings of interview transcripts with key words or phrases being highlighted, side notes being taken, and sections of text being coded by assigning them into columns of an excel document under headings either from my established framework or the new emergent themes.

3.8.7 Interview limitations

During the planning stages of this project the prospect of interviewing or holding focus groups with the participating children was considered. In his 2007 study for instance Bowker interviewed all participants about their drawing (n=30), providing clarification on what they had drawn and their reasoning behind it. Cainey et al. (2012) also had a sub sample of their participants discuss their drawings with the researchers (n=33), albeit in a more causal manner, as part of the observation process. With a much bigger sample size than these studies, interviewing all student

participants would not have been viable. It was however initially proposed that a sub-sample would be interviewed or asked to take part in a focus group. This idea was discounted after the initial 2015 pilot teacher interviews revealed how challenging this would be from a logistical perspective both in terms of getting consent to perform this kind of research, but also as it would require an additional member of school staff to supervise. Teachers also conveyed their reluctance at the idea children having to spend yet more time away from normal curriculum activities.

Interviews do of course have general limitations that threaten methodological validity and must be taken in account any research. This is particularly true when participants are being asked to self-report in impact studies, especially where educational gains are concerned (Gutek, 1978; Jensen, 2014; Marino et al., 2010; Plummer & Small, 2013). Such limitations include the 'interviewer effect' and potential bias in participant's answers, tailoring responses to 'what they think the researcher wants to hear'.

"*One reason for distrusting measures of satisfaction is simply that people seem to be satisfied with everything that social scientists ask them about*" (Gutek 1978: p.5)

Well-designed interview questions have been found to minimise these biases and so it is my hope that I reduced their potential impact on my own work through well thought out and piloted interview questions. I believe they will have had very limited impact on the fact collection side of my interviews but could have had a more pronounced influence where I was asking teachers to self-reflect. Even with these limitations, interviews were still deemed the most appropriate way to gather the more in-depth, reflective data. Interview questions were designed to minimise limitations as much as possible and this is where the pilot interviews proved very helpful. Where there was any subjectivity to an answer, questions were left open-ended with no obvious 'correct' answer.

Given the pre-post nature of my study, I also had to be to particularly careful that the pre-interview questions did not influence the participating teachers' practices

around trips and for this reason some questions were specifically kept back until the post-interviews.

3.9 Observations

3.9.1 Pilot observations

Informal observations were first used as far back as November 2014 in reconnaissance visits the NMA to familiarise myself with the aquarium and its educational offerings. As previously described, observation of visits by four school classes in the June 2015 pilot study were also used as sequential contributions to inform the production of the student questionnaires.

3.9.2 Observation approach

Observations for the main body of this study fell within the ethnographic category, involving the overt surveillance of my participants within the natural setting of the NMA: logging their actions and speech in an unstructured manner to allow for unrestricted recording of emergent themes and asking in situ questions to clarify my observations (Hammersley & Atkinson, 2007). Whilst ethnographic observations are traditionally associated with longer term anthropologic studies, where the researcher works intensively with an individual or group for months or even years (Silverman, 2000), tightening time constraints on researchers has resulted in a broadening of the definition with ethnography now requiring you only to have observed the life cycle of the phenomenon being studied (Bryman, 2015). In my case I witnessed the entire period of the aquarium school trip, from the group exiting the bus at the school arrivals area until their bus departs back to school, taking handwritten notes in a field journal that were subsequently typed up. I embraced my pragmatic methodology and used a semi- structured template for my field journal. Like my interview schedule, the template was dynamic, being revised between each observation period. In this way I ensured continuity in the key information for each school – ratio of children to adults, length of tour, conditions within the aquarium that day etc. – but with the flexibility to record new and unique aspects as they arose.

The formal, guided aquarium tour groups can consist of up to 33 students with one or more accompanying adults plus the aquarium staff member. The teacher led explorer tours tended to be broken up into groups of between 4 and 10 students accompanied by one adult, a teacher, teaching assistant or parent/guardian of one of the class members. Knowing where to look and what to record at any one time needs to be an instinctive decision (Delamont, 2002). I employed strategies for observation identified by Wolcott (1994): broad sweeping, searching for paradoxes, searching for (specific) problems and observations of nothing in particular.

3.9.3 Observation content

As well as observing each group's movements through the aquarium's public displays, observations were also made on any workshops or shows the group attended, their lunch break and time spent in the gift shop. The aim of these observations was to confirm that the students received a fairly standard aquarium trip and to be able to account for anything that could have influenced their experience and in turn their post-questionnaires. An example of what could have been considered a non-standard aquarium experience was witnessed during observations for the pilot study when the filtration system failed in the Atlantic tank rendering it impossible to view the sharks.

Observations were relatively easy for the staff guided groups who would be moved around the aquarium in one big group with short periods of 'free exploring' time contained to a particular zone, or even sub-zone, within the aquarium. For explorer tours (School B and one class from School F), and in the case of School D where student participants were split across different groups to tour the aquarium, I was forced to select one group to remain with for the duration of the visit. The deciding factor was usually to follow the lead teacher, the person who had been interviewed before the trip. In the case of School B, where both teachers were interviewed, a flipped coin decided at random which group to follow. In these situations, where not all student participants could be followed and observed in one big group, I would check in with the other group leaders, be it an aquarium staff member or a

designated adult from the school party, to check that the students had toured to every area of the aquarium and had a relatively standard visit experience.

3.9.4 Data recording / entry

Notes were handwritten in shorthand form and were typed up into a word document as soon as possible after the observation period whilst the events were still fresh in my memory. Observation notes were only used to refer back to, to verify aspects of the interviews and questionnaires, for instance confirming that the children saw all areas of the aquarium or whether they were told specific facts, for example that sharks have 5 gills. Given the relatively small number of observation notes, 6 sets, there was no need for them to be analysed or coded in a formal manner.

3.9.5 Restrictions/ Variations

Due to a limitation in my availability, School F's tours, one guided and one unguided, were observed and recorded by a substitute observer, an aquarium staff member. The staff member was selected by the NMA's Director of Education as someone who was familiar with the aquarium's education programs but was likely to be impartial and would not be compromised in any way by having to report on their colleague's actions. The substitute observer was briefed in my observation procedure and, in an attempt to retain uniformity between the observations for this school, they were given examples of the observation notes taken for School A and School B. Once supplied with the substitute's notes, I talked through them with him for clarity purposes.

3.9.6 Limitations

As the teachers and students were already familiar with me from the delivery of the pre-visit surveys and interviews, it was not possible to execute covert observations. Therefore, the possibility of 'researcher effect' also known as the Hawthorne effect, that students, teachers or indeed aquarium staff may have behaved differently due to my presence, may have influenced the reliability of my

results. Future studies could look to avoid this limitation through the use of covert recording technology or having different researchers undertake the observations from those who gather the pre-visit data. Unfortunately, these were not options at my disposal during my own research.

As I have already alluded to, observations of school trips were an incredibly important part of the pilot stage of this project, as this is the method by which I learnt about how teachers and students were using the aquarium, the content of the interactive tours and indeed the content of the aquarium more generally. The informal observations which I conducted when in school delivering pre- and post-visit surveys, along with the observations of the aquarium trips, were invaluable in helping me to create the school descriptions and the overview of their trips as found in section 3.7. In the main study, however, once I had elected to focus on knowledge and conceptual understanding as my measure of school trip learning and had opted to use questionnaires as my primary data gathering tool, observations became less important as a data-collection tool. Further information on my decisions around the use of observations are supplied in section 7.4.

3.10 Questionnaires

Quantitative questionnaires were selected to generate the key data source for the study as they best enabled the direct measurement of children's learning before and after a visit to the NMA. This was deemed a more valid approach than asking children, or indeed, as previously discussed, a proxy, to self-report on learning through interviews (Jensen, 2014; Marino et al., 2010). As well as knowledge gain, surveys also aimed to capture changes in pupils' attitudes towards marine animals and their habitats after a visit to the aquarium and any changes in future behaviour that they proposed to make as a result of their visit.

3.10.1 Repeated measure design

Surveys were conducted both before and after the children's aquarium visits, with each participant's pre and post surveys being directly matched for analytical purposes. Matched surveying allowed for a direct measure of the impact of the aquarium visit on each individual pupil's learning, attitude or opinion, and so offer more reliable results than alternatives such as treatment and control group design or comparing average results for unmatched pre and post visit groups (i.e. only administering pre surveys with some groups and post surveys only with other groups).

The use of a repeated measure survey design such as this does have the associated limitation of survey fatigue in participants and can also result in false negatives due to inflated 'pre-test' responses on self-reported items. However, as matched pre and post testing is a strong method for allowing any observed changes to be attributed to the cumulative effect of the aquarium visit, this design was deemed most appropriate even with its limitations (Jensen, 2014).

3.10.2 Pilot questionnaires

As previously discussed, questionnaires were first trialled during the pilot study in June 2016 with the aim of refining the survey instruments and identify the appropriate age range of the participants.

3.10.3 Questionnaire content

Themes for the questionnaires were based on the NMA's mission statement of *'driving marine conservation'* and a selection of their key education messaging- habitats, adaptations, pollution and climate change. Educational themes are listed on a session content selection form, supplied to teachers in advance of the trip, to allow them to indicate which topics they would like their tour to focus on. Only one of participating schools, School E, returned this session content form, a copy of this, including the full list of educational themes available, is included in Appendix 2.

Surveys utilised a mix of question types; multiple choice, Likert scale, true or false, thought-listing and open-ended questions with the aim of assessing interest, attitude and knowledge of participants. Within the questionnaires, students were also set a drawing task, being asked to draw a shark in its habitat and labelling what they had drawn including the shark's anatomy. In utilising such a mix of data genres the aim was to create a survey that was accessible to children from a wide range of abilities resulting in a reliable, rich pool of data. Drawing tasks in particular, open up research to children with lower linguistic capabilities, such as those who speak English as an additional language providing them with a medium through to which they can express their knowledge (Bowker, 2007; Jensen, 2014).

3.10.4 Survey Instruments

Pre and post questionnaires were designed to include very similar matched questions, with most of the changes from pre to post-visit being to reflect the altered tense of the visit. For instance, in the pre-questionnaire students were asked, "*What are most looking forward to about the trip*?" whilst in the post-questionnaire they were asked, "*What did you most enjoy about the trip?* Information that would not have changed during the visit was removed from the post survey such as questions on prior experience of non-formal learning venues, age and gender.

Complete copies of both the pre and post questionnaires are provided in Appendix 3.

3.10.5 Administering of questionnaires

Students were allocated 15 minutes to complete each questionnaire. The pilot questionnaires, which had the drawing activity at the very back of the survey instrument, highlighted that given free reign, some children would spend so much time thinking about their answers, they ran out of time to complete, or in some cases even start, their drawings. As the drawings were such an important component of the study, I moved this task to the front page of the questionnaire and ring-fenced the first five minutes of survey completion time for drawing only. Participants were then given the remaining ten minutes to answer the questions. Under ideal conditions, as per the Bowker study, participants would have had as long as they wanted to complete both the drawings and the questions. However, as this was not practical, especially when schools were completing both pre-and post-visit questionnaires in the aquarium, it was deemed more important that the same amount of time was allowed for undertaking the pre and the post drawings. Timings were tested during the pilot questionnaires and 15 minutes was found to be appropriate both in terms of what was required for the average KS2 child to complete the activity, but also what was acceptable for teachers to have children away from other activities.

A total of 255 students participated in the main, body of this study. Whilst pre and post questionnaires were issued to all children attending class on the day of the survey, due to absences and refusals the number of completed pre and post questionnaires was not double the number of participants (n=467). Where there was not a complete set of pre and post results, the individual was removed from the study. The number of matched survey sets is broken down by school in table 3.10.

The original intention was for both pre and post surveys to be administered by me personally, in the aquarium, as soon as the students arrived, before they were exposed to any of the displays or received any introduction from aquarium staff, and then again immediately before leaving the aquarium. This decision was based on increasing the validity of the data by limiting the time between the surveys and the aquarium experience, therefore reducing the chance that something other than

the trip could have influenced any changes noted between pre and post surveys.

Concerns however were raised by the education staff at the aquarium that this approach may not be practical due to the very limited time some schools have in the aquarium. With strict bus times to adhere to, schools normally arrive between 10:00 and 11:00 and leave between 13:30 and 14:30, making the average visit length of 3.5 hours. Given that aquarium tours last for 2 hours, workshops for 1 hour and time also required for registration, grouping, lunch and visits to the gift shop, some schools could simply not afford the extra 30-40 minutes required to administer the questionnaires. Therefore, a decision was made to offer teachers the opportunity to have me come to the school the day before and after the visit to complete the survey with their students. Table 3.3 outlines how surveys were administered for each school. This approach could have also gone some way towards reducing the effect of survey fatigue as for these students it meant not having to complete two very similar surveys on the same day.

Where post visit surveys were being completed in school, teachers were asked not to do any aquarium related follow up work with their students until after the post-visit survey had been completed. Whilst all teachers verbally agreed to this, there was no check in place to make sure that they kept to this. Therefore, for schools A, B and D, where post-surveys where not conducted until the next school day after their visit, it is important to recognise that this could be a limitation to the study and that there is a chance, albeit small, that factors other than the trip could have influenced any changes witnessed between pre and post responses. This could also include children being motivated to undertake further marine based learning of their own such as reading relevant books or watching related television programs or researching on the internet. Whilst such self-led informal learning can be viewed as a positive consequence of the trip, it would affect the validity of the results, with knowledge gains (or losses) falsely being attributed to the aquarium trip.

For a few of the school's circumstances - unforeseen and otherwise - meant that I was unable to administer the questionnaires in person, this is also outlined in Table 3.10. Where questionnaires were to be administered by teachers, clear, detailed directions were supplied including instructions to be read out to participants before they began and timings to be adhered to. A copy of these instructions can be found

in appendix 4. Again, there was no check in place to confirm that teachers followed the questionnaire instructions and timings, and this could have influenced the validity of the results, particularly if children were given extra time to complete one or other of the questionnaires.

In any future studies, where possible, it may be advisable to discount schools where the survey cannot be delivered by the researcher(s) immediately before and after the visit, in the non-formal learning institution. This would however require a bigger population to sample from than was available in the present study.

Table 3.10 Overview of number of questionnaires completed and delivery method

Institution Name	**Method of delivery of questionnaires**	**Number of questionnaires completed**
School A	Pre: By teacher, on bus, on the way to aquarium* Post: By researcher, in school, day after aquarium visit	• Pre visit – 24 • Post visit – 26 • Matched pre and post- 24 • Parental surveys returned - 1
School B	Pre: By researcher, in school, on day before aquarium visit Post: By researcher, in school, on day after aquarium visit	• Pre visit – 51 • Post visit – 51 • Matched pre and post- 51 • Parental surveys returned - 9
School C	Pre: By researcher, on arrival at the aquarium Post: By researcher, before leaving the aquarium	• Pre visit – 43 • Post visit – 43 • Matched pre and post- 43 • Parental surveys returned - 5
School D	Pre: Mix of teachers and researcher, in school, day before and day of the aquarium visit** Post: By teachers, in school, two days after the aquarium visit	• Pre visit – 43 • Post visit – 35 • Matched pre and post- 34 • School refused parental surveys
School E	Pre: By researcher, on arrival at the aquarium Post: By researcher, before leaving the aquarium.	• Pre visit – 42 • Post visit – 42 • Matched pre and post- 42 • Parental surveys returned - 8
School F	Pre: By teacher, in school, on the day before the visit *** Post: By teacher, immediately before leaving the aquarium	• Pre- visit – 63 • Post visit – 61 • Matched pre and post- 61 • Parental surveys returned - 12

**Researcher arrived at School A on the day before their visit to find the school in the process of closing early due to localised flooding.*

*** Researcher arrived at School D to find that some of teachers had not been told that their students would be required and so some children were not available. These students completed their questionnaires with their teacher, in school, on the morning before the visit*

**** Researcher unavailable during this visit.*

3.10.6 Questionnaire coding and scoring

Standard multiple choice, Likert scale and True of False style question answers were recorded into an excel spreadsheet. Open-ended responses were coded by looking for emergent themes before scores were assigned. This is described in detail for each of the scored areas.

3.10.6.1 Shark species

During the study period, the NMA was home to 14 species of shark and further species, including the extinct Megalodon shark, were mentioned in signage around the aquarium. The various species of shark on display are always listed as part of the staff-guided tours and aquarium observations showed that this was a common subject that visitors, public and schools alike, asked the randomly situated aquarium staff about. The shark listing activity was intended to ascertain whether students were taking in and retaining a specific fact – in this case species of sharks. In both the pre and post visit questionnaires, students were asked to list all the shark species they knew. One mark was awarded for each correct shark species listed with accurate spelling not being required so long as the intended species name was legible. Post-score was then subtracted from pre-score resulting in an overall 'change in species knowledge' score for each participant. This score could therefore be positive, neutral (no change) or negative.

Some educational studies have chosen to apply an accumulative knowledge approach when scoring similar repeated measure studies. Instead of subtracting the pre -score from the post, all new knowledge from the post score is added to the pre-score. This means the overall score could never be negative (Bowker, 2007) Such an approach would assume that pre-visit knowledge is still relevant even if not displayed again in post-visit and that when a child has demonstrated knowledge learning once, that learning event is complete. As most educational theory agrees that demonstrating knowledge of something just once would not be sufficient evidence that learning has occurred, the more traditional approach of subtracting pre to post was utilised for this study.

3.10.6.2 Conservation knowledge score

To assess conservation knowledge, all qualitative answers, in both the pre and post surveys, were analysed convergently for conservation/ environmental issue related themes. This process began as early as the pilot study stage. Issues mentioned by participants included; climate change, sea level rise, coral bleaching, rubbish in the sea (particularly plastics), need for recycling, pollution, oil-spills, endangered species, over-fishing, hunting, inappropriate animals being caught in nets (dolphins, turtles etc.) and shark finning. From this bigger list of environmental issues, I generated four overarching categories

- Overfishing/hunting
- Pollution
- Climate change (and associated issues)
- Endangered species/extinction.

Each survey was then analysed across every question, against these categories. Each new category mentioned received one mark with a maximum of 4 marks available for this 'conservation knowledge score'. Conservation related statement most often arose in answers to Q1. What do you think the sea will be like in the future? Q11. What threats might there be to sharks in the sea? Q13. Why do you think it is or isn't a good thing that we have aquariums? and Q.14 What do you think people can do to help save sea animals from extinction? Post scores were deducted from pre-scores resulting in an overall 'change in conservation knowledge score' which again could be negative, neutral or positive.

3.10.6.3 Analysing and scoring of drawings

Drawings were analysed using convergent influences from Bowker (2007), Cainey *et. al.* (2012) and Jensen (2014). Children were prompted to draw "*a shark in its habitat (all the plants and animals that live around it*)". This prompt was significantly more specific in its request to the participant than the those used by the influencing papers. Bowker requested students to "*draw a tropical rainforest*", Cainey *et. al*. to "*draw the underwater life off the Devon coast"* and separately to

"*draw the underwater life on a Coral Reef*" and Jensen to *"draw your favourite wildlife habitat and all the plants and animals that live there*". Such a specific prompt was used to ensure more consistency in the subject matter being represented from pre to post drawings and in turn, allow for a more exact comparison. In the three afore-mentioned studies, it was possible for the child, whilst still following the request of the prompt, to draw a completely different scene in the post-survey than they did in the pre-survey. In the case of Jensen's study, the participant could, whilst still properly following instructions, have chosen to draw a forest scene in one drawing and a dessert in another. As Jensen was only looking to establish an overall change in knowledge / understanding (positive, neutral or negative), not being able to compare exact elements of the drawings was not important. Bowker somewhat mitigated against this by returning the students' pre-drawings to them to review before they started their post-visit drawings and encouraging them to "*demonstrate how they were adding to their previous knowledge",* for logistical reasons, mainly time constraints, this was not an option for me. By having such a specific prompt, I was able to compare pre to post drawings in a more exact manner and could include analysis against a quite detailed topic – shark anatomy. The choice of shark as the subject matter was based on the fact that they make up such a big part of the NMA collection and that shark conservation is a key message both in direct communication from staff and in signage around the aquarium. It would be near impossible for children to visit the NMA without seeing a shark.

Jensen's 2014 approach to analysing the children's drawings specifically focuses on the potential change in understanding / learning and, takes into account the possibility of negative learning occurring. As well as asking the students to "*Please draw your favourite wildlife habitat and all the plants and animals that live there*", it also requested them to "*name or label everything that you draw*". During idiographic analysis, Jensen's participant drawings were simply coded as having undergone positive development (3 marks), no development (2 marks) or negative development (1 mark) from pre to post-visit. Positive development would be awarded where there was evidence of elaboration of the physical characteristics of the animals or plants, improved accuracy of the placement of animals within the represented habitat or increased complexity of the scientific terms being used (for example desert rather than sand).

Like Jensen's study I also asked children to label what they had drawn using the prompt "*please label everything you have drawn including the shark's body parts*". This proved to be incredibly useful in identifying what children had drawn but unfortunately was not universally undertaken. Some children would not label either drawing, some would only label the pre or the post. In drawing analysis within the pilot study, marks were awarded for all correct labelling of the shark's anatomy (with higher marks for the use of more scientific or complex terms such as fin instead of tail) or naming particular habitat interactions such as shoaling. However, the lack of consistent labelling proved problematic with drawings of less detail and reduced complexity scoring higher simply down to them having labels where their matched drawing did not. For this reason, it was decided that label scoring would only be applied where labels were applied in both the pre and post drawing.

In addition to labels, other techniques were applied to help clarify the content of the drawings. Bowker interviewed all 30 of his participants about their pictures, asking them to talk about what they had drawn. Given my larger sample size of approximately 250 participants, it would not have been possible to interview every child. Instead I utilised Jensen's method of including a written request, below the drawing, asking students to *"describe their drawing".* They were provided enough space to write about one sentence of text.

Actual quantitative scoring of the drawings was against a marking matrix which drew heavily from Bowker's system of analysing for breadth, depth and extent of themes demonstrated across drawings (also used adapted for use by Cainey et.al). This system had itself been developed from techniques used as part of Personal Meaning Mapping (PMM) methodology (Falk & Dierking, 1992, 2000) and Torrance's test of creativity (1962, 1990). PMM is a constructivist, 'child-centred' text and diagram activity which enables participants to highlight the knowledge, feelings and perceptions they consider most important. It does not involve demonstrating knowledge of a 'correct answer' and allows for participants entering into the activity with varying levels of prior knowledge, experience and interests. Bowker utilised the PMM methodology for previous research at the Eden project (2007b) before adapting it to analyse drawings rather than the text in the 2007 study.

Drawings were first analysed during the pilot study and a range of emerging themes were identified. Even with distinctly different drawing prompts, similar themes occurred between Bowker's and my own research; biodiversity - animals, biodiversity - plants, natural habitat features, environmental/conservation issues and interactions within ecosystem. As per Bowker's method, the number of unique examples within each theme constituted the score for extent. This is explained further in table 3.11.

Bowker describes the depth score as "*how deeply and richly children understood the themes*" (2007). Where breadth is a binary decision of yes or no, a theme is demonstrated in the drawing or it is not, and extent is based on a numerical figure of how many different representations are present, depth is more objective being measured against a five-point scale (one being a shallow understanding, five being in-depth comprehension and awarding of half points possible). For example, within the natural habitat features theme, if a child drew a smooth, round circle at the bottom of the drawing to represent a rock, this would receive a low score for depth, whereas, a ragged-edged overhanging rock crevice would earn more points. Or, for the interactions within ecosystem theme, if a child drew a shark eating fish, representing this widely understood element of the food chain would score lower than if the child had drawn a school of fish, all swimming in the same direction. Instead of using depth as a measure, Cainey *et. al.* used detail - defined as "*level of accuracy in the drawings"*- which they also rated on a scale from 1 to 5. Specific aspects considered in their detailing score were; appropriate use of colour, correct number of gill slits, correct number of arms / tentacles, distinct body parts (pincers, tails, fins etc.) and other specific detailing.

Table 3.11 below provides more detail on the different themes and information on how extent and depth was calculated for each.

In addition to the above, a more in-depth scoring was applied to the specifically requested element of the drawing – the shark. The aim of this particular part of the scoring was to assess if children were picking up on finer details during their visit, such as shark anatomy. As a similar approach to scoring was applied to this process, it was counted as an additional "Shark" theme and was included in the overall score for the drawing. The representation of the shark was marked for specific features

such as gills, major fins (dorsal - 1st back fin, caudal - tail fin, pectoral - side fins) teeth etc. with 1 mark being awarded if present and 0 marks if not. An additional mark was then awarded if the correct number of gills was drawn (sharks always have five or more) and one mark for each of the minor fins included (anal, 2nd dorsal and pelvic). Further marks were also awarded for species specific morphology such as whiskers on a nurse shark or a hammerhead's cephalofoil (flattened head protrusions). Next, a score of between 1 and 5 was awarded for caudal fin (tail) shape and overall body shape, side by side comparison of the matched drawings particular helped with this more objective scoring.

Table 3.11 Description of drawing scoring system

Theme	**Extent**	**Depth** **(1 to 5 points availabl**
Biodiversity - animals	One point awarded for each unique species of animal represented within the drawing, e.g. clownfish, grouper, octopus etc. Where the actual species being represented was not clear, for fish for example, each obviously different type of fish drawn would be counted as a species. For the purpose of scoring coral was counted as an animal.	Accuracy of overall form of each animal - distinguishing features of different species. Examples of different animal categories, e.g. fish, inverts, mammals etc.
Biodiversity – plants	One point awarded for each unique type of plant represented within a drawing.	Accuracy of the overall form of the plant - shape, texture.
Natural habitat features	One point awarded for each non-living feature represented in the drawing including: - sand, rocks, caves, bubbles, waves etc.	Elaboration or detail of features.
Interactions within ecosystem	One point awarded for each unique representation of distinct interactions between animals and plants and their environment, e.g. shoaling fish, creatures eating each other, snails living on seaweed etc.	Complexity of the form of interaction.

There were 3 other themes noted across the drawings that were of particular interest to the research but, due to their nature, had to be treated differently to the main

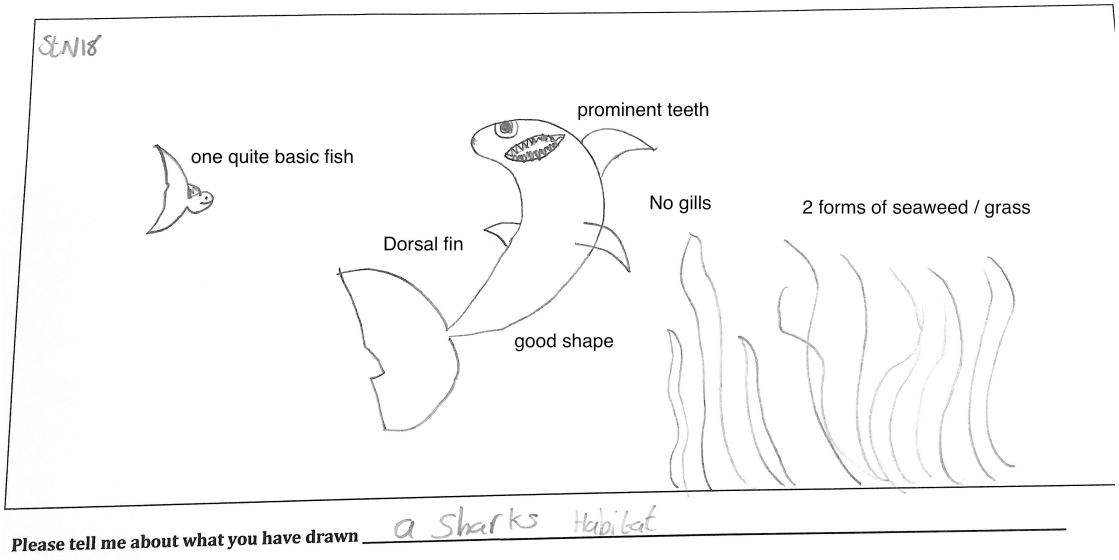
emergent themes. These were; man, or man-made elements shown in the habitat, human threats to the ecosystem and whether the shark was shown in an aquarium setting. Inclusion of any of these elements was extremely interesting and much was to be gained from analysing how and when they were used by participants. They did not, however, fit into standard extent and depth scoring system. For example, if a human threat was represented in the drawing (such as a fisherman hunting for shark fin) it could be viewed as either positive or negative. Positive in that the child is demonstrating awareness of a conservation issue but potentially negative in that perhaps that child now considers that to be a normal / acceptable part of the ecosystem. Similarly, it was extremely interesting to consider why a child might associate a shark's habitat as being an aquarium but not necessarily a useful input in the overall score. A decision was made to score these secondary themes as a binary yes or no for inclusion and to analyse this separately.

A copy of the scoring template, in the form of a worked example of scoring for one child's pre and post drawings, are available on the next two pages.

Jensen's (2014) approach of reviewing a single participant's pre and post drawings side by side was something that I applied to my own analysis. To avoid potential scoring bias, a research assistant electronically scanned each drawing, cropped out the pre or post visit status and randomly labelled each pair as A and B. Whilst not particularly relevant for breadth or extent scoring, it allowed for direct comparison to occur when calculating the depth score. For each theme the score for drawing B would be considered based on whether it showed the same, higher or lower depth than drawing A.

Unlike Bowker, both Jensen (2014) and Cainey *et. al* (2012) applied negative scoring to their analysis where mis-constructed knowledge was witnessed. I also chose to apply negative marks, for example, within the shark category, if a child was to draw and label their shark as a whale shark but then draw protruding sharp teeth, that would have results in a minus mark as whale sharks do not have teeth.

*Figure 3.3 E*xample of pre-visit drawing with scorer annotations and scoring



Student Name/Code:	StN18b				
Themes	**Extent -no. of examples**	**Depth*(1-5)**	**Features of note?**	**Extra or minus marks?****	**Total**
shark drawn	1	12	/	/	13
plants included	2	1.5			3.5
animals (other than sharks) included	1	1.5			2.5
natural habitat features (rocks, sand, bubbles etc.)	0	0			
interactions within ecosystem (something eating something else or hiding in something else etc.)	0	0			
Label score **(only added to total if given in both pre and post!)**	/	/	/	/	n/a
*Depth = Shark features (see table below) or score from 1-5 as to how well they have understood that particular theme					19
Man made element included? (y/n)	n				
Human threats ecosystem included (y/n)	n				
Is shark in an aquarium (y/n)	n				
** ex. Of minus mark could be inclusion of scales on the shark or animal clearly wrong for the habitat					
Shark features	**1 mark if present**	**score for shape (1-5)**	**Features of note**	**Extra or minus marks?**	**Total**
Dorsal fin	1	/			1
Gills	0	/			
correct no. of gills?	0	/			
Pectoral fin	1	/			1
Other fins (score of 2 or more possible if all fins pr	0	/			
Eye *	1	/			1
Teeth **	1	/			1
Caudal fin	1	4			5
Body shape	/	3			3
Other correct to species feature of shark (ex. Whiskers on a nurse shark)		/			0
* if perspective means eye would not be seen (ie Hammerhead from front on) mark still given				**Shark theme depth score =**	12
** minus mark if tooth is inappropriate to the species drawn (if spp. Confirmed!)					

As you can see from the table above, this participant, STN18, scored a total of 19 marks for their pre-visit drawing (which was scored blind in terms of pre or post status). This means a pre-visit marine environment knowledge score of 19 was awarded to this child.

Figure 3.4 Example of post-visit drawing with scorer annotations and scoring

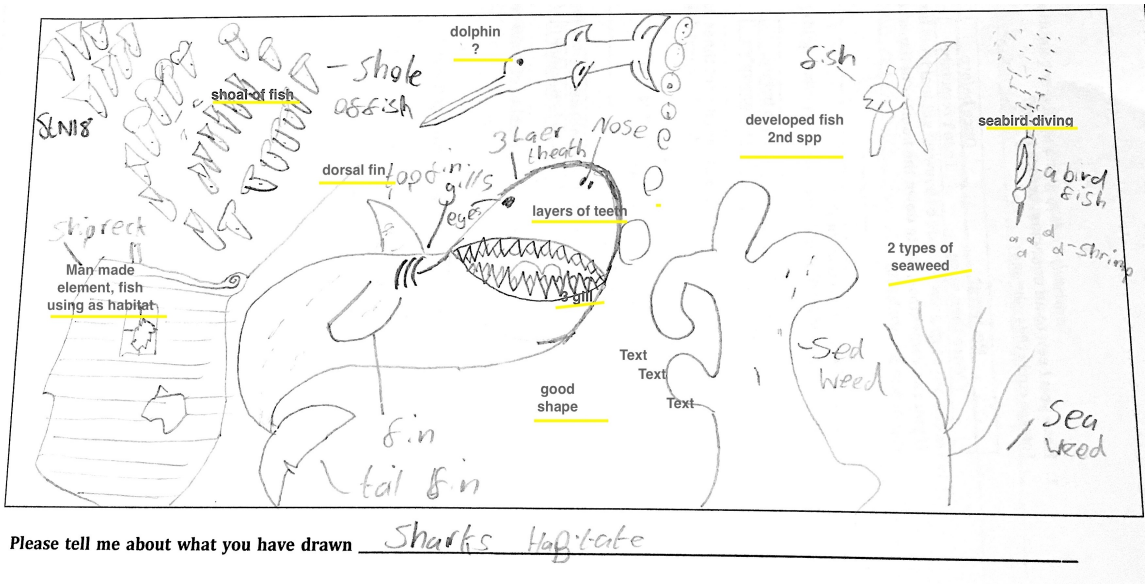


Figure 3.5 -Example of post-visit drawing scoring table

Student Name/Code:	StN18a				
Themes	**Extent -no. of examples**	**Depth*(1-5)**	**Features of note?**	**Extra or minus marks?****	**Total**
shark drawn	1	15.5	/	/	16.5
plants included	2	2	seaweeds x 2		4
animals (other than sharks) included	5	3	2 x fish, dolphin, shrimp, bird		8
natural habitat features (rocks, sand, bubbles etc.)	1	1	bubbles		2
interactions within ecosystem (something eating something else or hiding in something else etc.)	3	2.5	shoaling fish around wreck, bird diving for shrimp		5.5
Label score *(only added to total if given in both pre and post!)*	/	/	/	/	n/a
**Depth = Shark features (see table below) or score from 1-5 as to how well they have understood that particular theme*					36
Man made element included? (y/n)	y		shipwreck	neutral	
Human threats ecosystem included (y/n)	n				
Is shark in an aquarium (y/n)	n				
** ex. Of minus mark could be inclusion of scales on the shark or animal clearly wrong for the habitat					
Shark features	**1 mark if present**	**score for shape (1-5)**	**Features of note**	**Extra or minus marks?**	**Total**
Dorsal fin	1	/			1
Gills	1	/			1
correct no. of gills?	0	/	3 gills		
Pectoral fin	1	/			1
Other fins (score of 2 or more possible if all fins present)	0	/			
Eye *	1	/			1
Teeth **	1	/			1
Caudal fin	1	4			5
Body shape	/	3.5			3.5
Other correct to species feature of shark (ex. Whiskers on a nurse shark)	1	/	3 rows teeth	1	2
* if perspective means eye would not be seen (ie Hammerhead from front on) mark still given				**Shark theme depth score =**	15.5
** minus mark if tooth is inappropriate to the species drawn (if spp. Confirmed!)					

As you can see from the table above, the same participant. STN18, scored a total of 36 marks for their post-visit drawing (which was scored blind in terms of pre or post status). This means a post-visit marine environment knowledge score of 36 was awarded to this child and a change in marine environment knowledge score of 17.

Decisions on how negative scoring would be applied were made during the pilot study – specifically issues around what constituted a shark's habitat and what counted as a species being situated wrongly. For example, if a child drew a rabbit under the sea sharing a habitat with a shark this would very obviously be a negative understanding and result in a minus mark. If, however a child drew an Angler fish, only found in extremely deep water, next to a Reef Shark which could never survive at similar depths, the line was more blurred - would this still count as the same habitat? Given that understanding the exact habitats of different species requires a quite advanced knowledge, and many of the creatures could not be identified down as far as a species level anyway, it was decided that this would not be counted as negative understanding. Instead, for the purposes of this activity, the whole ocean would be counted as a single habitat.

As well as breadth, depth and extent, Bowker also applies a fourth scoring category of Mastery to his study defined as "a holistic judgement taking into account the scope of the children's understanding". It uses the total number of themes represented, along with the extent and depth of each to award an overall score of one to five. As I was keen to limit the requirement for objective decision making by the marker and the potential bias that can bring, I decided to follow Cainey et. al.*'s* lead and simply use the sum of the extent and depth scores, along with the labelling score (where appropriate), as my 'Mastery' score for each drawing. Pre-visit mastery scores were subtracted from post-visit ones to create an overall 'change in mastery' score. As the mastery scores in my case were all related to undersea habitats, and I was not actually interested in the skills in the drawings themselves, I renamed this score as 'overall marine environment knowledge' as I felt this was a better reflection of the variable being tested.

A second marker, experienced in the analysis of children's drawings, was recruited to moderate the reliability of my own scoring. Applying the same marking matrix, she independently scored the pre and post drawings for a random selection of 25 participants, just over 10% of the overall sample. The moderators scores were then compared to my own for the same drawings using a Cronbach's kappa test. A score of 0.79 was calculated, well within acceptable levels for inter-marker consistency reliability, suggesting that my own marking was consistent to the guidelines.

3.10.6.4 Measures of prior experience

One of the areas children were asked to comment on in the pre-visit surveys was number of previous visits to non-formal learning venues. Children were to comment on the number of times they had visited aquariums, zoos and museums- these specific types of venues being selected due to examples of such institutions being found relatively close to the NMA. Number of visits for each of these three types of venues was totalled equating a non-formal visit total for each participant. In addition a score out of three was applied for number of types of institutions visited.

These particular venues were selected as they were deemed to be the most commonly found across the UK with examples of each being found close to the research site. There are three zoos in the county of Devon (two within a one-hour drive of Plymouth), over 75 museums (6 of which are in Plymouth) and two aquariums inclusive of the NMA. Science Centres were considered as an additional venue type but as the closest centre was two and half hours from the research site, and in the interest of keeping the questionnaires a manageable length for children to complete, they were not included.

Asking children to self-report can be problematic as children may not remember all the relevant experiences they have had or for a variety of reasons, may exaggerate (Jensen, 2014). Attempts were made to verify the information the children gave through parental questionnaires but the return rate for these was very poor and those which were completed were often incomplete, making this data unsuitable for analysis. Whilst issues of exaggeration may still be a problem for the data, effect from this could be minimised when dealing with outliers and I was relatively unconcerned about children having forgotten about some of their prior visits as these trips were a) obviously not as memorable to the child and b) were likely to be when the child was quite a bit younger. Ultimately, what I was aiming to establish was an overall picture of each child's prior experience rather than exact details.

As a young child, I was taken by my Grandmother to my local museum very regularly due to its close proximity to their home and its free entrance policy. By the time I started school, my visit total to this museum would have been over 100 but I had never been to a zoo or an aquarium. Would my 100 plus visits to one kind of institution mean I would have been considered to be a high level of experience of non-formal learning, even though I'd never visited the other institution types? - I didn't believe so. I therefore decided to create a fifth category which amalgamated visit total and types of institutions visited. On top of their visit total, each participant was awarded an extra five marks for each of the types of institutions they had attended. This was recorded as their scored visit total.

How much to award as 'extra' marks per institution was a somewhat of an arbitrary figure but after considering the mean number of total visits, the mean number of institutions visited and playing about with various examples from the data (two provided below), the figure of five was settled on. It is acknowledged that this 'scored total' approach will not have completely eliminated issues of a large number of visits to a single type of institution skewing the data, but I believe it creates an interesting additional category with which to consider prior experience.

Example 1. – Ben has been to a zoo 5 times, an aquarium 3 times but has never been to an aquarium. His total visit number is 8, institution total is 2 and his scored total is 18.*

Example 2. – Rob has been a zoo 8 times but has never been to an aquarium or museum. His total visit number is also 8, his institution total is 1 but his scored total is 13.*

As cultural capital is not theorised to be measurable in a quantitative way, to properly investigate whether prior experience of non-formal learning institutions could be treated as form of cultural capital, it was decided that a high or low ranking system may be a more appropriate than the scored total as used in the previous analyses.

By averaging the student's scored totals for each school, a scored total mean was calculated for each of the six participating schools. By comparing their individual scored total to the mean for their school, students were ranked as above (A) or below (B) average in a new variable called Prior Experience School Average. Where a student's score was the same as the mean, they were rounded up to the above average ranking. Next, a scored total mean across all six participating schools was calculated and children were then ranked above or below average against this variable, Prior Experience Overall Average. Each of the three learning measures was then compared in children who were above and below average for each of the two categories.

I would like to take this opportunity to acknowledged that I recognise that whilst perhaps a preferable way of approaching capital than raw scores, ranking is still an imperfect proxy. Two children who rank as above average, or indeed have exactly the same visit total score, are likely to have had very different experiences during their previous visits and so the capacity for increasing their capitals could be very different. However, given the way that cultural capital has been operationalised in the past, I do believe ranking may provide a better representation that using raw visit scores alone.

3.11 Collection of demographic Information

Given the age of the children involved in the study, children were not asked to supply their own demographic or socio-economic status related information with this instead being provided by the schools. Data protection was ensured through methods discussed in the following section.

Teachers were asked to complete a spread sheet providing, ethnicity, nationality and English language status for each child, as well as confirming whether the student was eligible for pupil premium or free school meals.

Since children of armed forces families are eligible for pupil premium independent of their household income, schools were also asked to confirm if any of the

participants met this criterion. The one participating child who was from an armed forces family was removed from the study as there was no reliable indicator of the socio-economic status of the child.

Teachers were also asked to comment on whether children had any special education needs, including those in gifted and talented or similar programmes. Whilst students of all abilities were included within the study, this information assisted the researcher when analysing the questionnaires, helping her to understand why a student may have struggled to answer a particular question or may not have completed the task.

3.11.1 Limitations to demographic information

Due to the lack of diversity in the sample, it was necessary for statistical purposes to run some statistical tests with binary categories in the form of majority represented vs. 'other'. To have considered each category individually would have resulted in groups of less than 6, unsuitable for statistical analysis. This was necessary for the variables of ethnicity and nationality and the decision to do so was not taken lightly as the process of grouping all the non-white ethnic groups, and for that matter grouping all Nationalities other than British together, is a form of 'othering', a concept which I recognise to be problematic and highly contentious. 'Othering' has been attributed to the perpetuation of prejudice and discrimination, holding difference at its core (Mills et al., 2010). It can suppress both agency and identity, particularly in communities that have already been victimised and marginalised and so should, where possible be avoided in research. My choice to group all participants from ethnicities other than white was based on having enough data to include ethnicity as a social factor in my research. On weighing up my options I believed it would have been more remiss of me to appear to be ignoring the potential role of ethnicity on trips altogether. However, as White researcher I have to acknowledge and take ownership of the problematic nature of this particular research decision and would like to take this opportunity to state that I recognise the great diversity that exists within ethnicity. I have attempted to avoid the particularly negative connotations of 'othering' by using the less contentious grouping label of BME (Black and minority ethnicity).

This grouping process is certainly not the approach I would have taken, had I had enough diversity within my sample to run tests across all the represented ethnic groups and I would recommend that future research in this area looks to use a more diverse population to avoid having to take such measures.

3.12 Parental / Guardian Questionnaires

Parental/guardian surveys were designed to confirm some of the demographic and socio-economic indicators provided by the school and to provide more detailed information on their child's informal learning experiences beyond just aquariums, zoos and museums. They were issued to all but one of the schools, School D, who said that they did not wish to burden parents with even more paperwork having just sent out permission forms for the trip and a school newsletter.

Return rates on the parental surveys was quite poor, even with the incentive to win a family cinema pass that parents could opt into on returning the form. Out of a possible 267 surveys, only 35 were returned, a return rate of 13%. With so few returns, and those which were returned frequently being incomplete, it was not possible to analyse the data in a statistically significant way, but it did however prove to be a useful tool in verifying the data being supplied by schools and students.

3.13 Data Analysis Procedures

Data was transferred from the Excel worksheet into the statistical analysis software- SPSS. Using t-tests, Mann-Whitney u-tests, ANOVAs, multiple regression and General Linear Models the following was analysed:

- Any significant differences in the change of the three independent variables - marine environment, conservation and shark species knowledge- scores across various socio-economic indicators including; gender, SES status and ethnicity.
- Any relationship between the independent variables

- Cross referencing of prior experience of informal learning against socio-economic indicators
- Any significant differences in the change of knowledge scores of students from high and low levels of prior experience of non-formal learning venues.
- Comparison of knowledge scores for students on guided and non-guided tours, students who were exposed to pre-visit materials and those who were not and those who took part in a workshop and those who did not.
- Comparison of reported enjoyment levels of students on guided and non-guided tours and those taking part in workshops and those who did not.

Exploratory analysis of data was used to check for outliers and where obvious data entry errors were identified these were corrected. Due to the number of outliers identified in some of the statistical testing procedures, it was necessary to transform the data using a Winzorisation process (replacing outliers with the next closest conforming value) rather than have a significant drop in statistical power. Missing data was treated using average (entering the mean) or common-point (entering the mode) imputation methods for the same reason.

Due to the relatively large sample size of n=255, data was treated as normally distributed and so parametric tests were applied. The only exception to this was where the number of cases in a variable fell below 16 and, in such cases, which are identified in the results section, an equivalent non-parametric test was used.

A 95% confidence level (p=0.05) was applied across this research – unless otherwise stated - which is the most commonly used level in research and is SPSS's default setting. At this level we have can be 95% certain that any correlations we find between variables are statistically significant. This of course does not mean that there definitely is a relationship between variables or explain the nature of any relationship or why they exist. It simply means that there is only a 1 in 20 possibility that the correlation is down to pure random chance. Unless otherwise stated, results are presented as mean ± standard deviation.

3.14 Ethical concerns

The ethical codes underpinning this research were beneficence and non-malice, to

attempt to do good whilst avoiding harm to others (Resnik, 2011). This research raised a number of ethical concerns, primarily around the participation of the school students who were under 18 years of age. In May 2015 a full ethics application was approved by Warwick University Humanities and Social Science Ethics Research Council (HSSERC) based on the initial pilot work interviewing and observing teachers visiting the aquarium. A further ethics review for the project as a whole was undertaken as part of the upgrade procedure and approved in March 2016.

3.14.1 Recruitment and consent

As previously discussed, only schools who had already begun the process of booking a trip the aquarium were approached to take part in this study. From my initial approach it was made clear that participation was entirely optional, and refusal would not have any consequence on their upcoming aquarium trip. From an ethical perspective, best practice would have been to not provide schools with any incentive but high rates of disinterest / refusal in the first pilot studies demonstrated the need to provide some form of motivation to participate. After additional approval from HSSERC, all participating schools were offered a free family pass to the aquarium with the condition that it was to be used only for fundraising purposes for the school. Similarly, an incentive was offered to families for filling in and returning the parental/guardian survey. In this instance families were offered the option to be entered into a prize draw to win a family cinema ticket, one ticket per participating school. Whilst these incentives were attractive, they were not so lucrative that they would influence an individual to participate against their initial will.

'Informed consent' is an essential aspect of ethical research and so a detailed information sheet, including information on the research process, purpose and implications, was supplied to teachers with an opportunity to ask questions or raise concerns directly with my supervisors or myself. A copy of the consent form is provided in Appendix 5.

Teachers were then asked to sign a personal consent form of participation and were informed of their right to withdraw consent at any point during the research for any (or no) reason, again with no consequence on their aquarium trip.

Consent was also required for the students and as they were under the age of 18 years, this comes from the parents/guardians. Schools have their own individual policies regarding research consent with some having blanket consent in place for research in place with students along with photograph and media consent. I worked with each individual school to establish what approach was required and where appropriate supplied a tailored consent form and participation form to be issued to parents. In the interest of anonymity, where consent forms where distributed to parents, teachers collected and retained them, signing a disclaimer that parental/guardian consent had been obtained for every participating child. No child had to be discounted from the study due to consent reasons. In addition to parental consent, I also made a request to teachers than no child was be forced to undertake the surveys against their will. Where I was personally delivering the surveys to the students, I made this explicit in my introduction and no child chose to opt out.

3.14.2 Anonymity and Data protection

Before signing up, all schools were assured that participation in the study would be completely anonymous with no individual child, teacher or school being identifiable in this thesis or in any resulting publications. Some schools however, still expressed concerns for privacy and data protection particularly around providing the more sensitive demographic data. To alleviate these concerns, schools were offered the option of making children completely anonymous throughout the study with even the researcher not knowing individual children's names, this option was taken up by Schools B, C and E. In these instances, teachers issued children with an identifying number, it was suggested to them that this might be the number position of the child against an alphabetical class register. To distinguish children from each participating school I then also added identifying letters to each child's number. For example, a child from School A might now be L31 and a child from School B might now be St42.

Rather than receiving blank surveys where they could fill their names in themselves, teachers were required to issue children the survey with their identifier code pre-printed on it. Similarly, they had to make sure that the correct pre coded parental / guardian surveys went home with each child so that these could be matched up the child's questionnaire responses.

Whilst I attempted to make the process as straightforward as possible, complete anonymisation of the students did make the questionnaire process more complicated, requiring more time to administer the surveys and putting more responsibility on the teachers. The researcher was required to put trust in the teacher that the correct paperwork was being issued to each child / family and that demographic information was coded accurately.

From the outset, participants were assured that all personal data such as demographic information would be kept in a secure manner, with hard copies being stored in a locked cabinet in my home and digital copies being password protected.

3.14.3 Wellbeing and influence on participants

Wellbeing of the participants was considered through the research design process. Care was taken to ensure that participants would not be harmed in any way by participation in the study, but also that schools and students who did not participate would not be missing out financially or educationally. As this was not an active research project, with no additional educational materials being provided to participating schools the later was less of a concern. However, it is possible that taking part in the surveys themselves could have resulted in an educational benefit as it got students to think more about issues included in the questionnaires. As no individual children from participating classes were excluded from the survey process, this was not deemed a major ethical concern.

Interviews and questionnaires did not contain any contentious or emotionally fraught issues and so did not pose any risk to participants from a content perspective. It was however recognised that the act of completing the two questionnaires could result in survey fatigue or even stress for the young participants. For this reason, questionnaires were kept as concise as possible with

students also being assured that they did not need to complete all questions and could opt out altogether if they preferred.

It is ethically appropriate for research participants to know they are being observed or in the case of under 18's that the parent or guardian knows and consents to observation. However overt observations can influence the experience of the observed persons either directly - the presence of the observer alters the event in some way - or indirectly - the observed persons perform differently because they know they are being watched. Whilst my observations had to be overt, every effort was made to ensure that my presence had minimal influence on the student experience. This was achieved through employing techniques such hanging back from the tour group and not initiating dialogue with any of the participants during their visit. It was not always possible to completely avoid conversations with them though as there were instances where they, the teachers, aquarium staff and students, would attempt to initiate conversations with me. In the case of the teachers and their students this was very often to ask questions about the NMA facilities or exhibits. This was almost certainly due to the participants seeing me as having 'insider status' at the aquarium, viewing me as another member of staff. In these instances, I would try to minimise the conversation, directing questions to actual aquarium staff.

3.14.4 Researcher based issues

As is covered in the reflexive positionality, it would be disingenuous of me to pretend that I could approach this research in a completely value and bias-free way. As a practitioner of non-formal science education, I have an inherent belief that this form of education is effective in influencing attitudes, behaviours and knowledge of learners in a positive way. It is therefore completely reasonable to assume that I might, consciously or otherwise, skew data towards an outcome that appeared to prove that students were gaining out of their aquarium experience.

In a similar vein, it is important that I recognise the potential biases that undertaking a collaborative project might have brought, especially when coupled with the 'insider-status' I developed. Having spent a great deal of time within the

institution during the research process, and particularly time spent with its staff, it is natural that I would, at least to some degree, come to feel, and be treated as, part of 'the team' at the NMA. As the education staff are also practitioners of non-formal education and have similar beliefs to my own regarding the importance of its role within the overall spectrum of educational experiences, it is fair to say that they would similarly hope, and perhaps even expect, that my research would support this standpoint. As this was a collaborative project with the NMA providing access to venue and its staff and visitors, I could have felt compromised and under pressure to skew my data towards this outcome. Thankfully this was not the case but regardless, I put into place a number of techniques to minimise the effect of biases. For example, as well as the afore-mentioned blind scoring of the pre and post drawings, I put in place a detailed, well-defined and relatively clear-cut scoring system and then had my scoring verified by an independent person. However, there were elements of the research process still open to interpretation and subjectivity, particularly when it came to analysing the open-ended questions and this is where it was particularly important that I tried to remain open-minded, reflexive but most importantly directly acknowledge where biases may be having an effect.

3.15 Validity, Reliability, Generalisability, Transferability and Credibility

Throughout this methodology chapter I have made attempts to highlight where reliability and validity of my research may have been compromised, what I have done to mitigate this and offer ideas on how it may be avoided in any future studies. In this section, I bring these thoughts together for a comprehensive overview of these research issues.

Reliability

Reliability refers to the extent to which the research, its methods, and its findings, could all be replicated. A reliable finding, for example, would be one where the same result was found with the same participants on two or more occasions (Cohen et al, 2011). In the case of the present project, an example of a reliability measure being utilised was the use of a second scorer for the children's drawings as this was

an example of two people interpreting data in the same way, using the same procedures. Attempts at reliability are also made through the transparency, and explicit description, of the research design, data collection and analysis which should allow for easy replication of the project in the future should anyone so wish.

Validity

Validity comments on the extent to which the research reflects on and measures what it set out to do in the research questions. This includes aspects such as the appropriateness and rigour of the research design, data collection and analysis procedures (Bryman, 2007). The use of pilot questionnaires and interviews was one way that internal validity of my study should have been increased by testing and improving on the data collection methods before primary data collection began. All drawing scoring was conducted blind, with the scorer not being aware if they were analysing pre or post drawings. This should have prevented researcher bias from consciously or subconsciously influencing the validity of the scoring process. The employment of a mixed methods approach in this study allowed for triangulation of data, using one method to support the findings of another, which should provide validity to my results. For example, observations and in particular interviews have been used to support and explain the findings of the primary data source – the questionnaires.

Generalisability

Generalisability is the extent to which the research findings could be extended out to the population as whole. In this case, would any findings extend out to all schools that visit the NMA or just the ones who happened to be selected for the study? The participant number of 255 is reasonably substantial and so should increase the generalisability of the findings. However, the number of schools involved, six, is actually relatively small compared to the total number of educational institutions who visit the aquarium over the course of a year. As no two schools are the same, it would be ill advised to make any generalisations at the school level.

Transferability

Transferability is the extent to which the research design and procedures could be applied in different locations or contexts with similar results. The thick description of the methodology should allow other researchers to replicate this study in other scenarios, particularly non-formal science learning venues where such school trips occur such as other aquariums but also zoos, museums, science centres etc.

Credibility

Credibility of the study will be attempted by providing copies of the results, including quotes from interviews to the adult participants of the project. Should any of participants have concerns about how they have been portrayed or feel they have misquoted, this will be rectified before any publications are made.

Chapter 4 - *The effect of social inequalities on school trip learning*

4.1 Introduction to findings on social inequalities and school trips

This first results chapter takes the form of two parts which together look to address my second research question **"***What role do social factors such as ethnicity, gender and social class have on learning during such trips and do teachers recognise and mitigate against any inequalities in this area?"*

In part one I present the key findings from my quantitative data collection and subsequent analysis into how social inequalities and other demographic factors may affect the cognitive learning achieved during school trips to non-formal learning venues. The data focuses on the analysis of the children's pre and post visit questionnaires, including the drawing element, using quantitative analysis software - SPSS. It is broken down into three main sections based on the key measures of knowledge used in the study; knowledge of shark species, knowledge of conservation issues and general knowledge of the marine environment. In part two I present the relevant qualitative data from educator interviews under the overarching theme of '*School trip learning'*. This is broken down in three sub-themes:

- Rationale for school trips
- Types of school trip learning
- Equality in the school trip learning experience.

The qualitative and quantitative results are then brought together in and discussed.

In order to understand the following results, it is first necessary to fully comprehend the process by which the questionnaires and interviews were analysed. Whilst this is covered in some depth in the methodology chapter, as the approaches differed depending on the nature of the activity, the analytical approach is summarised at the start of each new section.

PART ONE – QUANTITATIVE RESULTS

4.2 Relationship between learning measures

The relationship between all three dependant variables – shark species, conservation and marine environment knowledge – was investigated using a multiple regression test. As marine environment was considered the most all-encompassing of the knowledge measures, it was selected as the dependent variable for testing purposes. All test assumptions were met with outliers being treated as described in section 3.13 of the methodology.

The multiple regression model found only very weak linear association between the variables, with shark species and conservation knowledge scores not predicting marine environment knowledge in any statistically significant way. **$F(2,178) = 0.004$, $p=0.996$, adj. $R^2 = -0.011$.**

As no significant relationship was found, each learning measure was therefore investigated separately.

4.3 Shark species knowledge

As previously discussed in the methodology section, the shark listing activity was intended to ascertain whether students were taking in and retaining a specific fact - in this case the names of various species of sharks. A pre-visit, post-visit and then change in species knowledge score was recorded for each participant.

4.3.1 Overview statistics

- Pre-aquarium visit, participants could name an average of 3.681 shark species, post-visit this increased to 5.177.
- Pre-visit the most commonly known number of shark species was 4, post-visit this grew to 5 known species.

- Pre-visit the maximum number of species named by any one participant was 16, this increased to 20 species in the post-visit surveys.
- The average change in shark species knowledge pre to post visit was 1.696
- The largest increase was by 8 species and the most common increase was by 2 species.

4.3.2 Analysis

Independent sample t-tests were run to compare the mean change in species knowledge scores, across various demographic factors; gender, ethnicity, nationality, English as an additional language status, free school meals status and pupil premium eligibility.

In all the above cases data was treated as binary. For gender - male/female - and for free school meals, pupil premium and English language status - yes/ no. As discussed in section 3.11.1 the lack of diversity in the sample population made it necessary for both ethnicity and nationality to also be treated as binary, employing the categories white/BME and British/non-British.

As there were fewer than 15 cases of children not of a British background, a Mann-Whitney U-test was used to analyse against Nationality instead of a t-test.

In the case of the variables of age and MDI index of school, a one-way analysis of variance (ANOVA) was run as an alternative to the t-test due to the number of categories involved.

Figures 4.1, 4.2 and 4.3 below provide histograms that demonstrate that the three dependent variables have near normal distribution (with skewness and kurtosis values between -2 and 2) and so meet the assumption of normality required to run the ANOVAs)

Figure 4.1 Histogram for assumption of normality for change in shark species scores

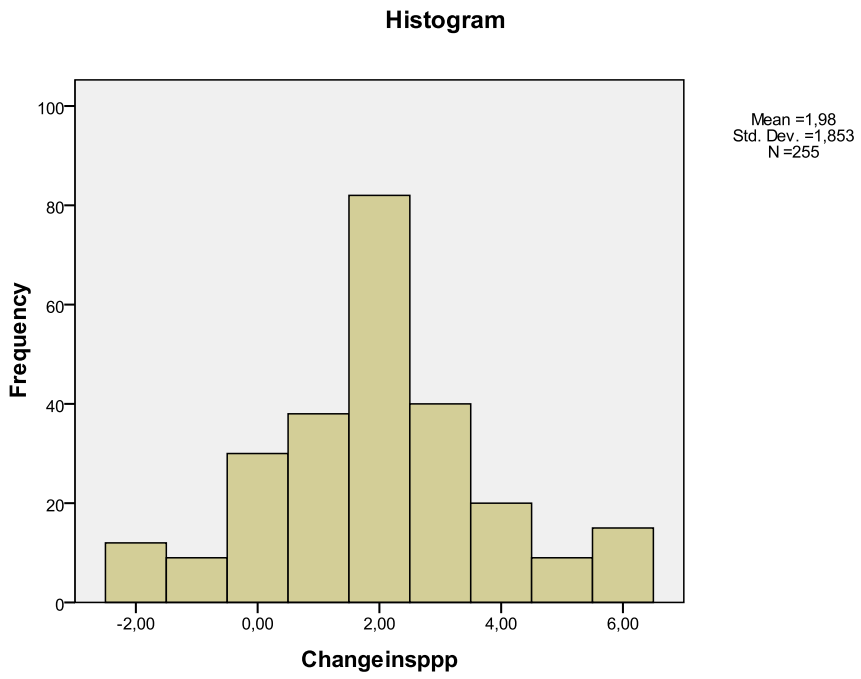


Figure 4.2 Histogram for assumption of normality for change in conservation knowledge

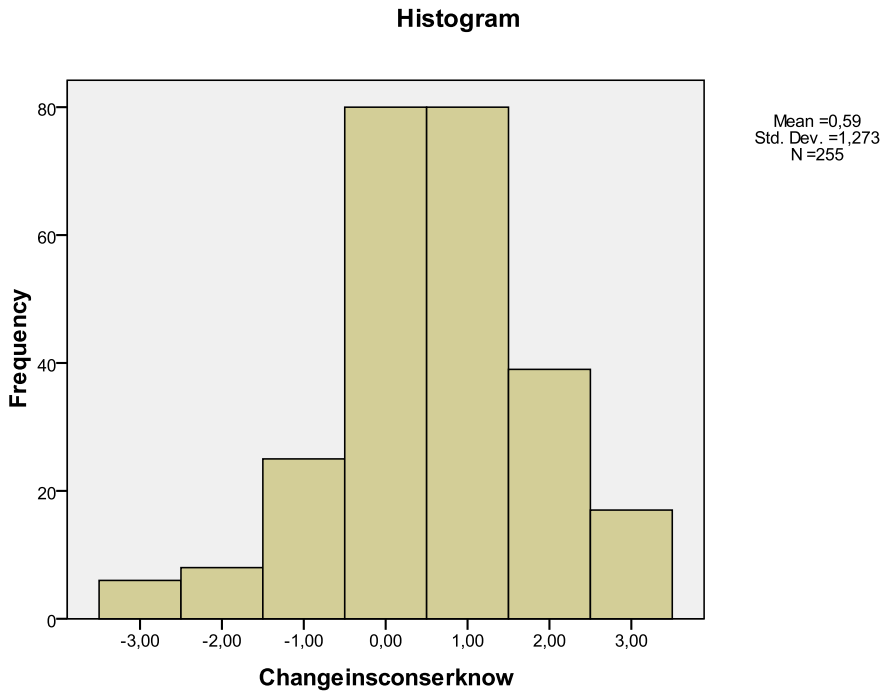
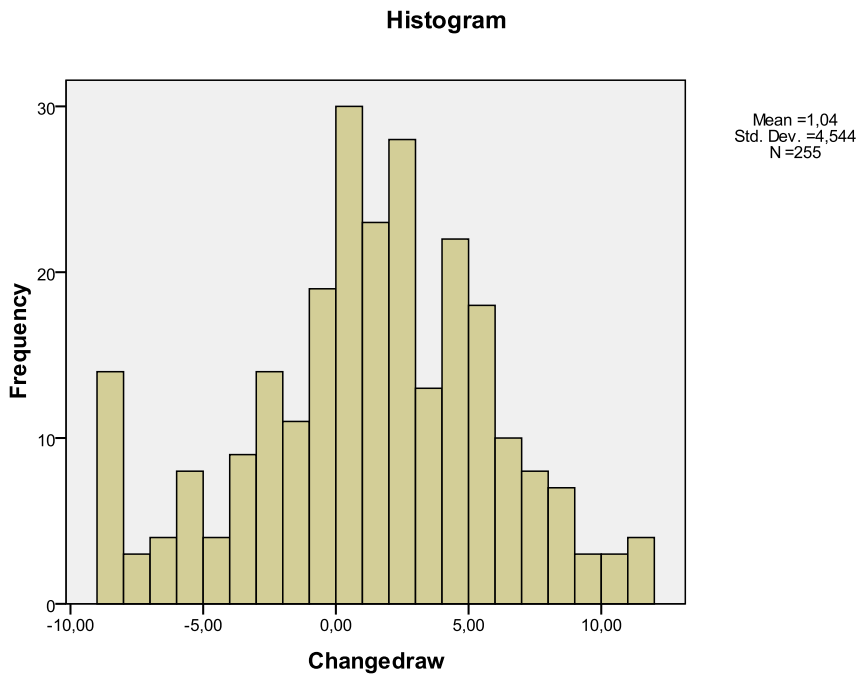


Figure 4.3 Histogram for assumption of normality for change in marine environment knowledge



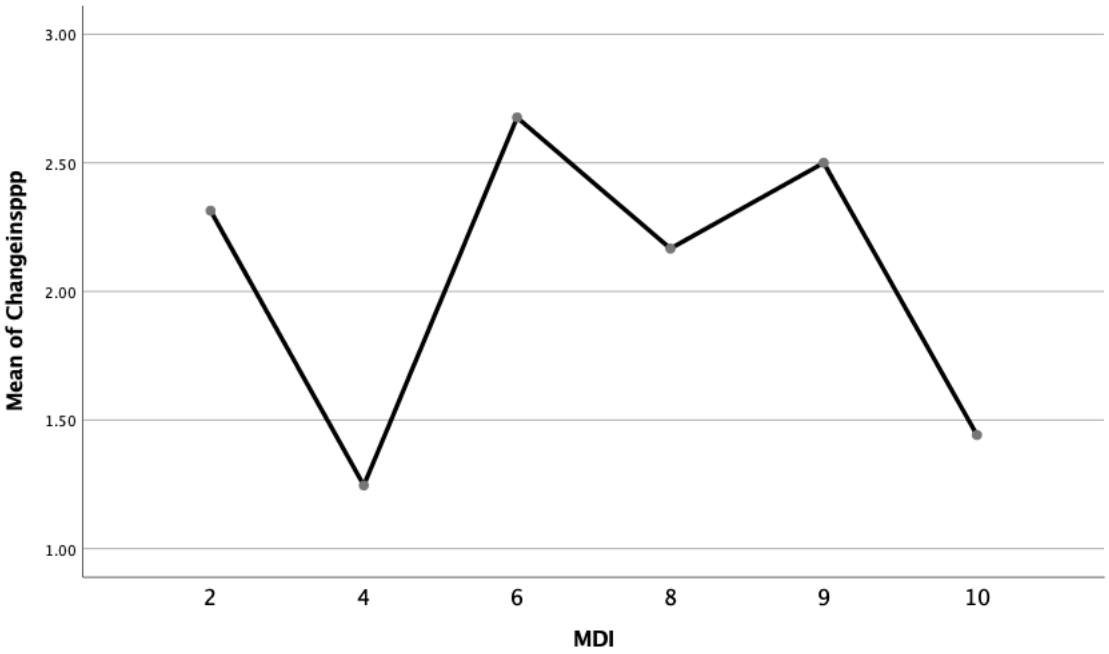
4.3.3 Results (change in knowledge pre- to post-visit)

Age – The one-way ANOVA revealed that the change in shark species score showed a statistically significantly difference between the various ages of the participants: ***F (3,250) 4.317, p=0.005***. A visual inspection of the means plots showed that in general, older children demonstrated a greater change in species knowledge with the exception of a drop off for ten-year olds. Change in shark species score increased from eight-year olds (1.92 ± 1.6, n=26), to nine-year olds (2.19 ± 1.88, n=90), to eleven-year olds (2.63 ± 1.95, n=38) and with ten-year olds (n=100) having the smallest mean change of score of 1.51 ± 1.73 (*equal variances assumed, Levene's test = 0.648*).

MDI decile of school – The one-way ANOVA revealed that the change in shark species score showed a statistically significant difference between the various schools and their varying deprivation index deciles: ***F (5,249) 5.010, p=0.000***. As shown in figure 4.4 below, visual inspection of the means plot however showed that there was no pattern between the MDI decile of the school and the change in

shark species score. Change in shark species score was lowest in the 4th decile school (1.25 ± 1.65, n=61) followed by the 10th decile school (1.44 ± 1.59, n=43), followed by the 8th decile, (2.17 ± 1.71, n=24), followed by 9th decile (2.5±1.89, n=42), then 6th decile (2.68 ± 1.79, n=34) and finally the highest change was witnessed in the 2nd decile school (2.32 ±2 .0, n=511) (*equal variances assumed, 0.580*).

Figure 4.4 Plot of means for change in shark species knowledge against MDI of school.



Gender – Girls (n=133) demonstrated a bigger improvement in shark species knowledge (2.3 6± 1.85) than boys (1.56 ± 1.77, n=122) pre to post visit, a statistically significant difference of 0.8 (CI 95%, -1.11 to -0.12): ***t (253) = -3.537, p = 0.000*** *(equal variances assumed, 0.579).*

Ethnicity- Children from BME backgrounds (n=16) were found to show a greater increase in species knowledge (2.94 ± 1.65, n=239) than children from a white background (1.91 ± 1.85), a statistically significant difference of 1.03: ***t (253) = -2.159, p = 0.032*** *(equal variances assumed, 0.883).*

No significant differences were found for change in shark species knowledge for any of the remaining demographic variables, results for which are outlined below.

Pupil premium - Children not receiving pupil premium (n=44) demonstrated a greater improvement in shark species knowledge (2±1.9) than children receiving this benefit (1.82 ±1 .58, n=211)**,** a non-statistically significant difference of 0.18: ***t (235) = -0.622, p = 0.534*** *(equal variances assumed, 0.424).*

Free School Meals - Children receiving free school meals (n=30) were found to show a greater increase in shark species knowledge (2.07±1.7) than those not receiving this benefit (1.96 ± 1.87, n=225) a non-statistically significant difference of 0.11: ***t* (253) = 0.283, *p* = 0.777** (equal variances assumed, 0.584).

English language status - Children who spoke English as an additional language (n=17) were found to show a greater increase in their shark species knowledge (2.12 ± 1.69) than native English speakers (1.9 ± 1.8), a non-statistically significant difference of 0.22: ***t* (251) = 0.315, *p* = 0.753** (equal variances assumed, 0.672).

Nationality – British children were found to demonstrate a greater increase in species knowledge (mean rank of 128.02) than those of other nationalities (mean rank of 127.63) but not at a statistically significant level: **U= 1453.5, z = -0.018, p = 0.985.**

Table 4.1 below provides a summary of the findings for change in shark species knowledge for the various demographic factors listed above. As well as identifying which variables were found to be statistically significant, it identifies which of the binary categories within each variable showed the greater increase in shark species knowledge pre to post-visit.

Table 4.1 Summary of findings for change in shark species knowledge

Variable where significant difference found in means (C.I. 95%)		**Variables where no sig. diff found in means (C.I. 95%)**	
Higher increase in shark species knowledge	**Lower increase in shark species knowledge**	**Higher increase in shark species knowledge**	**Lower increase in shark species knowledge**
Older children	Younger children	Receiving free school meals	Not receiving free school meals
BME children	White children	English as additional language	English as first language
Females	Males	British children	Non-British children
Multiple Deprivation Index of School		Children not receiving pupil premium	Children receiving pupil premium

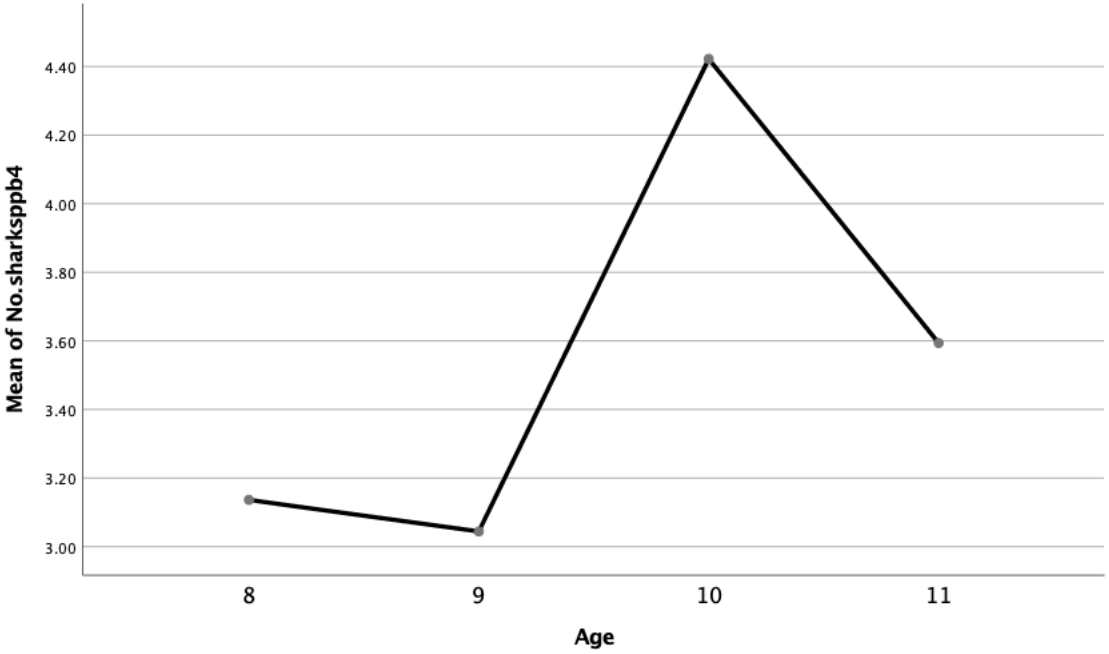
4.3.4 Results - Pre-visit score

To properly assess the effect that the aquarium visit may be having, it was necessary to understand participant pre-visit understanding separately to the overall change. This is particularly true in instances where there is a fixed number of possible correct answers, such as number of shark species. In these cases, children with a more advanced pre-visit knowledge could demonstrate a lower overall change simply because of the limitations to new knowledge that could be presented to them during the trip. Therefore, to understand how this effect may be influencing my results, tests were run to compare pre-visit scores for variables where a significant difference was found i.e. MDI, age, gender and pupil premium.

Age – A significant difference in pre-visit shark species knowledge scores was also found between the various ages of participants: $F(3,219) = 3.775, p = 0.011$. As can be seen in figure 4.5 there was no specific pattern found between age and pre-

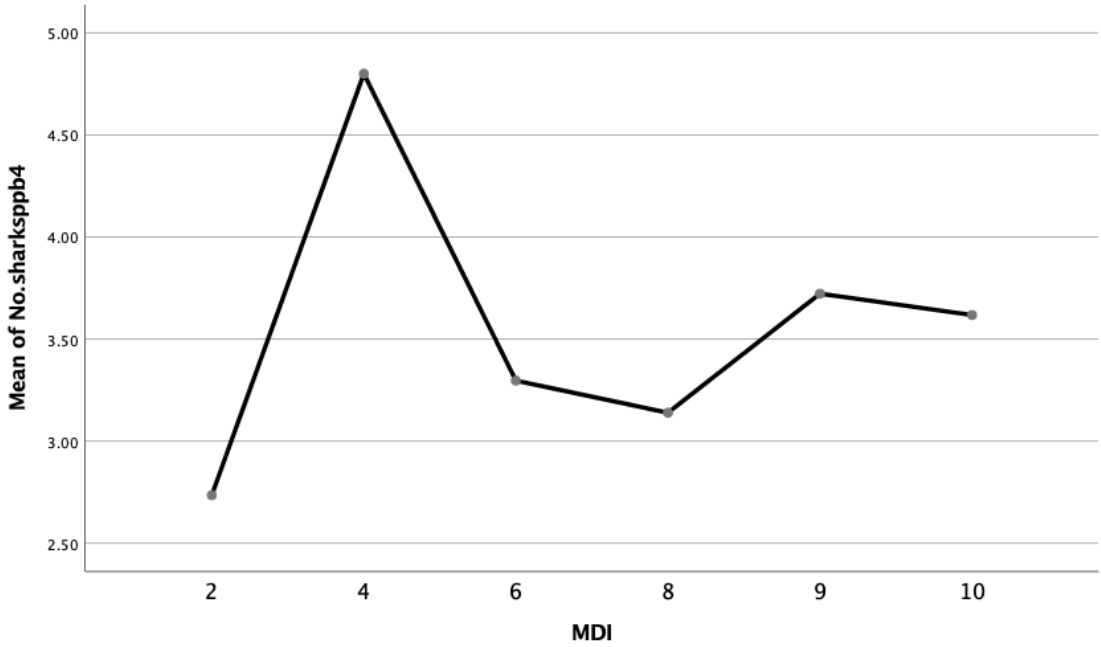
visit shark species knowledge. Ten-year olds had the highest pre-visit species knowledge (4.42 ± 3.26, n=90), followed by eleven-year olds (3.59 ± 2.28, n=32), followed by eight year olds (3.14 ± 2.05, n=22) and finally nine-year olds (n=7) demonstrated the lowest pre-visit shark species knowledge 3.04 ± 2.56 (equal variances assumed 0.142).

Figure 4.5 Plot of mean number of shark species knowledge pre visit by age.



MDI decile of school – A significant difference in pre-visit shark species score was also found between the different schools and their varying deprivation index deciles. ***F (5,218) = 3.357, p=0.006***. As shown in figure 4.6 there was again no pattern between the MDI decile of the school and shark species knowledge. Knowledge score was lowest in the 2nd decile school (2.73 ± 2.4, n=49), followed by 8th decile school (3.14 ± 1.98), followed by the 6th deciles school (3.3 ± 2.51), then the 9th deciles (3.72 ± 2.22), the 10th decile (3.62 ± 1.89) and finally the 2nd decile school (2.74 ± 2.4).

Figure 4.6 Plot of mean number of shark species known pre visit by MDI of school.



Gender – Boys (n=111) demonstrated a greater pre-visit shark species knowledge (4.59 ± 3.13) than girls (2.78 ± 2.19, n=113), a statistically significant difference of 1.81:***t (196.3) = 5.012, p = 0.000*** *(equal variances not assumed – 0.002).*

Ethnicity – White children (n=208) demonstrated a greater knowledge of pre-visit shark species knowledge (3.71± 2.88) than BME children (3.17±1.9), a non-statistically significant difference of 0.54:***t (222) = 0.644, p = 0.520*** *(equal variances assumed, 0.208)*

4.3.5 General Linear Model with interactions

A univariate General Linear Model was conducted to examine the effects of each explainer variable separately and interactions between these variables.

As with all the statistical tests undertaken, outliers were winsorised and missing values replaced by the most common value.

Corresponding to the individual t-test described above, the main effects of MDI, gender, age and ethnicity were found to explain the most significance in the model, along with the interaction variable of MDI*Age– (R^2 = 0.207, Adj. R^2 = 0.157).

However, only MDI, Gender, Ethnicity and Age*MDI were found to be statistically significant within the model. **GLM: MDI, Gender, Ethnicity, Age, Age*MDI F=3.592, 1.156, 6.449, 1.156, 2.720; df = 5,1.1,3,5; p=0.004, 0.001, 0.12, 0.327, 0.021.** Full results are provided in table 4.2 below along with supporting plots.

A Kolmogorov-Smirnov test showed the residuals met the assumptions of normality, validating the model: **D (254) = 0.033, p=0.200.**

Table 4.2 Results of GLM for Change in shark species and demographic variables

Tests of Between-Subjects Effects

Dependent Variable: Changeinsppp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	176.774[a]	15	11.785	4.132	.000
Intercept	369.077	1	369.077	129.399	.000
MDI	51.225	5	10.245	3.592	.004
Age	9.891	3	3.297	1.156	.327
Gender	31.478	1	31.478	11.036	.001
Ethnicity	18.393	1	18.393	6.449	.012
MDI * Age	38.790	5	7.758	2.720	.021
Error	678.832	238	2.852		
Total	1832.000	254			
Corrected Total	855.606	253			

a. R Squared = .207 (Adjusted R Squared = .157)

Figure 4.7 Plot of interaction between MDI and Age

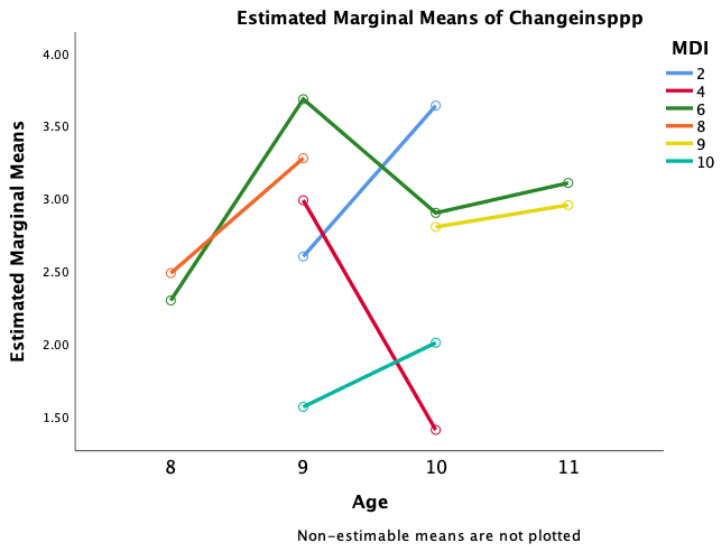


Figure 4.7 above demonstrates the interaction between MDI and Age and shows that there is a general trend towards the gap between participants from higher and lower MDI schools to widen the older they become.

Figure 4.8 Histogram of residuals for change in species score

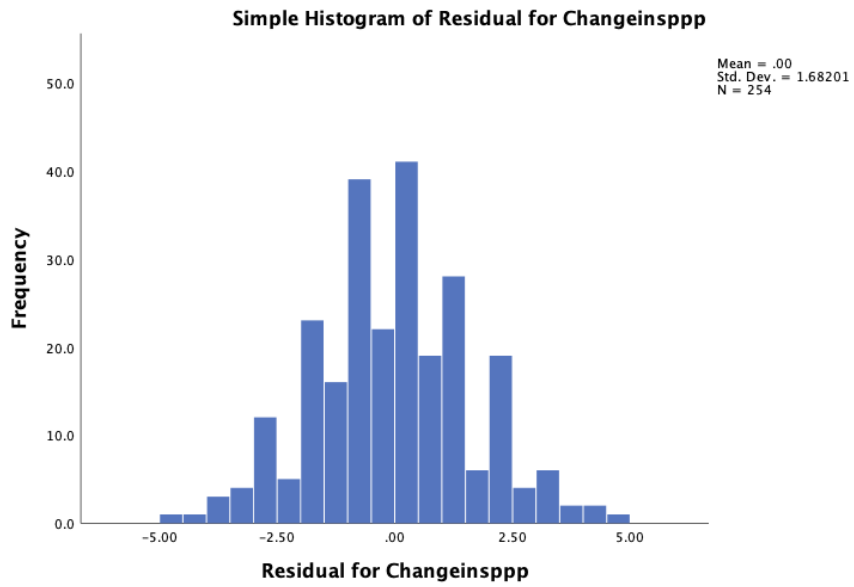


Figure 4.8 above demonstrates that the model meets the assumptions of normality.

Figure 4.9 Scatter plot of standardised residuals against predicted values for change in species score

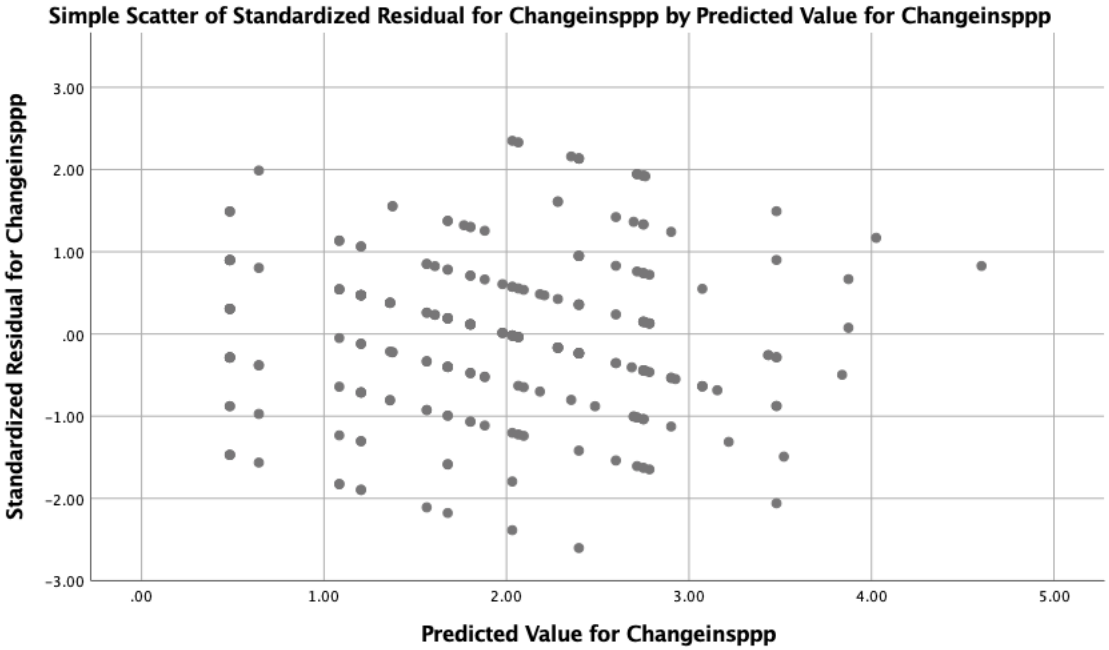


Figure 4.9 above demonstrates that the model meets the assumptions for heteroscedasticity and linearity. The plot is relatively shapeless without any clear patterns in the data. It is generally symmetrical around the 0 line without any particularly large residuals.

4.3.6 Summary of findings for shark species learning measure

The individual tests, along with the GLM showed that out of all the demographic variables tested for only age, ethnicity, gender and multiple deprivation of the attended school appeared to have any potential significance on shark species knowledge gained during the trip to the aquarium.

Girls demonstrated a statistically greater improvement in shark species knowledge than boys pre to post trip. However, as pre-visit analysis showed boys to hold a

significantly higher prior knowledge of shark species before the trip, it is possible that girls were being presented more new information on this particular subject during the trip and so had more opportunity to demonstrate learning. Therefore, we cannot state with any certainty that gender does have an influence on change of shark species knowledge during a trip to the aquarium.

Children from BME backgrounds demonstrated a greater improvement in shark species knowledge pre to post trip than white children. Whilst white children did appear to have a more developed pre-visit knowledge of shark species, it was not at a statistically significant different level. This suggests that the difference we see in knowledge gain between white and non-white students could well be a genuine effect. However, it is important to acknowledge the small sample size involved with this variable, n=17.

In general, the older the child, the greater the change in shark species knowledge pre to post-trip with the exception of children aged 10 years old who appeared to break the pattern, and seemed to learn significantly less than the other age groups. Whilst no particular pattern was identified in knowledge levels in different age groups before the trip, children aged 10 years were found to have the highest pre-visit knowledge of shark species. This would suggest that the 10 years old had the least room for improvement during the trip and so broke the age-related pattern of older children appearing to learn more new shark species during the trip.

Whilst change in shark species knowledge was significantly different between the various MDI deciles, along with pre-visit knowledge of shark species, no specific trend was noted. However, it must be noted that as only one school represented each of the 6 different MDI's in the study, the difference in this knowledge could also be attributed to other differences between the schools.

4.4 Conservation Knowledge

As previously discussed in the literature review, education on conservation, and environmental issues more generally, are key aims of the NMA and aquariums

across the world but there has been little empirical work conducted in this area. It is therefore of particular interest to investigate how a visitor's background may result in differences in this form of knowledge production during a trip to an aquarium. In the method described in the methodology, a pre-visit, post-visit and then change in conservation knowledge score was calculated.

4.4.1 Overview statistics

- Pre-aquarium visit, participants mentioned an average of 1.502 of the conservation issues, post visit this increased to 1.807.
- The mode for pre-visit was 1 conservation issue, post-visit this grew to 2.
- The average change in conservation knowledge score was 0.452.
- The biggest change noted in any one participant was by an increase in the maximum available 4 marks. The biggest decrease in any one participant was by minus 3 marks.

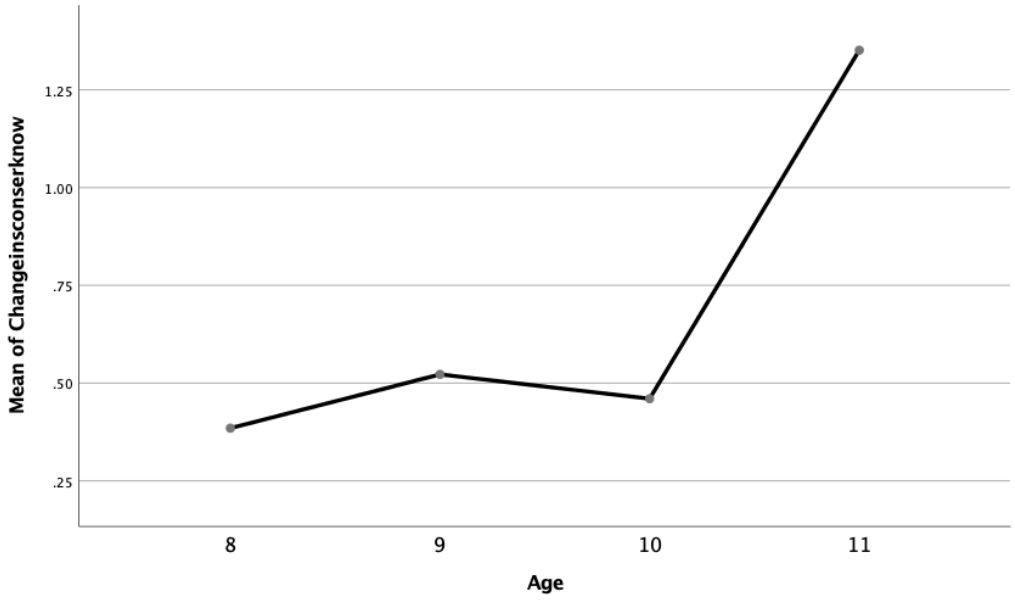
4.4.2 Analysis

Analysis was conducted in the same manner as described for shark species knowledge in section 4.3.2 above.

4.4.3 Results (Change in knowledge pre to post-visit)

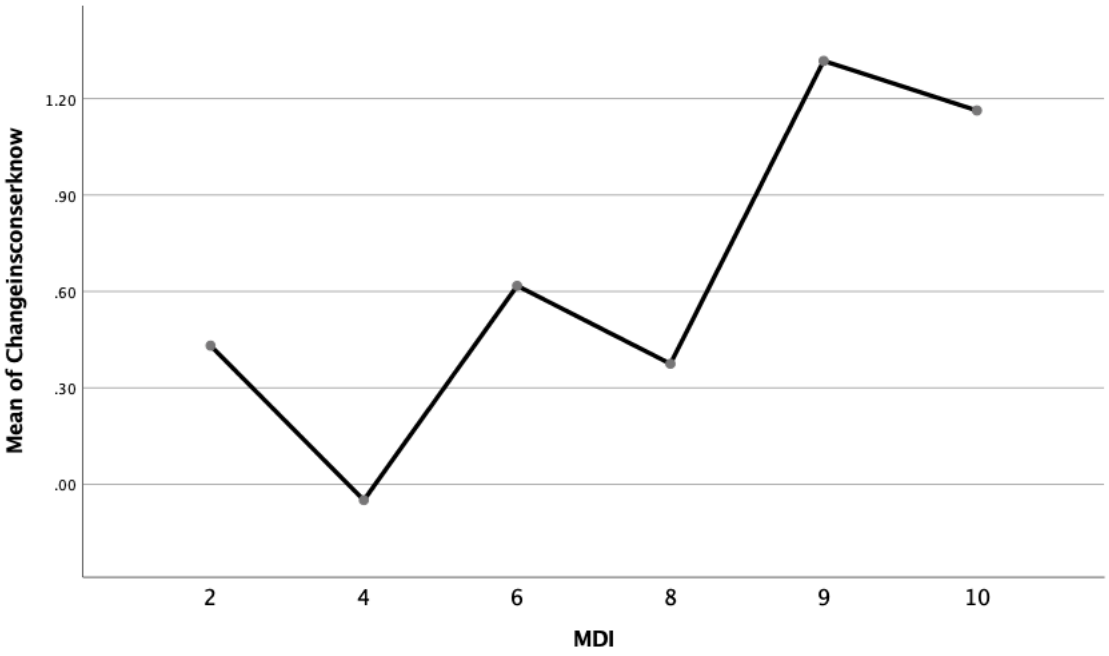
Age – The one-way ANOVA revealed that for the change in conservation knowledge there was a statistically significantly difference between the various ages of students: ***F (3,250) 4.057, p=0.008.*** A visual inspection of the means plots, figure 4.10 below, showed that in general, older children demonstrated a greater change in conservation knowledge with the exception of a drop off for ten-year olds. Change in conservation knowledge score increased from eight-year olds (0.39 ± 1.10, n=26) to nine-year olds (0.52 ± 1.13, n=90) to eleven-year olds (1.24 ± 1.4, n=38), with ten-year olds (n=100) having a mean change of score of 0.46 ± 1.33. (equal variances assumed, 0.357).

Figure 4.10 Plot of mean of change in conservation knowledge across varies ages.



MDI decile of school – The one-way ANOVA revealed that for change in conservation knowledge score, there was a statistically significant difference between the different schools and their varying deprivation index deciles ***F (5,249) 8.135, p=0.000***. As shown in figure 4.11 below, visual inspection of the means plot showed that there was a slight trend towards children from higher MDI deciles demonstrating a greater change in conservation knowledge pre to post visit. Schools from deciles 4 and 8 do however appear to go against this general trend. Change in conservation score was lowest in the 4th decile school (-0.49 ± 1.38, n=61, followed by the 8th decile, (0.38±0.92, n=24),followed by the 2nd decile school (0.43 ± 1.12, n=51), then the 6th decile (0.62 ± 1.04, n=34), the 10th decile (1.16 ± 0.98, n=43) and finally the highest change was witnessed in the 9th decile school (1.21 ± 1.41, n=42). (equal variances assumed, 0.356)

Figure 4.11 Plot of mean change in conservation knowledge across represented MDI deciles



Ethnicity - Children from BME backgrounds (n=16) demonstrated a greater improvement in conservation knowledge (1.25 ± 1.34)**,** than white children (0.544 ± 1.26)**,** a statistically significant difference of 0.71: ***t (253) = -2.163, p = 0.031.*** *(equal variances assumed, 0.876).*

No significant differences were found for change in conservation knowledge for any of the remaining demographic variables.

Gender – Girls (n=122) demonstrated a greater improvement (0.68 ± 1.78) in conservation knowledge than boys **(**0.49 ± 1.85, n=133) pre to post visit, a non-statistically significant difference of 0.19: ***t (221.74) = -1.15, p = 0.254.*** (equal variances not assumed, 0.003).

Pupil premium status – Children receiving pupil premium (n=30) demonstrated a greater increase in conservation knowledge (0.68 ± 1.07) than those who were

not (0.57 ± 1.31, n=211) a non-statistically significant difference of 011: ***t (253) = 0.54, p=0.593.*** *(equal variances assumed, 0.163).*

English language status - Children who spoke English as an additional language (n=17) were found to show a greater increase in their conservation knowledge (0.65 ± 1.27) than native English speakers (0.59 ± 1.28, n=236), a non-statistically significant difference of 0.06: ***t* (251) = 0.21, *p* = 0.837.** (equal variances assumed, 0.11).

Free school meal status - Children receiving free school meals (n=30) were found to show a larger increase in conservation knowledge (0.63 ± 1.0) than those not receiving this benefit (0.5 8± 1.31)**,** a non-statistically significant difference of 0.05: ***t* (253) = 0.206, *p* = 0.837** (equal variances assumed, 0.108)

Nationality – Children from nationalities other than British (n=12) were found to demonstrate a greater increase in conservation knowledge pre to post-visit (mean rank of 136.92) than those of other nationalities (mean rank of 127.56, n=243) but not at a statistically significant level: **U= 1351, z = -0.44, p = 0.657.**

Table 4.3 (below) provides a summary of the findings for change in conservation knowledge for the various demographic factors listed above. As well as identifying which variables were found to be statistically significant, it identifies which of the binary categories within each variable showed the greater increase in conservation knowledge pre to post-visit.

Table 4.3 Summary of findings for change in conservation knowledge

Variable where significant difference found in means (C.I. 95%)		**Variables where no sig. diff found in means (C.I. 95%)**	
Higher increase in conservation knowledge	**Lower increase in conservation knowledge**	**Higher increase in conservation knowledge**	**Lower increase in conservation knowledge**
BME children	White children	Female	Males
Older children	Younger children	English as additional language	Native English speakers
Children from higher MDI decile schools	Children from lower MDI deciles schools	Children receiving free school meals	Children not receiving free school meals
		Children of other nationalities	British children
		Children receiving pupil premium	Children no receiving pupil premium

4.4.4 Results (pre-visit)

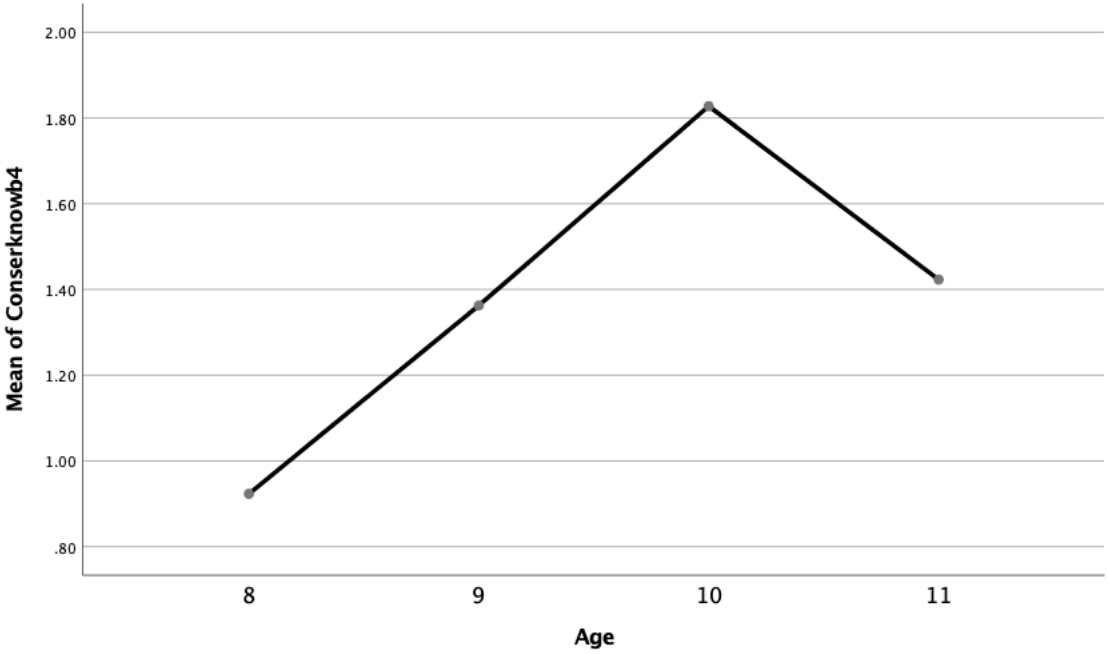
As with shark species knowledge, pre-visit scores for conservation knowledge were run against the variables which showed significance for overall change.

Ethnicity - In terms of pre-visit data only, BME children (n=16) showed a greater conservation knowledge (1.56 ±1 .41**)** than white children (1.49 ±1.15, n=204), however in this instance it was a non- statistically significant difference of 0.07: ***t (218) = -0.238, p = 0.844*** *(equal variances assumed, 0.152).*

Age – For pre-visit conservation knowledge also, there was found to be a significant difference between the different ages of participant: ***F (3,215) =5.084,***

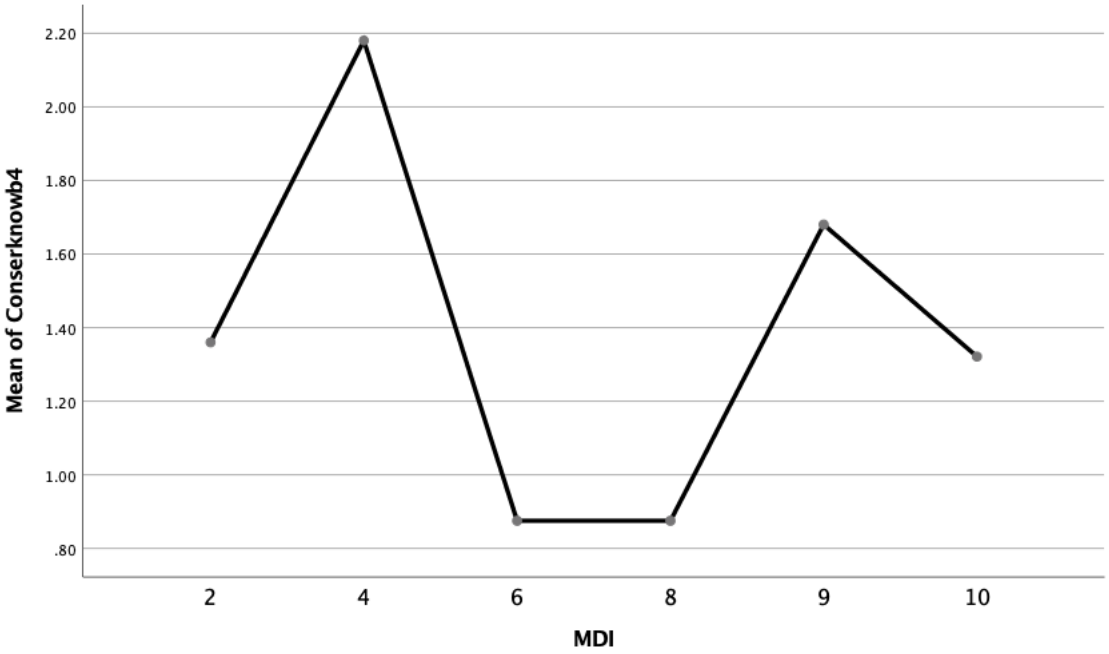
p = 0.002. As seen in figure 4.12 there was again a general trend towards older children demonstrating a greater pre-visit conservation knowledge with an exception of a drop off for 11-year olds. Ten-year olds had the highest pre-visit species knowledge (1.83 ± 1.11 n=87, followed by eleven-year olds (1.42 ± 0.95, n=26), followed by nine year olds (1.36 ± 1.19, n=80) and finally eight-year olds (n=26) demonstrated the lowest pre-visit conservation knowledge 0.92 ± 1.2(equal variances assumed 0.601)

Figure 4.12 Plot of mean number of pre visit conservation knowledge by age.



MDI decile of school – A significant difference in conservation knowledge was also found between the different schools and their varying deprivation index deciles. ***F (5,214) = 9.176, p=0.000.*** As shown in figure 4.13, visual inspection of the means plots again revealed no pattern between the MDI decile of the school and the knowledge score. Pre-visit conservation knowledge was joint lowest in 6th (0.88±1.01, n=32), and 8th decile schools (0.88 ±1.12 n=24), followed by 10th decile school (1.32 ± 0.61, n=28), then the 2nd deciles (1.36 ± 1.24, n=50) and finally, the 4th decile school (2.18 ± 1.17, n=61). (equal variances not assumed, 0.000).

Figure 4.13 Means plot of pre-visit conservation knowledge against MDI of school



4.4.5 General Linear Model with interactions

As with the shark species knowledge measure, a univariate General Linear Model was run to assess the effects of each variable separately and interactions between variables. However, a Kolmogorov-Smirnov test revealed that the residuals broke the assumptions of normality and therefore a GLM was not valid for this learning measure: **D (254) = 0.080, p=0.001.**

4.4.6 Summary of findings

Children from BME backgrounds demonstrated a greater change in conservation knowledge from pre to post visit than their white counterparts. As pre-visit analysis did not find ethnicity to have significant influence on conservation knowledge before the aquarium visit, this suggests that the significant difference we see in overall change in score for ethnicity could well be genuine. However again, the low sample size here (n=16) must be acknowledged.

As older children demonstrated a greater change in score and also demonstrated a greater pre-visit knowledge of conservation issues, it would appear that age may well have an influence on learning during the trip to the aquarium with older children potentially benefiting more cognitively from the aquarium trip.

The results of the investigation into the pre-visit scores found no particular pattern between MDI of school and conservation knowledge and so provide authenticity to the change in score finding for this variable. This would suggest that children from higher MDI decile schools were in general, learning more during their trip to the aquarium, at least for this particular type of learning.

4.5 Marine environment knowledge

As discussed in the literature review, drawings have been found to be a useful tool in evaluation of children's non-formal learning, including previous use in a smaller scale study at the NMA. As described in depth in the methodology chapter, a scoring system was employed based on convergent influences from previous studies by Bowker (2007), Jensen (2014) and Cainey et al. (2012).

For each student a general marine environment knowledge score was calculated, pre and post-visit, based on the breadth and depth of knowledge of the marine environment that they demonstrated in their drawings. Pre-scores were deducted from post-scores resulting in an overall 'change in marine environment knowledge' score.

4.5.1 Overview statistics

- Pre-aquarium visit the average marine environment knowledge score was 19.76, this rose to 20.65.
- Pre-visit the maximum marine environment knowledge score achieved by any one participant was 40, this increased to 43 post-visit.

- The average change in marine environment knowledge score, pre to post-visit was 1.986.

4.5.2 Analysis

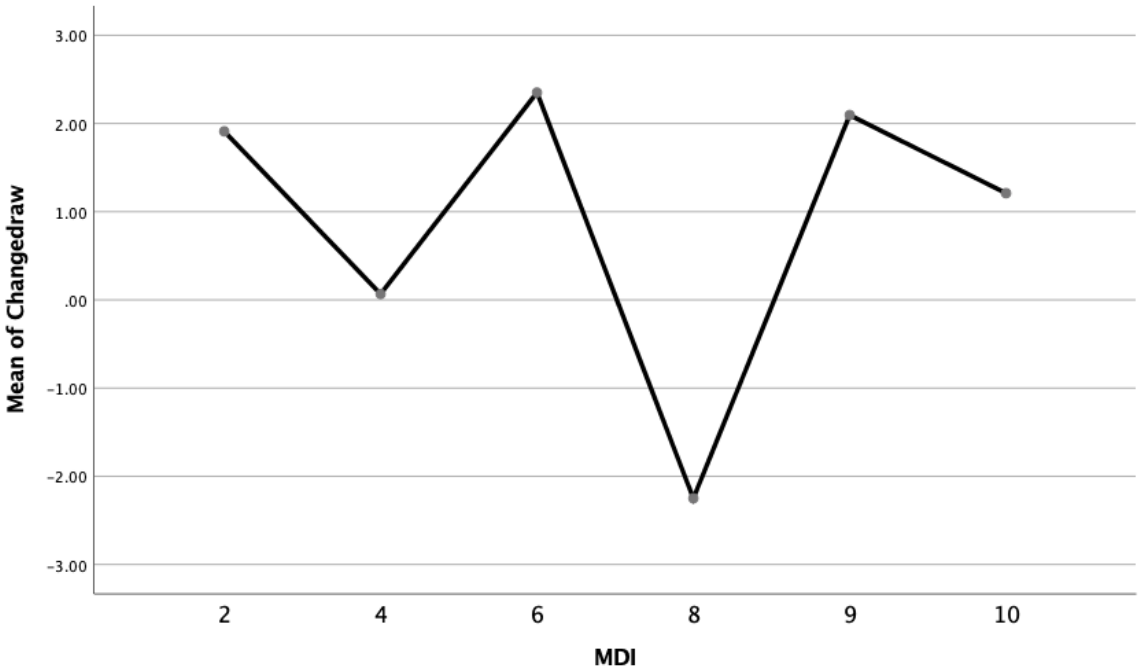
Analysis was conducted as described for shark species knowledge and conservation knowledge in section 4.3.2 and 4.4.2 above.

4.5.3 Results (change in marine environment knowledge pre to post-visit)

Age – For marine environment knowledge, a significant difference was again found between the different ages of participants: ***F (3,250) = 5.315, p = 0.001.*** Visual analysis of the plot of means against age revealed a general trend of older children demonstrating a greater marine environment knowledge with 10-year olds once again bucking the trend. In this case, eight-year olds actually demonstrated an average decrease in marine environment knowledge (-1.52 ± 5.03, n=26), followed by ten-year olds (0.72 ± 4.41, n=100), then nine-year olds (1.40 ± 4.52, n=90 and finally eleven-year olds who demonstrated the greatest change in knowledge pre to post visit (2.83 ± 3.87, n=38).

MDI decile of school – For this measure too, a significant difference was found between the different schools and their varying MDI levels: **F (5,249) = 5.074, p=0.000.** Visual analysis of the means plot – figure 4.14 - revealed no particular pattern to the relationship between MDI decile of school and the student change in marine environment knowledge. Pupils from decile eight schools were found, on average, to demonstrate a negative change in knowledge (-2.41 ± 4.9, n=24), followed by 4th decile students (0.10 ± 4.9, n=61), followed by 10th decile (1.21 ± 4.91, n=43), then 2nd decile (1.91 ±3 .46, n=51), then 9th decile (2.09 ± 4.0, n=42) and finally decile six students who demonstrated the greatest change in marine environment knowledge pre to post visits (2.35 ± 3.96, n=34).

Figure 4.14 Mean plot for change in marine environment knowledge score against MDI index



No significant differences were found in marine environment knowledge for any of the remaining demographic variables.

Gender-In general, girls (n=133) demonstrated a greater improvement in marine environment knowledge (1.36 ± 4.35) than boys (0.69 ± 4.73, n=122) pre to post visit, a non-statistically significant difference of 0.67: ***t (253) = -1.169, p = 0.244*** (equal variances assumed, 0.586)

Ethnicity-Children from BME backgrounds (n=16) showed a greater increase in marine environment scores (2.59 ± 5.39) than white children (0.94 ± 4.47, n=239), a non-statistically significant difference of 1.65: ***t (253) = -1.413, p=0.159*** (equal variances assumed 0.617)

Pupil premium–Children receiving pupil premium (n=44) demonstrated a significantly lower change in marine environment knowledge (0.15 ± 4.02) pre to post visit than those not in receipt of this benefit (1.23 ± 4.63, n=211), a statistically significant difference of 0.23: ***t (253) = -1.439, p=0.151*** (equal variances assumed, 0.326).

Free school meals-On average children receiving free school meals (n=30) demonstrated a lower change in marine environment knowledge (0.42 ± 3.64) compared to those who are not (1.13 ± 4.63, n=225), a non-statistically significant difference of 0.71: ***t (253) = -0.803, p=0.423*** (equal variances assumed, 0.413)

English language status-Native English speakers (n=17) were found to demonstrate a lower change in increase in their marine environment knowledge (1.01 ± 4.58) than those who had English as a second language (1.53 ± 4.23, n=235), a non-statistically significant difference of 0.52 : ***t* (251) = 0.454, *p* = 0.651** **(**equal variances assumed, 0.617)

Nationality-British children (n=243) were found to demonstrate a lower increase in marine environment knowledge (mean rank of 126.74) than those of other nationalities (mean rank of 153.46, n=12) but not at a statistically significant level: **U= 1152.5, z= -1.23, p = 0.22.**

Table 4.3 (below) provides a summary of the findings for marine environment knowledge change for the various demographic factors listed above. As well as identifying which variables were found to be statistically significant, it identifies which of the binary categories within each variable showed the greater increase in marine environment knowledge pre to post-visit.

Table 4.4 Summary of findings for change in marine environment score

Variable where significant difference found in means		**Variables where no sig. diff found in means**	
Higher increase in marine env. knowledge	**Lower increase marine env. knowledge**	**Higher increase in marine env. knowledge**	**Lower increase marine env. knowledge**
Older children	Younger children	Girls	Boys
Multiple deprivation index of school		EAL students	Native English speakers
		BME children	White children
		Children of other nationalities	British children
		Children not receiving free school meals	Children receiving free school meals
		Not receiving pupil premium	Receiving pupil premium

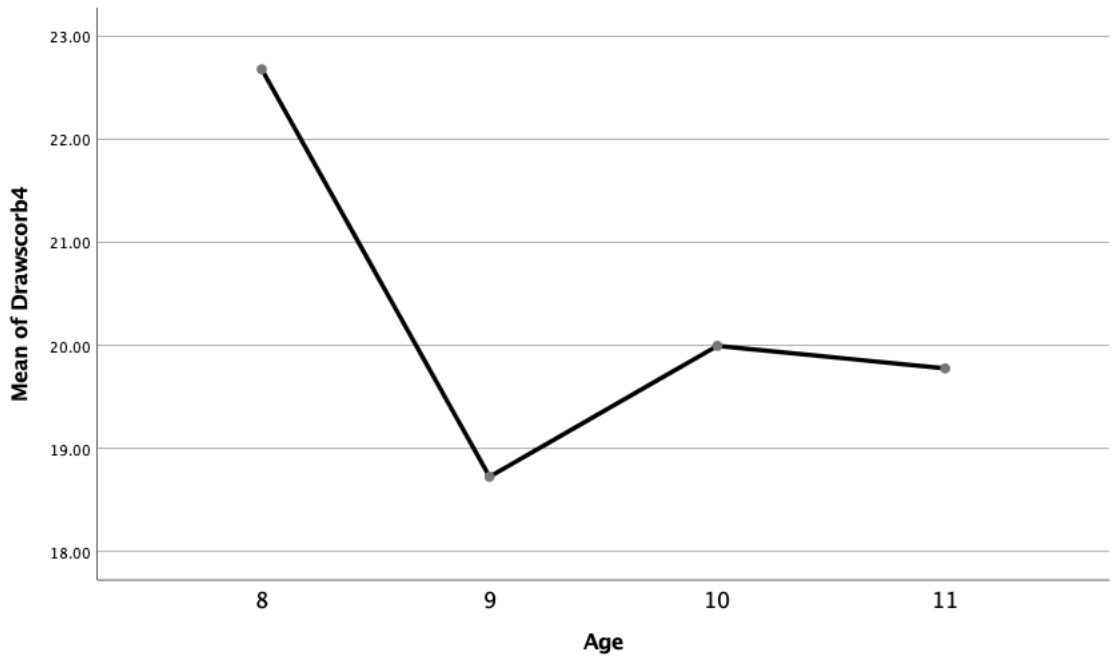
4.5.4 Results (pre-visit knowledge)

As per shark species and conservation knowledge, pre-visit scores for marine environment knowledge were run against the variables found to be significant for overall change – age and MDI decile.

Age – Age of participants was also found to be a significant factor in pre-visit marine environment knowledge: ***F (3,248) = 3.599, p = 0.014.*** A visual assessment of the means plot, figure 4.15 below, showed a general trend towards younger children having greater pre-visit knowledge of the marine environment. Nine-year olds (n=89) were found to have the lowest pre-visit knowledge scores (18.72 ±5 .09), followed by eleven year olds (19.78 ± 4.17, n=38), then ten-year olds (20.0 ±

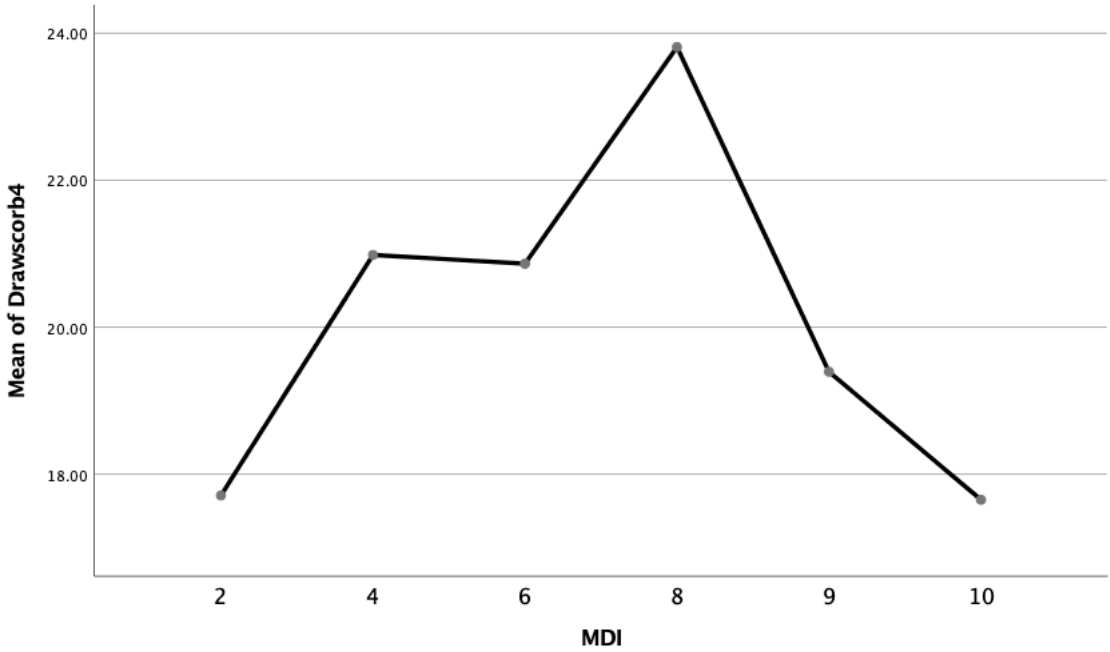
5 .39, n=100) and finally eight year olds who demonstrated the highest pre-visit marine environment scores (22.68 ±7 .7, n=25)

Figure 4.15 Means plot of pre-visit marine environment score against age



MDI decile of school – Multiple deprivation index of a participant's school was also found to be a significant factor in pre-visit marine environment knowledge: ***F (5,247) = 6.96, p = 0.000.*** A visual assessment of the means plot, figure 4.16 below, showed no particular trend between MDI decile and marine environment knowledge before the aquarium visits. Decile eight students (n=24) were found to have the greatest pre-visit knowledge of the marine environment (23.81 ± 6.83), followed by decile four students (20.98 ± 5.72, n=61), followed by 6th decile students (20.86 ± 5 .82, n=33), then 9th decile (19.39 ± 3.56, n=43), 2nd decile (17.71 ± 4.77, n=50) and finally the 10th decile school where students demonstrated the lowest pre-visit knowledge (17.65 ± 4.54, n=43).

Figure 4.16 Plot of means of pre-visit marine environment score against MDI



4.5.5 General Linear Model with interactions

As with the shark species and conservation knowledge measures, a univariate General Linear Model was run to assess the effects of each variable separately and interactions between variables. As with conservation knowledge, a Kolmogorov-Smirnov test revealed the residuals were not normally distributed and so the GLM was not valid: **D (254) = 0.060, p=0.029.**

4.5.6 Summary of findings

In general, the older the child the greater the change in marine environment score pre to post visits. Pre-visit analysis however showed the opposite with younger children tending to have more prior knowledge of the marine environment. This brings into question the validity of the finding for change in knowledge as it is possible that younger children were being presented with less new information during the trip, compared to their older counterparts.

Multiple deprivation index of the school attended appeared to have an influence on the marine environment knowledge both in terms of existing pre-visit knowledge and change in knowledge pre to post visit, but no particular trend was found in terms of the direction of such an affect.

4.6 Overview of quantitative findings around social inequalities and school trip learning

Statistical analysis suggests that social inequalities and other demographic factors had a range of influences on learning during the trip to the aquarium with some factors being more influential than others.

As perhaps might be expected, given the different learning abilities of children of different ages, age was found to have an influence. Overall, older children tended to show a greater change in score than younger children across all three learning measures. However, in the case of marine environment knowledge, this relationship may have been skewed by higher pre-scores for the younger children and so we cannot say with any certainty that any relationship exists for this particular learning measure.

Gender was only found to have a significant influence on one of the knowledge measures - shark species knowledge - with girls demonstrating a greater overall change in knowledge pre to post visit. However, this is also likely to have been skewed by the boys'significantly higher pre-visit knowledge of different shark species and so we cannot be confident of a true relationship.

In all cases, children from BME backgrounds showed a greater change in score than their white counterparts and this was found to be a statistically significant difference for both shark species and conservation knowledge. Analysis of pre-visit scores suggested that prior knowledge in these measures was not skewing this finding and so the effect was likely to be genuine although the small sample sizes involved must be acknowledged.

Two of the socio-economic indicators, free school meals status and pupil premium, did not appear to have influence on school trip learning on their own. The third indicator, Multiple Deprivation Index of the attended school was however found to be significant for every learning measure although with no particular directional trend identified.

These findings, particularly those around gender, ethnicity and socioeconomic status at school level will be discussed in more detail later in this chapter alongside the qualitative data.

Table 4.4 (below) provides an overall picture of the findings of the analysis of knowledge measures against demographic variables. As well as identifying which variables were found to be statistically significant (shaded boxes), it identifies which of the binary categories within each variable showed the greater increase in the various knowledge measures pre to post-visit.

Table 4.4 Overall Change of knowledge measures against demographic variables

	Age	**Gender**	**Ethnicity**	**Nationality**	**EAL**	**MDI**	**PP**	**FSL**
Shark species	Older	Females*	BME children	British	Yes	n/a	No	Yes
Conservation	Older	Females	BME children	Other nationalities	Yes	Higher deciles	Yes	Yes
Marine Environment	Older*	Females	BME children	Other nationalities	Yes	n/a	No	No

* this finding of significant difference may be skewed by significantly different pre-visit scores

PART TWO – QUALITATIVE RESULTS

4.7 Introduction to Theme 1: School Trip Learning

The interview data analysed and discussed in this section was collected during the primary research period of November 2016 to June 2017. Interviews were conducted with seven teachers from the six participating schools, both pre and post their aquarium visit, and with the NMA's Head of Discovery and Learning. Interviews with teachers were intended to provide context to each class's aquarium visit (objectives, preparation, previous experience etc.) whilst encouraging some self-analysis amongst participants.

Analysis of interviews took place on an on-going basis, throughout the fieldwork period and used a part deductive – analysing against my established framework to test my preconceived theories – and part thematic content analysis – looking for emergent themes and subthemes. During the analysis, three particular sub-themes emerged relating to the first of my research question: "*how do social inequalities affect the learning achieved during school trips to non-formal learning venues*?"

- teacher's rationale for school trips
- types of learning
- equality of the learning experience during trips.

These are categorised together in an overall theme of '*School trip learning'*.

To increase transparency, and provide insight into how each theme came about, standardised tables are provided listing the relevant interview questions, my key interpretations / findings for each, links to existing knowledge in this area and where applicable how this links to my quantitative analysis.

Pertinent quotes are provided as testimony for each theme, with my analysis of each being explained. Each quote is labelled with the pseudonym of the speaker and the school, the school's Multiple Deprivation Index decile (MDI) and the year of the class(es) involved in the study. Alternative interpretations and potential limitations to the depth of my understanding of each quote are also considered.

This is followed by a general discussion of the theme which, where appropriate, incorporates my quantitative data through comparison of the teacher's perceptions of school trip learning and my own statistical findings.

4.8 Sub-theme 1: Teacher's rationale for trips

To investigate how social inequalities may be influencing the learning achieved during visits to non-formal learning venues, it is important to understand what the teacher's objectives for the visits are. Before being asked more generally about what, if any, kinds of learning they believed took place during trips (discussed in more detail in sub-theme 2), the teachers were asked to comment on whether school trips always had to be linked to classroom learning.

Table 4.5 Overview of sub-theme 1

SUB-THEME 1: **Teacher's rationale for school trips**
RELEVANT INTERVIEW QUESTION(S): • How do you view school trips? As stand-alone events or linked to classroom lessons? - Was this the case for your trip to the NMA? (pre-visit) • Why are you taking your students to the NMA? (pre-visit) • Who is usually responsible for deciding on location of class trips? (pre-visit)
OVERVIEW OF RESULTS • 6 out of 6 schools stated that trips were usually linked to classroom learning • 6 out of 6 schools cited learning was a key objective for the trip to NMA • 5 out of 6 schools were linking the trip to NMA to a marine related topic in class
INTERPRETATION/ FINDINGS • Learning is a key objective of school trips • The majority of school trips must have clear, curriculum links and links to classroom syllabus • Trips are often approved based on their links to classroom learning
LINKS TO LITERATURE May contradict existing research which states that there are many reasons teachers may use to justify school trips such as rewarding / incentivising pupils, forging bonds, confidence building or just "having a nice day out"

In all cases, teachers participating in this study stated that their school trips had to have an educational objective at their core, and in most cases were directly linked to topics being covered in the classroom. An example of a 'linked' trip would be School A planning to start a unit of work called *Oceans and Coastlines* after their aquarium trip or School B undertaking a topic in the classroom called *Water World* - all about the water cycle - prior to their aquarium trip. Even when examples were provided where trips did not have to directly be linked to current classroom

syllabus, the teacher would often go on to clarify the learning potential of the experience regardless.

When asked if school trips could ever be stand-alone events not linked to classroom learning, Mr M. (School E – MDI 9) stated that:

"*Like **99% of our trips link into classroom lessons**. Obviously, not our residential because that is slightly different. Some of them don't necessarily link to particular areas of **classroom activities and stuff**"*

Quotation: Mr. M, School E (MDI 9 – Yr.6), pre-aquarium visit, phone interview, May 2017.

Whilst the use of the figure of 99% should not be taken literarily, I believe that Mr M's use of such a high percentage allows me to interpret that the majority of his school's trips are, in some way linked to lessons taking place in the classroom. Unlike some of the respondents, Mr M. did not go on to clarify what constituted such a 'link' between classroom lessons / activities and school trips more generally. Elsewhere in his interview, Mr M. did then in fact go on to supply an explanation of how the trip to the NMA, which formed part of their year six residential, was in fact being used as an introduction to the topic of 'The Oceans' which his pupils would begin when they got back to school. In making this association between a residential trip (the NMA visit) and classroom learning (the forthcoming class topic), Mr M. is somewhat contradicting the only example of where trips wouldn't link to classroom syllabus, something I believe strengthens the evidence for my conclusion that most school trips now do have educational objectives at their core.

When asked the same question, Mr O. and Mrs F. from School B also stated their belief that only under very specific circumstances would trips occur that were not curriculum linked:

*Mr O: "When we **plan the trips,** we have to think about **the intended learning outcome** don't we*
Ms F: "Yeah

Mr O: "It's really ***specific as to what, what we're learning in class,*** *like going to the aquarium"*
Ms F: "I don't think we'd be ***allowed*** *to take them out if it wasn't* ***linked to learning****"*
Mr O: "No, not if it was just random"
Ms F: "Unless it was like the end of year 6 and it was the leaver's trips which is just for enrichment"
Mr O: "But normally the ***term time trips have to be linked to what we're doing in class***
Ms F: "Yes, they have to be ***linked to classroom learning****"*

Quotation: Mr. O and Ms F. School B (MDI 2, Yr. 5), pre-aquarium visit, in school interview, Nov. 2016

The repeated use of the word learning in the response, is perhaps the strongest evidence of Mr O. and Ms F's belief that learning is a key objective of school trips. The answers about most trips having to be 'specifically' linked to what they are learning about in class, again allows me to conclude that the majority of School B's trips are related to topics being covered in the classroom. This quote also introduces the concept of trips being planned around classroom topics and learning objectives, rather than the other way around. Where perhaps in the past teachers could have looked for engaging, suitable, venues and then build learning outcomes around this particular experience or location, now the classroom syllabus is seen to dictate the location of class trips. Finally, this quote also highlights the need for trips to be approved or "allowed". When the teachers were asked who it was that decided on the location for trips, all said that it was the relevant class teachers, but that approval would be required from the Principal or Head of learning.

Mrs G. Principal of School C - as well as trip leader to the NMA - confirmed that in her role as headteacher, she considered the approval of trips based on how well they relate to classroom learning and the curriculum:

"We would ***rarely do a stand-alone trip****. It's* ***always linked.*** *Some of our P.E. visits we do sports days and take students on adventure days so those are sort*

of stand-alone but it's still really part of our P.E. curriculum. The other ones are ***very much linked to the topic and themes that the children are doing in class****. It would be very rare that a teacher would come and say, "I just want to take my class to wherever"****. I probably wouldn't agree*** *to that to be honest"*

Quotation: Mrs G. School C (MDI 10, Yr. 6), pre-aquarium visit, telephone interview March 2016.

Mrs G's confirmation that trips would "rarely" be stand-alone and would "always" be linked, whilst slightly conflicting with each other, cumulate to allow me some certainty that the majority of School C's trips are indeed linked to classroom learning. Mrs G goes on to clarify that the 'link' she is referring to includes "topics and themes" being covered in the classroom. Like Mr M. does his in his earlier quote, by explaining that their adventure days are part of the physical education curriculum, Mrs G. also contradicts the only example she gives as to where a trip that might be considered a stand-alone event. Again, I believe this provides credence to my conclusion that school trips now have to be founded around educational objectives.

School D was the only participating institution who did not cite education as a key aim for their trip to the NMA. As funding was provided for this trip based on every child in the school having a shared 'fun day out', the children's enjoyment of the experience was considered more important than learning being achieved, and the 'whole school' participation in the trip made it difficult to make direct links to classroom learning. However, Mrs W. from School D explained that this approach to trips was unique to these particular circumstances:

"In general class trips would ***very much be linked to the topics****, just because this is a stand-a-lone trip as a whole school thing doesn't mean to say we're not going to* ***link our learning to what they've done****. We will* ***link their learning****; it would be a shame to waste it"*

Quotation: Mrs W. School D (MDI 6- yr3-6), pre-aquarium visit, in school interview, March 2017

4.8.1 Summary of sub-theme 1 findings

The literature review highlights the various reasons given by teachers for taking students on school trips; knowledge building objectives. rewarding and/or incentivising good behaviour, boosting confidence, relationship building or just having a "*nice day out".* Whilst all these perceived benefits from trips would still apply, the quotes from Schools B, C, D and E appear to provide evidence that, for at least the teachers participating in this study, the only real *justification* for taking children out of school now is to enhance classroom learning by providing real world contextualisation and hands on experiences. This is discussed more in the next sub-theme. When specifically asked if trips could be taken as stand-alone events, all confirmed that this would only occur in unusual circumstances and that most trip locations were decided upon based on how well they linked with the topics being covered in class, with demonstrable curriculum links being of key importance. It would seem that the experience of being on trips itself, and the enjoyment and learning that goes alongside that is no longer, in itself, ample validation for taking children out of school.

The comments made as to whether non-linked trips would be "approved" or "allowed" suggested that the requirement for trips to be linked to classroom learning is being filtered down from more senior levels of education, although that is not to say that teachers themselves are unhappy about this prerequisite being imposed on their class trips.

In her interview, Miss M. - Head of Discovery and Learning at the NMA - proposes one potential reason for the emphasis on curriculum linked trips - finances:

*"**The teachers have to pay a lot of money to get on a bus, they pay for the tickets to come here,** they want to come here and **feel secure that the national curriculum is going to be covered** and their **learning outcomes are going to be covered** and this isn't going to be just a massive hassle, a waste of time, waste of money"*

Quotation: Miss M, Aquarium staff member, in aquarium interview, March 2017.

This may be somewhat corroborated by Mrs G:

*"**The costs of coaches and entrance fees has shot through the roof in recent years** and that can be a challenge but we're still maintaining it here and trying to keep it going but it can be quite a challenge"*

Quotation: Mrs G. School C (MDI 10, Yr. 6), post-aquarium visit, telephone interview March 2016.

Given that School C was the least deprived school participating in the study - and in the top 10% of schools in the country in terms of least deprivation - and yet still describes feeling it a "challenge" to keep meeting the rising cost of buses and entrance fees, this would suggest that many schools are in a similar predicament.

Perhaps the biggest indicator of the rationale for trips being financially motivated is the U.K. Government's 2008 guidance document "*Charging for School Activities*" (Department for Education, 2008). Here it is advised that schools in England can only charge parents for school trips if they form part of the national curriculum syllabus. In other words, for trips which are not considered to be directly curriculum linked, schools can only request voluntary payment from parents/guardians and could not exclude a child from participating if no payment is made by the families. Given the recent and ongoing cuts to school budgets (8% real-term reduction in per-pupil funding for mainstream schools between 2014 and 2020 - (National Audit Office, 2016) it is becoming increasingly unlikely that schools would be able to cover the cost of such non-curricular trips - without outside influences such as in the case with School D's aquarium trip - and so, this guidance is likely to explain the requirement now for syllabus linked trips.

4.9 Sub-theme 2: Types of Learning on Trips

In sub-theme one, I established that all the teachers participating in the study believe that educational objectives with strong classroom syllabus links were now the only real justification for school trips. Theme two looks at interview responses around the types of learning that teachers believe occurs during trips. In the pre-visit interviews this was a generic question about all trips. In the post-visit interview, the question was posed specific to their NMA visit.

Table 4.6 Overview of sub-theme 2

SUB- THEME 2: **Types of learning on trips**
RELEVANT INTERVIEW QUESTION(S): • What kinds of learning, if any, do you believe occurs during school trips? (pre-trip interview) • How can you tell if learning has occurred? (pre-trip interview) • What kind of learning, if any, do you believe occurred during your trip to the NMA? (post-trip interview)
OVERVIEW OF RESULTS • 6 out of 6 schools believed learning had occurred during aquarium trip • 6 out of 6 schools reported knowledge / fact building occurring • 5 out of 6 schools referred to affective learning taking place
INTERPRETATION/ FINDINGS • Teachers believe learning is taking place during trips • Teachers are easily able to recognise and provide examples of cognitive learning taking place • Teachers do recognise, and value, the other affective forms of learning occurring such as social, skill-building and attitude change but to a lesser degree
LINKS TO QUANTITATIVE RESULTS My analysis showed cognitive learning was occurring during trips
LINKS TO LITERATURE Findings align with the majority of literature on school trips which suggest that teachers are overwhelmingly positive about trips and believe learning can occur across all domains depending on the nature of the trip.

In all cases participants believed that learning did occur during field trips more generally and during the NMA visit specifically. There was however some variation between the types of learning that teachers reported witnessing.

Some teachers, such as those from School B commented only on the knowledge building aspect of learning:

Mr O: *Oh they've come* ***away knowing much more****, especially about the animals. There are kids in my class now who can identify between a stingray and a ray, so they are much better about* ***physiology of the animals?***
Ms F: *"Yeah and size of seahorses* ***they learnt about***
Mr O: *"Before the trip some of them thought seahorses were huge and they've come away having seen them in real life and* ***just knowing loads more*** *about them, you know*

Quotation: Mr. O and Ms F. School B (MDI 2, Yr. 5.), post-aquarium visit, phone interview, Nov. 2016

Mr O. and Ms F's repeated use of the word 'knowing' and 'learnt', along with providing specific examples of new knowledge that their students had demonstrated after the trip, can be viewed as evidence that they believed that cognitive gains were an important part of school trip learning. It is important not to presume that students from School B only gained cognitively from the trip, or indeed that Mr O. or Ms F. believed that this was the only form of learning taking place. However, given that it was the only form of learning they referred to in their response, it is perhaps indicative of the value they were bestowing on the cognitive learning aspect of the trip. By only answering in terms of knowledge-based learning, this could be presumed to be main benefit they see arising from the trip.

In her response to being asked about the types of learning occurring on school trips more generally, Mrs W. introduces the concept of "experiential learning" as well as bringing us back to the idea of trips enriching classroom learning:

"Its educational, it's good for them, it's very engaging and helps ***contextualise the learning they are doing in class****, and they enjoy it and have a positive attitude about it so you know, we can* ***hinge a lot of lessons around the experience*** *and can do a lot of other sorts of teaching around the learning*

experience they have had …they've had something ***experiential*** *and it does give us an opportunity to get some lovely writing out of them about the trip"*

Quotation: Mrs W. School D (MDI 6, Yr. 3-6), pre-aquarium visit, in school interview, March 2017

The use of metaphors describing trips as providing a "*hinge*" or "*hook"* was used by many of the respondents along with answers stating that trips introduce, contextualise, enhanced, reinforce and "*bring to life*" classroom lessons. The repeated use of such terms could be interpreted as evidence that the teachers really do see trips as an opportunity to enhance classroom learning, rather than just having to make superficial links to justify taking children out of school.

Both "*hinge*" and "*hook*" appear to have become 'buzzwords' in field of education. An educational hook is defined as "*a mental or physical image on which students can hang their understanding as they learn a new topic*" and can be applied by students consciously or unconsciously (Astrachan, 1998). A 'hinge' in teaching is described as a critical checkpoint in the learning process when teachers need to confirm if a student has mastered a particular concept before they can move on to construct upon it. Similarly, 'hinge questions' is the name given to the diagnostic tool that assist teachers in making the judgement call as to when a student is ready to link on to the next section of knowledge (Coe et al., 2014) The context in which Mrs W. uses the word 'hinge', would in fact be seen to be more aligned with the definition for 'hook" and she was not the only respondent to appear to use this term outside the standard definition. It is possible that these two adages have become somewhat interchangeable with teachers using 'hinge' to mean attaching or joining.

Mrs W. also describes the aquarium trip as being "experiential" which, considering the context, I am taking to mean that the children have had a first-hand experience that they can then reflect about, in this case, in writing. Experiential learning can also be described as "learning though doing" and, in its best manifestation, results in "whole person learning" with cognitive, affective and behavioural components (Hoover et al., 2010).

In his response, Mr. D from School A concentrated on the skill building opportunities during school trips:

"Other than knowledge-based learning, they ***learn how to move about in a group****, they* ***learn how to listen****… I don't suppose they learnt how to listen, but they learn how to* ***display they are listening****. They* ***practice asking good questions****…I suppose every experience you learn from don't you, it's hard not to learn if you're a child."*

Quotation: Mr D. School A (MDI 8, Yr. 5), post-aquarium visit, phone interview, Nov. 2016.

After cognitive development, practice of skills was the second most common response to the questions about types of learning occurring during trips. Mr D. provides examples of skills from both the affective (listening and questioning) and psychomotor learning domains (moving about in a group).

Mrs G. also commented on the skill building aspect of the trip, but believed the learning occurring was even more extensive than that but that it varied from student to student:

"It's very wide -there is obviously the knowledge aspect. For some children they will pick up a lot of knowledge on a trip… but they are ***applying all of their skills*** *really, their* ***literacy and reading*** *work, also,* ***mathematical*** *and* ***geographical skills****,* ***reading a map*** *they know where they're going. I guess the biggest thing is the* ***hidden curriculum*** *really, where children are working and* ***collaborating with each other****. Some of that hidden curriculum is not always thought about on trips in the same way, it's thought about as bit sort of* ***soft learning*** *but actually its quite* ***key skills*** *that the children have to have to absorb all the things that they have to absorb and achieve where ever they are about their learning"*

Quotation: Mrs G. School C (MDI 10- Yr.6), pre-aquarium visit, telephone interview March 2016

As well as cognitive learning skills such as mathematics and map reading, Mrs G's response also introduces the concept of the "hidden curriculum" – the values, beliefs, attitudes and norms that are unofficially, and often unintendedly, taught throughout the school day, including break times (Cubukcu, 2012). The specific example of hidden curriculum that Mrs G. provides is collaborative working amongst students. Mrs G. also refers to this as soft learning, but other names might include affective learning or, under Eshach's definition as described in Chapter 1, this would be considered informal learning taking place during school hours (Eschach, 2007). As Mrs G. refers to this as the "biggest thing" and "key skills", it can be concluded that she puts great value on the informal learning occurring during school trips, potentially more so than formal or indeed non-formal learning that may be occurring simultaneously.

In her answer, Mrs B from School F introduces another facet of trip learning - careers knowledge and aspiration building.

"*As well as having the factual information about the animals, things that they never knew, you've also got that other layer of* ***environment studies*** *and the people working there have chosen to go into that profession so they generally have good interpersonal skills and are very good at putting their views across about saving the planet in a very child friendly way so they are* ***setting up that aspiration*** *by being with the children and discussing issues with the children, they get to* ***meet people who do other things, you know, not necessarily run of the mill jobs"***

Quotation: Mrs B. (MDI 4, Yr. 6), post-aquarium visit, telephone interview, July 2017

This socialisation, meeting new people, learning about their opinions and their careers, is a form of affectual learning. The environmental awareness raising she touches on "*environmental studies*" and "*saving the planet*" could count as

cognitive learning if it is new information to the students, whilst also being affectual learning if it builds values and shifts attitudes.

4.9.1 Summary of sub-theme 2 findings

When these quotes from Schools A, B, C, D and F are considered together, they appear to demonstrate that the teachers from this study do believe that learning is occurring during school trips, and that the learning takes the form of more than just knowledge building. Teachers appear to both recognise and value the role trips including the one to the NMA play in delivering the hidden curriculum and developing affective skills. The argument could put forward that, whilst it is the cognitive learning directly linked to the classroom syllabus that allows them to justify the trips they are arranging, overall, they see trips as providing a much wider learning experience. However, it is important to acknowledge the role that respondent bias, specifically social desirability, might have played in how teachers answered all the questions around learning. As the role of a teacher is to facilitate all forms of learning, it could therefore be desirable to them to be seen by the researcher as having enabled children in achieving more than just cognitive knowledge. As in most cases the teachers were able to provide quite specific examples of where the different types of learning were occurring during trips, this concern is minimal.

4.9.2 Sub-themes 1 and 2: Link to quantitative data - Confirmation of Learning

The qualitative results of both sub-themes one and two appear to highlight the importance teachers put on learning as an outcome of school trips. It was therefore compelling to investigate whether my quantitative findings aligned with the teacher's belief that learning was occurring during trips.

Affective learning is much harder to measure than knowledge construction through questionnaires alone, so it was not within the scope of this study to compare this in students pre to post visit, however teachers were able to provide anecdotal examples of this taking place during the trip such as children practicing listening,

questioning and collaboration skills and even efficiently moving around a public space as a group. Future studies in this area may benefit from increased access to participants pre and post visit to allow for the employment of other research tools such as interviews or focus groups which would better allow for the measurement of affective learning.

From a cognitive learning perspective, my quantitative results appear to show that learning is occurring during trips. As summarised in sections 4.2, 4.3 and 4.4 of this chapter, for all three of the learning measures used in this study – marine environment knowledge, conservation knowledge and shark species knowledge - the mean change in score from pre to post visit was always a positive number. One sample t-tests showed these mean overall increases to be statistically significant in all cases.

- Mean change in drawing score pre to post visit (1.98 ± 4.60) was higher than the test value of 0 (i.e. no change in score): **t (251) = 6.854, p=0.000**

- Mean in conservation knowledge score, pre to post visit (0.456 ± 1.289) was higher than the test value of 0 (i.e. no change in score): **t (228) = 5.383, p=0.000**

- Mean in shark species knowledge pre to post visit was (1.686 ± 2.266) was higher than the test value of 0 (i.e. no change in score): **t (207) = 10.766, p=0.000.**

Therefore, I believe it is fair to say that my quantitative results support the teachers' belief that learning - specifically knowledge gain - is occurring during school trips. It is particularly important to acknowledge that conservation knowledge appeared to be increasing during the trip. Whilst this is not a specific focus of my research, this result could be taken as evidence that the aquarium's goals of education in this specific area may well be being achieved, something that has been missing in the existing body of literature.

This finding aligns with existing research in this area, discussed in the literature review, which also found cognitive gains to be made from school trip experiences (Bamberg & Tal 2008; Bowker 2007; Cainey et al, 2012; Falk &

Dierking, 2000; Jensen, 2014; Schauble et al., 2002; Stronch, 1983). Whilst perhaps not a surprising finding, it was necessary for me to check whether learning was occurring during trips to the aquarium, before I could go on to investigate whether there were inequalities in the learning experience. This is explored in the next sub-theme.

4.10 - Sub-theme 3: Equality of the learning experience

Whilst sub-theme one confirmed that learning was a key objective for the school trips, equality in that learning experience did not appear to be a key concern for teachers when planning and executing school trips. When asked to comment on the equality of the learning taking place during trips, and specifically during their class trip to the NMA, teacher responses were fairly conclusive that equal learning was a hard, if not impossible thing to achieve.

Table 4.7 Overview of sub-theme 3

SUB-THEME 3: **Equality of the learning experience**
RELEVANT INTERVIEW QUESTION(S): • Do you think all your students learnt equally during the trip and why do you think this? (post – interview) • What kind of things might have influenced the equality of the learning? (post-interview)
OVERVIEW OF RESULTS • 4 out of 6 schools believed the NMA learning experience was not equal across all students • 4 out of 6 schools stated that equal learning could never be achieved • 1 out of 6 schools raised a social issue when asked about potential influences to learning during trips prior to prompting • After prompting, 4 out of 6 schools raised social issues
INTERPRETATION/ FINDINGS

• Teachers do not appear to be putting much importance on how social factors may be influencing learning during school trips
LINKS TO QUANTITATIVE RESULTS • Social factors such as ethnicity, gender and socio-economic status do appear to have some influence on school trip learning
LINKS TO LITERATURE • Existing literature suggests that ethnicity, gender and socio-economic status all have an influence on children's school trip experiences and the learning potential of such visits. Teachers do not report an awareness of this potential influence and do not report taking any actions to mitigate this effect.

To ascertain their thoughts on equality of the learning experience of the trip overall, participating teachers were all posed the question "*Do you think all your students learnt equally during the trip and why?"*. This question was chosen for its generality, allowing me to find out what issues, if any, the teachers believed might be causing inequalities during the school trip experience. Asking specific questions around socio-economic status, prior experience and other demographic factors could have been seen as leading and creating bias in the responses.

Mr D appeared to be quite certain in response to this question:

*"**No**, children don't learn equally, **ever**… **I'd have to clone them 27 times**"*

Quotation: Mr D. School A (MDI 8, yr.5), post-aquarium visit, phone interview, Nov. 2016.

His use of the word "ever" alludes that he is referring not just to school trip learning, but to learning more generally in his response. My interpretation of the phrase "*I'd have to clone them 27 times*" is that Mr D. finds the very idea of equal learning amongst children so preposterous that he is employing an equally ridiculous allegory. This, along with the conciseness of his answer suggests a level

of certainty for him that equality in learning is an impossible feat to achieve under any circumstances.

Mr M. gave an equally concise response but seemed a little less sure about his answer:

"Um, **no**, **probably not**, probably in **different ways for different kids**"

Quotation: Mr. M, School E (MDI 9, yr. 6), post-aquarium visit, phone interview, July 2017.

Most of the teachers went on to expand in their reply to this question, also providing reasons why they believed that that learning during trips, or more generally, could never be a truly equitable experience. Mrs G focussed on the differing abilities of the children:

*"**I don't think they ever do**. They learn at different rates and paces… I've got children with very, very **different academic abilities**, **different social abilities**… some will have taken very little from the day - but it will come out later, others will have taken masses from the day and nothing comes out later – all very different"*

Quotation: Mrs G. School C (MDI 10, yr.6), post-aquarium visit, telephone interview March 2016

Mrs W. however, put more emphasis on environmental factors:

*"**Children don't learn equally**…interest, attitude, learning disposition, previous experience, how they felt on the day, what they ate for breakfast, you know, all of the things that **affect children's learning all the time**, how much sleep they had, you know what they did today, what opportunities they had afterwards when they got home. You know, how many questions did their families ask them about their day to consolidate their learning".*

Quotation: Mrs W, School D (MDI 6, yr. 3-6), post-aquarium visit, telephone interview March 2016

Like Mr D, both Mrs W. and Mrs G. appear to be answering the question of equality in learning more generally, rather than being specific to school trips. Again, both teachers appear to be quite certain in the idea that learning can never be equal with both able to provide reasons for their stance. Mrs W. in particular, proffers more specific examples of the kind of potentially influencing factors, some of which we will go on to consider in later themes.

The teachers from School B and School F were the only ones to report some modicum of equality in the learning experience of their students.

Mr O: *"**Ummm, yes, obviously yes, I mean I don't know, mostly yes, I mean mostly**. They had the same kinds of levels of interaction with the staff they saw all the different parts of the aquarium, everyone saw everything, um obviously some children are going to get difference experiences from it cause their listening skills are better or they are kind of walking around in a bit more of a calm fashion so they see the tanks more in depth but **on the whole, generally, I'd say yes they did learn to the same level**, you know"*

Quotation: Mr O, School B (MDI 2, yr.5), post-aquarium visit, telephone interview March 2016

In the first sentence of his response, Mr O. appears to go from confident that the trip learning experience was equal "y*es, obviously yes*", to not sure "*I mean, I don't know*", to reasonably certain "*mostly yes, I mean mostly*". Such changeability may be read as uncertainty in his answer but by the end of the quote, after having provided examples of why he thinks the experience was equal, Mr O seems to be more comfortable with his response stating: "*on the whole, generally, I'd say yes they did learn to the same level*". Notably, Mr O

was also the only teachers to comment directly, before prompting, on how children's behaviour during the trip might be an influencing factor in their learning experience. This is discussed more in future themes.

Mrs B from School F, who had one group take a guided tour and the other being led by the teachers themselves, framed her response around the learning experience of the two different groups:

"The guided group would have more knowledge at the end, about what they had seen... they would have retained more facts. Within each group it's ***harder to tell*** *but it was* ***definitely an even playing field****"*

Quotation: Mrs B. School F (MDI 4, yr.6), post-aquarium visit, telephone interview July 2017

In this quote Mrs B. appears to be confident that one of her groups would have gained more cognitively than the other group. Within each group however, she appears to believe that there was the potential for equal learning stating that there was "*definitely an even playing field*". The use of the phrase "*it's harder to tell*", suggests that she is not however willing to completely commit that equal learning occurred.

4.10.1 Summary of sub-theme 3 findings

Whilst many of the teachers did provide reasons for why they believed the learning experience of their students might not have been an equal one during their NMA trip, prior to prompting, few of the respondents directly mentioned children's backgrounds or other social inequalities as being potentially influencing factors. The absence of responses considering social factors is particularly interesting when considered alongside my own quantitative data which suggests that they may have some influence on school trip learning. Whilst Nationality and English language status did not appear to have any significant effect on the learning achieved, my

data did find some significant difference in learning scores across ethnicity, gender and socio-economic status.

4.11 Discussion around social inequalities and learning

As the literature review identified, until the launch of the Enterprising Science project in 2013, the concept of social factors influencing non-formal science learning experiences was under-represented in the research, particularly in relation to school trips. At the start of my research project my personal anecdotal experience, along with the literature as presented in the literature review, led me to believe that social factors would have a significant influence on the learning experience for students visiting the NMA. This shaped the second of my research questions "*What role do social factors such as ethnicity, gender and social class have on learning during such trips and do teachers recognise and mitigate against any inequalities in this area?",* which I have attempted to answer throughout this chapter.

The results of my quantitative investigation into the influence of demographic / variables on learning are perhaps best described as a 'mixed-bag'. Whilst they do not provide conclusive proof that social inequalities across the board are influencing non-formal learning during trips to the aquarium, there does appear to be some evidence that gender, ethnicity and socio-economic status may play a role.

4.11.1 Role of age on school trip learning

Whilst not a social factor, the role of ages was an interesting demographic factor to consider. There was a general trend, across all three learning measures, of older children demonstrating a bigger change in knowledge pre to post aquarium visits. Given that older children are further along their learning development, and therefore should have more matured levels of conceptual development, this is not a particularly surprising finding. As participants are all between 8 and 11 years old, they all fall within the same stage of Piaget's theory of conceptual development-

the concrete operational stage- which includes young people from 7 to 11 years old. (Piaget, 1964). This stage, when organised and rational thinking is developed, is considered as a turning point in their rational development. It therefore stands to reason that the eight-year olds in my study, who would only be a year or so into this period of their development, would be less advanced in their logical thinking skills than children of 11 who may well be moving into the next, formal operational stage of development. This was an expected finding but what is interesting here is the exception to the trend.

For shark species knowledge the 10-year-old participants, the second oldest age group represented in the study- demonstrated the lowest change in score out of all the age groups, however, pre-visit analysis showed that these same students also had the highest pre-visit scores for shark species knowledge. This suggests that this particular age group may have in fact been exposed to less new knowledge doing their aquarium visit and so had less room to demonstrate improvement in this specific area of learning. For marine environment knowledge, the other measure where a significant difference was found between the age groups, 10-year-olds once again went against the trend of increasing change in score with age, although being beaten to lowest change in score by eight-year olds on this occasion. On analysation of the pre-visit score alone, the reverse pattern was again found with ten-year olds showing a significantly higher pre-visit score for marine environmental knowledge than the other age groups. This result could be seen to be suggesting that at around ten years of age children are interest in marine life peaks and, if true, it might therefore be advantageous to target visits to aquariums to this particular age group when they are most engaged in that subject matter.

Where age is concerned, it is important to acknowledge that school year groups tend to group children of the same age (all born with one 12-month period), and surveys were, with the exception of School D, conducted on one or two classes from the same year group. This means that participating children of the same age were also highly likely to be in the same class. For instance, 31 out of the 38 eleven-year olds participating in the study were all from the same school - School E. As some age groups were closely aligned to specific schools and classes, and each class would have had very different conditions leading into the trip, it is impossible

say with certainty that it is definitely their age which is influencing the change in knowledge scores for conservation and marine environment. For example, it could have been that most of the eleven-year olds were in the same class being taught by a particularly enthusiastic teachers who, as discussed in the literature review, tend to create more ready and enthusiastic learners (Griffin & Symington, 1997; Jarvis & Pell, 2005; Price & Hein, 1991). Future studies in this area would benefit from having a wider age range in their sample population with students of the same age from many different classes and schools so they are able to make more assertive claims about the relationships between aquarium learning and age.

4.11.2 Role of gender on school trip learning

After prompting teachers to consider the influence of social and demographic factors, only one teacher - Mrs G. - commented on a possible difference in learning between the genders:

*"Some of the children, **particularly boys, will learn more outside** than they would inside in the classroom where it is more restricting"*

Quotation: Mrs G. School C (MDI 10, Yr.6.), post-aquarium visit, telephone interview March 2017

My own research in the NMA does not appear to support the idea that boys tend to learn during trips out of the classroom. Gender did appear to have a steady influence on learning scores with girls being found to demonstrate greater pre to post visit scores for all three learning measures. When pre-visit scores were analysed however, the significant increase in shark species scores by female participants was counteracted by the boys having significantly higher pre-visit scores. Given that there is a finite number of shark species (approximately 400 – (Castro et al., 1999) and only a small sample of these, in general the most notorious species, would be referred to within the aquarium, it is likely that the boys had less opportunity to learn and demonstrate new knowledge in this area. Girls on the other hand were potentially being exposed to more new knowledge (i.e. more names of shark species they hadn't heard of before) and so were able to demonstrate more

new knowledge than the boys. As a result, I cannot say that I have found any significant gender influence in my study. This aligns with the findings of Euler and Weßnigk (2011) who also found no particular gender gap when comparing the learning of boys and girls participating in an out-of-school science activity. Their study was however verging into the formal learning domain taking the form of a week-long work experience style program in a science lab, so they studies are not directly comparable.

Whilst my own study did not provide any substantial evidence for it, many of the studies predeceasing it do support the existence of a gender gap in non-formal learning. Archer et al.'s 2016 study "*I'm being a man here*" suggests that the hands-on nature and competitive element of many interactives within many non-formal learning environments is beneficial to boys as they can showcase science knowledge and, in some cases, even their physical skills. As aquariums are mostly designed around aims of observing the tanks, there are relatively few hands-on elements to the exhibitions in the NMA. Observation of the school visits revealed that very few of the children actual engaged with the few hands on, interactive elements and where they did, children of both genders were found not to read instructions or wait for any results, instead preferring to just to hit any buttons and run on to the look at the next exhibit.

Although not a statistically significant difference, the fact that girls tended to outperform boys across all learning measures does aligns with previous literature in this area which has found that whilst girls are underrepresented in science more generally, they are drawn to biological and nature focussed studies (Ormerod & Wood 1983) and have been proven to show a greater interest in animals living in the sea (Dawson, 2010). This would align with Godec's 2018 paper "*Sciency Girls*" which proposes that girls tend to align themselves with more feminine elements of science, tending to go into science roles that also involve caring and nurturing such as in medicine or pharmaceuticals. Girls may be particularly interested in a visit to an aquarium due to the popularity of big sea animals such as dolphins, whales and turtle which are often represented to girls in popular culture as friendly animals which need to be looked after, appealing to a their caring and nurturing side, something which is more associated with females (Godec, 2018). Boys on the other

hand are found to be particularly engaged by phenomena with an element of danger, which of course, shark are stereotyped as having (Ormerod, 1979; Ormerod & Wood, 1983; Taber 1991) and so the aquarium may also have held appeal to them due to the prescience of these supposedly dangerous and less friendly creatures.

Dawson et al.'s 2019 study "*Selfies at the museum*" suggests that, because girls are underrepresented in science, they do not feel their identities as learners are valued in some science environments resulting in a disadvantage to their learning experience. However, as the aquarium is biological, nature and animal based, which as discussed above aligns as a particular interest for girls (Ormerod and Wood 1983), this may be why gender learning disparities appeared to be less defined in this particular study as opposed to somewhere like the Science Museum, where the Enterprising Science studies took place.

Overall, it would seem likely that a range of gender factors such as differences in subject interests and favoured styles of learning could have been at play during the school's aquarium visit. The hands-on, out of school learning environment may have been of benefit to the boys learning whilst the biological content matter may have been advantageous to the girls learning, but overall the experience seemed to be relatively even between the genders.

4.11.3 The role of ethnicity on school trip learning

It was only after prompting that one of the teachers mentioned potential cultural difference affecting school trips. When asked if any students might be missing the trip due to cultural reasons, Mrs B from School F (MDI 4) provided the example of a boy in her class, from an Indian family, who had missed out on a school trip the year before due to his parents believing the time would be better spent in private tuition.

"They have recently moved here from India and ***I don't think they saw the same academic value in it (the trip)*** *than we did. He's a lovely boy who has had a lot*

of additional tuition in Maths and English so he can take the entrance exam to the private school, they used that time to prep for the exam"

Quotation: Mrs B. School F (MDI 4, Yr. 6), post-aquarium visit, telephone interview July 2017

In this specific example, external to this particular study, the child could be viewed to be at a disadvantage due to missing the school trip and the learning potential of this experience. However, it is also possible to view this extra time with a tutor as an overall advantage to his learning. Regardless, in supplying this example, Mrs B. was not commenting on whether ethnicity of the students might influence the learning potential of those who did attend the aquarium trip. We could therefore presume from their lack of responses on this subject, even after prompting, that teachers do not believe ethnicity to be a particularly important factor influencing learning during trips.

This is particularly interesting considered alongside my own research which found that in all three learning measures children from BME backgrounds showed a greater change in score than their white counterparts, although this was only a statistically significant difference for conservation knowledge $t\ (16.793) = -2.497,\ p = 0.023,$ **mean of 1.313** compared to **0.383.** In this instance when the pre-scores alone were compared, no significant difference was found between the scores of the white children and those from BME backgrounds. $t\ (16.614) = 10.193,\ p = 0.849,$ **mean of 1.563** compared to, **1.493.** It can therefore be assumed that the ethnicity of the student may have had a genuine influence on the learning of conservation knowledge during the aquarium trip.

As explained in the methodology section, the lack of ethnic diversity in my sample made it impossible for me to run statistical analysis across the various ethnic groups as no one group met the minimum numbers required for statistical tests, so instead a binary method, grouping all participants from BME backgrounds was used. To properly assess my findings around ethnicity however, it is important to understand the ethnicities represented in my sample population. In terms of ethnic breakdown, which was supplied to me by the schools, participants included; 8 students who had

been identified as Asian, 2 students identified as White-Asian, 1 identifying as White-Black African, 3 identified as White-Other and 6 identified as Other. Therefore, the ethnicity predominantly represented after White was Asian students.

As discussed in the literature review, Asian students, in general, tend to be high achieving (Archer, 2008; Archer & Francis, 2005; Gillborn 1997). It is therefore less surprising, given that half the students from BME backgrounds came from Asian or White-Asian background, that these students were found to demonstrate the greatest increases in knowledge pre to post visit.

It is interesting to consider why a significant difference for ethnicity was found only for the conservation knowledge measure. The groups showed no significant difference in this area of knowledge in pre-visit analysis, suggesting that ethnicity was having a genuine influence on the learning of this specific subject area during the aquarium visit. The data could be viewed as indicating that children from ethnic BME backgrounds hold a particular interest in learning about conservation issues. Certainly, there is substantial literature suggesting that there are cultural patterns to how well members of society relate to and have concerns about the environment (Milfont, 2012). However, to be sure of any link would require deeper analysis with a larger, more diverse sample population.

Previous studies investigating ethnicity and non-formal learning have centred around public rather than school visits and have found such venues to exclude and even 'other' some communities through the perpetuation of language and cultural barriers (Dawson, 2014b; Feinstein & Meshoulam, 2014). Whilst overall ethnic diversity was not well represented in my study, it was an accurate reflection of the diversity of the visiting classes with teacher interviews being used to confirm that every child in each class would be attending the trip, and none were missing the trip for any financial or cultural reasons. The teacher from School F was able to provide the example from a previous year's school trip where a boy from an Indian family did miss the same school trip to the NMA so he could spend time in private tuition instead. The teacher, Mrs B., appeared to be attributing this choice- to provide their son with extra formal learning time - as culturally linked. This would support the aforementioned studies suggesting that Asian students achieve higher

academic performances due to pressure from Asian parents who put more emphasis on the importance of education (Archer, 2008; Archer & Francis, 2005).

Overall, it would appear that children from BME backgrounds held the learning advantage during their aquarium trip, but it is impossible to say that such an advantage existed for all students from BME backgrounds, as the higher achievement of Asian children may have skewed this result. It would be advisable to use a more diverse sample population for any future studies and, based on my results and the findings of previous studies, I would not advise altering school trips to try and bolster the experience of white children.

4.11.4 Role of socio-economic status on school trip learning

Whilst not explicitly labelled as such, when questioned on what might influence the equality of the learning experience during trips, two of the teachers did raise issues that could be considered to be socio-economically linked e.g. Mrs W's (School D – MDI 6) earlier quote on "*what they had for breakfast"* or "*what opportunities they had at home*" and Mr M's expansion of this when prompted to commented on how social factors may influence learning:

*"**Practical things like their lunch**, the games they have to bring on the coach. You know, **some kids will get sent with vegan organic lunch boxes and others with just a packet of crisps.** Slightly extraneous factors can sometimes have a surprisingly high influence on things – they can really matter when you are a kid"*

Quotation: Mr M. School E (MDI 9, Yr.6), post-aquarium visit, telephone interview, July 2017

In both these examples, the teachers report the food that the children consume, both before and during the trip, as being a potential influence on the learning. Neither Mrs W. nor Mr M. went on to explain how they thought different food being consumed by pupils might influence the learning taking place. I am however interpreting both quotes to be referring to children not receiving enough sustenance

from the pre and during trip meals to allow them to fully engage and concentrate on the visit.

These quotes are particularly interesting when considered in the context of one of the measures of socio-economic status employed in my study– free school meal status. Whilst there is no official government policy on whether children eligible for free school meals must also be provided with lunch whilst on trips, all the schools participating in the study did report to making such provisions. Whilst free school meals do not normally cover breakfast, and so some children may be coming on trips under nourished, in theory, no child should only have a "*packet of crisps*" to consume during the trip. In practice however, for this to be true, need for free school meals would have to be perfectly correlated to eligibility and eligibility correctly correlated to uptake by parents – a perfect synergy which is highly unlikely to occur.

As outlined in the methodology chapter, socio-economic status was interpreted in three different ways in this study – pupil premium eligibility, free school meal status and Multiple Deprivation Index decile of the school. Pupil premium and free school meal status both acted as proxies for SES at the individual level of the child, whereas MDI is a measure of how deprived an entire school is considered based on the area it is located. Schools are ranked into deciles from one, the most deprived 10%, to ten, the least deprived 10 % of schools across England. Out of these three proxies of SES, only MDI- the measure at school level - appeared to have any statistically significant influence on learning measures.

Given the existing research in this area which has found a link between children from lower socioeconomic groups and reduced academic achievements (Caldas & Bankston 1997; Coleman et al., 1966; Sutton & Soderstrom, 1999), it was a surprise to find that neither pupil premium or free school meal status had any significant influence on the aquarium learning. Whilst both are commonly used in educational research, neither pupil premium nor free school meals can be considered perfect proxies of the SES status of a child. A number of studies have found that eligibility for Free School Meals and deprivation are not necessarily properly associated, with some of the poorest children in the country not being

eligible due to their parents' tax credit status (Hobbs & Vignoles, 2010). A study by Shuttleworth (1995) found that whilst children eligible for free school meals are more likely to come from families where neither parent was employment, 47% were found to be in working families, whilst 11% of ineligible children were in workless families. There are also issues around the take up of free school meals as children's family members are required to apply for free school meals, and as many as 20% of those who are eligible do not apply (McMahon & Marsh, 2009). Proposed reasons for the lack of uptake include the stigma of being seen as 'poor', perceived poor quality of the meal that is provided, an assumption that meals will not met specific dietary requirements, a lack of knowledge of who is eligible and cultural reasons such as some children being expected to go home at lunchtimes (Storey & Chamberlin, 2001). As the two benefits are so closely tied, the same issues of accurate representation of uptake and need will of course apply to pupil premium too.

The fact that the two proxies of SES at an individual level did not appear to have significance on the aquarium learning, whilst MDI decile of the school did, may offer credence to the work of Caldas and Bankston (1997) who proposed that lower SES children's academic achievements could be bolstered by being surrounded by individuals from more privileged backgrounds. However, the GLM for shark species knowledge did not find any particular significance in the interaction variables between MDI and pupil premium or free school meals so there is no specific evidence of such an effect in my data.

As with ethnicity, teachers confirmed that all their pupils were attending the trip and that none were missing out for financial reasons so, at an individual level at least, there was no issue of financial barriers resulting in some children missing out - something that has been identified as an issue for public visits to non-formal institutions (Bell et al., 2009; Dawson, 2014; OECS 2012). All of the schools reported that pupil premium would be being used to cover at least part of the cost of the trip for some pupils with the exception of School D as their trip was fully funded by their charitable sponsor. Financial barriers may however have still existed at the school level as no schools from multiple deprivation index decile one, the most deprived 10% in the country, were represented in the study. There

are number of reasons why this might have been the case. It could be that MDI 1 schools are underrepresented, or not represented at all, in the aquarium' school bookings and so were less likely to be approached to participate in the research. It could have been that MDI 1 schools were approached but were less likely to agree to take part in research. Finally, it could be down to random chance that no schools from MDI 1 elected to take part, in a similar way that no school from MDI's 3, 5 or 7 participated in the study.

Whilst my data would appear to provide some evidence that children attending higher MDI decile schools learnt more during their aquarium trip, it is of course important to acknowledge the fact that, within the study, each multiple deprivation index decile was represented by a single school. As every school is different, there are therefore many factors beyond just the MDI level that will also have influenced the learning results in these particular comparisons. Any future studies would benefit from having representation from multiple schools in each MDI decile to attempt to minimise the effect other influence can have on this particular type of testing.

4.11.5 Do teachers recognise and mitigate against inequalities during school trips?

The second part of research question two focusses on whether teachers recognise, and mitigate against, inequalities during school trips. One of the most unexpected findings to come out of my educator interviews was that the teachers did not appear to be particularly concerned about inequalities during school trips. When they were asked to comment on how equal they felt the learning experience was during the aquarium trip, and school trips more generally, very few of the teachers were able to provide examples of how social factors could be playing any kind of role on the experience or achievement of their pupils. Teachers did not report employing any methods to minimise the effect of social factors during the school trips they ran. Given that analysis performance of different groups is fairly routine in education and, as is discussed in the literature review, disparities between different group's learning abilities are commonly found, it is somewhat surprising that potential

social inequalities during trips did not appear to be something that teachers have put much thought into prior to being part of this study.

Whilst my own quantitative results found only very weak potential correlations, the existing studies discussed in the literature review, such as the papers from the ASPIRES and Enterprising Science teams, along with Ash (2004), Bell et al. (2009), Garibay (2009), Bätz et al. (2010) and Wunchmann et al. (2017) provide much stronger evidence of how ethnicity and socio-economic status, along with gender and English as an additional language can affect children's experiences of non-formal learning venues. This therefore leads me to believe that influence of social factors during school trips is something that may need to be promoted within the teaching community as a potential source of inequality.

During their interviews, the teachers confirmed that no particular training around school trips had been offered to them and that they had learnt '*on the job'* from more experience teachers. This aligns with the findings of the papers discussed in the literature review on this subject (Anderson et al., 2006; Behrendt & Franklin, 2014; Gupta et al. 2010; Kisiel, 2006; Tal & Morag, 2009; Tal et al., 2014). I would therefore build on the previous calls for formal training in the organisation and management of school trips (Gupta et al., 2010; Tal & Morag 2009), and suggest that this training should also raise awareness of potential social inequalities during school trips, and methods to mitigate against such disparities. The potential role non-formal learning venues could play in such training is discussed in Chapter 6.

Chapter 5 – The effects of prior experience on school trips

5.1 Introduction to findings around prior experience

This second results chapter follows the same format to the previous chapter, separating the quantitative and qualitative findings before bringing these results together to address the third of my research question "*How does prior exposure to such venues affect subsequent experiences and learning processes for students on school trips to an aquarium? Does such prior experience act as a form of cultural capital, underpinning differential learning outcomes from the aquarium experience?"*

In part one I present the results of my investigation into the link between social class, prior experience of non-formal learning venues and cognitive gain during school trips. Through the implementation of a self-designed ranking system, I test whether prior experience of non-formal learning institutions could be considered as an indicator of cultural capital, influencing the learning occurring during school trips. The data in part one of this chapter once again focuses on the analysis of the children's pre and post visit questionnaires, including the drawing element, using quantitative analysis software – SPSS. The three key learning measures – shark species, conservation knowledge and marine environment knowledge- are again employed, this time to analyse the learning achieved during a visit in children with differing levels of prior experience of non-formal learning spaces.

In part two, I present the relevant qualitative data from educator interviews under the overarching theme of '*Prior experience of non-formal learning'*. This is broken down into two sub-themes:

- Trips as levelling tools
- The influence of prior experience during school trips

Each of the sub-themes is discussed with quantitative results being used to contextualise the qualitative findings.

PART ONE – QUANTITATIVE RESULTS

5.2 Socio-economic status and prior experience

As discussed in the literature review, previous research has shown that families from lower socio-economic backgrounds are less likely to visit non-formal learning venues. The first part of my investigation, therefore, was to test if my own data concurred with existing literature by testing if my participants from low SES backgrounds reported having less prior experience of non-formal learning venues.

Prior experience of non-formal learning venues was self-reported by students and recorded in the following ways.

- **Total number of visits to an aquarium** (numerical answer)
- **Total visits to museums, zoos and aquariums** (numerical answer)
- **Number of types of institutions visited** (numerical answer)
- **Scored total** (numerical answer – calculation for which is described in section 3.10.6.4 of the methodology chapter)

Three indicators of socio-economic status were used for this section of the research - pupil premium eligibility, free school meals status and the Multiple Deprivation Index of the school. As well as general comparison against all MDI levels, results for School C, in the top decile for MDI were compared to the school with the lowest MDI in the study, School B from decile 2.

Table 5.1 below provides an overview of average prior experience scores for the three socio-economic markers used in the study. It shows that for all four of the prior experience measures, children receiving pupil premium scored lower than children not in receipt of this benefit.

Similarly, it shows that for all four prior experience measures, children from School B, the most deprived school in the study, scored lower than children attending School C, the least deprived school in the study. These figures are explained in more detail in the next section.

5.2.1 Overview statistics

Table 5.1 Overview of average scores for SES measures

	Av. no. previous aquarium visits	**Av. no. total non-formal learning visits**	**Av. no. institution types visited**	**Average scored visits**
Receiving pupil premium	2.0	7.84	2.57	15.61
Not receiving pupil premium	2.98	11.00	2.69	19.17
Children on FSM	1.77	6.97	2.43	14.27
Children not on FSM	2.95	10.92	2.7	19.13
school B – MDI decile 2	1.45	8.6	2.35	15.38
school C – MDI decile 10	4.42	10.45	2.81	17.72

5.2.2 Analysis

Independent t- tests were used to compare children receiving pupil premium and free school meals against those who were not receiving these benefits for each of the four measures of prior experience.

Due to the non-linear relationship between variables, a Spearman's rank correlation test was applied to measure the strength and direction of any relationship between the Multiple Deprivation Index level of the school the children attended and the four difference measures of prior experience.

Finally, Independent t-tests were also used to compare the prior experience of students from the highest and lowest level MDI schools represented in the study – School C, decile 10 and School B, decile 2.

5.2.3 Results (Pupil Premium)

Visit total – Pupils in receipt of pupil premium (n=44) reported significantly fewer total visits to non-formal learning institutions (7.84 ± 5.23) than those who were not eligible for this benefit (11.0 ± 6.68, n=211), a statistically significant difference of 3.2: ***t (75.39) = -3.465, p= 0.001*** *(equal variances not assumed, 0.008).*

Scored total – Pupils in receipt of pupil premium (n=44) had a significantly lower scored total for non-formal learning institution visits (15.61 ± 6.27) than those who were not eligible for this benefit (19.17 ± 7.38, n=211), a statistically significant difference of 3.56: ***t (253) = -2.98, p = 0.003*** *(equal variances assumed, 0.097).*

Neither of the other measures of prior experience showed significant differences between those on pupil premium and those who were not.

Aquarium visits total – Pupils in receipt of pupil premium (n=44) reported having fewer total visits to an aquarium (2.0 ± 2.37) than those who were not eligible for

this benefit (2.98 ± 4.1, n=211) a non-statistically significant difference of 0.98: ***t (210) -1.53, p=0.127*** *(equal variances assumed, 0.172).*

Types of institutions total – Pupils in receipt of pupil premium (n=44) reported having fewer different types of institution visits (2.57 ± 0.62) than those who were not eligible for this benefit (2.69 ± 0.58, n=211) a non-statistically significantly difference of : **t (253)= -1.27, *p= 0.206*** *(equal variances assumed, 0.121).*

5.2.4 Results (Free School Meals)

Visit total – Pupils in receipt of free school meals (n=30) reported significantly fewer total visits to non-formal learning institutions (6.96 ± 4.55, n=225) than those who were not eligible for this benefit (10.92 ± 6.64, n=225) a statistically significant difference of 3.96: ***t (47.34) = -4.2, p= 0.000*** *(equal variances not assumed, 0.019).*

Scored total – Pupils in receipt of free school meals (n=30) had a significantly lower scored total for non-formal learning institution (14.27 ± 6.17) visits than those who were not eligible for this benefit (19.13 ± 7.28, n=225), a statistically significant difference of 4.86: ***t (253) = -3.5, p = 0.001*** *(equal variances assumed, 0.458)*

Neither of the other measures of prior experience showed significant differences between participants receiving free school meals and those who were not.

Aquarium visits total – Pupils in receipt of free school meals (n=30) reported having fewer total visits to an aquarium (2.43 ± 0.73) than those who were not eligible for this benefit (2.68 ± 0.58, n=225), a non-statistically significant difference of 0.25: **t (34.32)= -1.81, *p= 0.079*** (equal variances assumed 0.101).

Types of institutions total – Pupils in receipt of free school meals (n=30) reported having fewer different types of institution visits (2.43± 0.73) than those who were

not eligible for this benefit (2.7 ± 0.56, n=225) a non-statistically significant difference of 0.27: ***t (33.79)= -1.95, p=0.060*** (equal variances not assumed, 0.003).

5.2.5 Results (Multiple Deprivation Index- all schools)

Aquarium visit total - A Spearman's rank-order correlation found a statistically significant, weakly positive correlation between the MDI of the school the students attended and the number of previous aquarium visits made: $\boldsymbol{r_s(255) = 0.149, p = 0.017}$

Types of institutions total - A statistically significant weakly positive correlation was found between the MDI of the school the students attended and the number of types of institutions they had visited. 0.170, p=0.008, $\boldsymbol{r_s(240) = 0.170, p = 0.008}$

Neither of the other measures of prior experience showed any significant correlation in prior experience and MDI decile of attended school.

Visit total - No significant correlation was found between the MDI of the school the students attended and the total number of previous visits to zoos, aquariums and museums: $\boldsymbol{r_s(255) = -0.016, p = 0.800}$

Scored total - No significant correlation was found between the MDI of the school the students attended and the scored total of non-formal visits: $\boldsymbol{r_s(255) = 0.022, p = 0.724}$

5.2.5 – Results (Multiple Deprivation Index - Highest to Lowest comparison)

Total aquarium visits- Participants from School B (n=51), the most deprived school in the study, reported a lower number of prior visits to an aquarium (1.45 ± 2.01) than participants from School C (4.42 ± 6.98, n=43), the least deprived school, a statistically significant difference of 2.97: ***t (47.89) = -2.69, p = 0.010*** (equal variances not assumed, 0.003).

Types of institutions total - Participants from School B (n=51) reported visiting fewer types of non-formal learning institutions (2.35 ± 0.72) than School C pupils (2.81 ± 0.55, n=43), a statistically significant difference of 0.46: : ***t (91.13) = -3.54, p= 0.001*** (equal variances not assumed, 0.000).

Scored total for visits - Participants from School B (n=51) demonstrated a lower scored total for visits (15.38 ± 7.33) than those from School C (17.72 ± 6.83, n=43), a non-statistically significant difference of 2.34**:** ***t (92) = -1.59, p= 0.115*** (equal variances assumed, 0.850).

Visit total – Participants from School B (n=51) demonstrated a lower total number of non-formal learning visits (8.6 ± 5.72) than School C participants (10.16 ± 5.86, n=43), a non-statistically significant difference of 1.56: ***t (92) = -1.307, p=0.195*** (equal variances not assumed, 0.546).

5.2.6 – Summary of SES and experience findings

Across all four measures of prior experience level, participants receiving pupil premium, and pupils receiving free school meals, were found to have lower levels of exposure to non-formal learning institutions than their counterparts not in receipt of these benefits. However, for both these variables, the difference was only found to be significant for the visit total and scored-visit total measures.

Significant but weak, positive correlations were found between the MDI of the school the students attended and both the number of previous aquarium visits made, and the number of types of institutions they had visited. That is to say that there appeared to be a statistically significant pattern of children from less privileged schools having fewer previous visits to aquariums and a lower scored total for visits. Pupils from the most deprived school in the study, School B, reported lower levels of exposure to non-formal learning institutions than the most affluent school in the study, School C, across all prior experience indicators although the difference was only found to be significant for number of aquarium visits and number of types of institution visited.

Table 5.2 (below) summarises this overview information. As well as identifying which variables were found to be statistically significant (shaded in grey), it identifies which of the binary categories within each variable showed higher prior experience levels, or, in the case of the non-binary MDI level of all schools, whether there was a relationship and if so, its direction.

Table 5.2 Table of findings SES status and prior experience measures

	Total visits	**Scored visits**	**Aquarium visits**	**No. institutions**
Which students had higher level of prior experience	Students not receiving pupil premium and students not receiving FSM	Students not receiving pupil premium and students not receiving FSM	Students not receiving pupil premium and students not receiving FSM	Students not receiving pupil premium students not receiving FSM
Correlation between MDI of school and prior experience?	No	No	Yes, Higher MDI= more previous experience	Yes, Higher MDI= more previous experience
Comparison of school B & C?	School C (highest MDI)	School C (highest MDI)	School C (highest MDI)	School C (highest MDI)

5.3 Shark species knowledge

As per Chapter 4 and as previously discussed in the methodology section, the shark listing activity was intended to ascertain whether students were taking in and

retaining a specific fact with children being awarded a mark for every correct shark species they could name. Pre, post and overall change scores for shark species knowledge were totalled and tested against the four indicators of prior experience as described above.

5.3.1 Analysis

Pearson's product-moment correlations were used to identify any relationship between the continuous variables.

5.3.2 Results

For the shark species knowledge learning measure, none of the prior experience measures appeared to have any statistical significance on change in knowledge pre to post aquarium trip.

Total aquarium visits – no correlation was found between the total number of previous visits to an aquarium and the change in shark species knowledge: $r\ (255) = 0.001,\ p = 0.987$

Total visits – no correlation found between the total number of visits to non-formal learning venues and change in shark species knowledge pre to post visit: $r\ (255) = -0.059,\ p = 0.346$

Scored total visits –no correlation found between the scored total for visits and change in shark species knowledge: $r\ (255) = -0.018,\ p=0.769$

Types of institution visits –no correlation found between the number of types of non-formal learning institution visited and shark species knowledge: $r\ (255) = -0.025,\ p = 0.689$

5.3.3 Summary of findings

None of the four indictors of prior experience appeared to have any correlation with increased shark species knowledge pre to post aquarium trip. This could be interpreted as suggesting that for the participants of this study, level of prior experience of non-formal learning venues did not influence the learning achieved during a trip, at least for this particular learning measure.

5.4 Conservation Knowledge

As per chapter 4 and as previously discussed in the methodology section, participants' conservation knowledge was assessed by assigning them a score out of 4 depending on how many conservation related topics they had referred to in their survey answers. Scores were allocated for pre and post surveys and then an overall change score was totalled. This change in conservation knowledge score was tested against the four indicators of prior experience as described above.

5.4.1 Analysis

Pearson's product-moment correlations were used to identify any relationship between the continuous variables.

5.4.2 Results

Total aquarium visits– no correlation found between the total number of previous visits to an aquarium and the change in conservation knowledge: $r\ (255) = 0.032$, $p = 0.610$

Total visits - no correlation found between the total number of visits to non-formal learning venues and change in conservation knowledge pre to post visit: $r\ (255) = -0.064$, $p = 0.307$

Scored total – no correlation found between the scored total for visits and change in conservation knowledge: ***r (255) = -0.064, p=0.307***

Types of institution visits - A Spearman's correlation also showed no relationship between the number of types of non-formal learning institution visited and conservation knowledge: ***r (255) = -0.003, p = 0.961***

5.4.3 Summary of findings

None of the four indictors of prior experience appeared to have any correlation with increased conservation knowledge pre to post aquarium trip. As in part 5.4, this could be interpreted as suggesting that for the participants of this study, level of prior experience of non-formal learning venues did not influence the learning achieved during the trip for this type of learning.

5.5 Marine environment knowledge

As per Chapter 4 and as previously discussed in the methodology section, participant's drawings were analysed to create an overall marine environment knowledge score. Scores were allocated for pre and post surveys and then the overall change in scores was totalled. The change in marine environment knowledge scores were tested against the four indicators of prior experience as described above.

5.5.1 Analysis

Pearson's product-moment correlations were used to identify any relationship between the continuous variables.

5.5.2 Results

Total aquarium visits – no correlation found between the total number of previous visits to an aquarium and the change in marine environment knowledge: ***r* (255) = -0.057, p = 0.368**

Total visits – no correlation found between the total number of visits to non-formal learning venues and change in marine environment knowledge pre to post visit: ***r* (255) = -0.121, p = 0.054**

Scored total visits – no correlation found between the scored total for visits and change in marine environment knowledge: ***r* (255) = -0.096, p=0.128**

Types of institute visits – no correlation found between the number of types of non-formal learning institutions visited and marine environment knowledge: ***r* (255) = -0.026 = 0.678**

5.5.3 Summary of findings

Once again none of the four indicators of prior experience appeared to have any correlation with increased marine environment score pre to post aquarium trip. As none of the learning measured appeared to have a relationship with any of the prior learning measures, it seems appropriate to deduce that for the participants of this study, level of prior experience of non-formal learning venues did not influence the cognitive learning achieved during their aquarium trip.

5.6 Prior experience ranking

As discussed in section 3.10.6.4 of the methodology cultural capital is not theorised to be measurable in a quantitative way. For this reason, a high- or low-ranking system was deemed to be a more appropriate way of attempting to align non-formal learning prior experience and cultural capital. Students were ranked as above (A) or below (B) average against their school average and the overall study average for scored visits.

I would like to take this opportunity to repeat my acknowledgment that I do recognise the flaws in such a ranking system but believe that it may provide a better representation of capital than using raw visit scores alone.

5.6.1 Analysis

An independent t-test was used to compare the mean change in each of the knowledge measure scores between those who were ranked above and below average for each of the previously discussed prior experience categories.

5.6.2 Results – Prior Experience School Average

Shark species knowledge - An Independent t-test showed that participants who ranked as above (school) average for visits (n=121) demonstrated a larger change in shark species knowledge pre to post visit (2.0 ± 1.86, n=134) compared to those who ranked as below average (1.96 ± 1.86), a non-statistically significant difference of 0.04: **t(253) = 0.19, p=0.848** (equal variances assumed, 0.999)

Conservation knowledge - An Independent t-test showed that participants who ranked as below (school) average for visits (n=134)demonstrated a greater change in conservation knowledge (0.72 ± 1.18) pre to post visit compared to those who ranked as above average (0.45 ± 1.36) but not at a statistically significant level **t (253) = -1.7, p=0.09** (equal variances assumed, 0.059)

Marine Environment knowledge - An Independent t-test showed that participants who ranked as below the (school) average for visits (n=134) demonstrated a greater change in marine environment score pre to post visit (1.47 ± 4.41) compared to those who ranked as above average (0.57 ± 4.66, n=121) a non-statistically significant difference of 0.9: **t (253) = -1.6 , p=0.112** (equal variances not assumed, 0.536)

5.6.3 Results – Prior Experience Overall Average

Shark species knowledge - An Independent t-test showed that participants who ranked as below the (overall) average for visits (n=143) demonstrated a larger change in shark species knowledge pre to post visit (2.04 ± 1.88) compared to those who ranked as above average (1.89 ± 1.82, n=), a non-statistically significant difference of 0.15: **t (253) = -0.637, p=0.525** (equal variances assumed, 0.726).

Conservation knowledge - An Independent t-test showed that participants who ranked as below the (overall) average for visits (n=143) demonstrated a larger change in conservation knowledge score (0.67 ± 1.08) compared to those who ranked as above the (overall) average (0.48 ± 1.48, n=112), a non-statistically significant difference of 0.19: **t(253) = -1.18, p=0.258** (equal variances not assumed, 0.000)

Marine environment knowledge - An Independent t-test showed that participants who ranked as below the (overall) average for visits (n=143) demonstrated a greater change in marine environment knowledge pre to post visit (1.17 ± 4.58) compared to those who ranked as above (overall) average (0.88 ± 4.5, n=112), a non-statistically significant difference of 0.28: **t (253) = -0.493, p=0.623** (equal variances assumed, 0.745)

5.6.4 Summary of findings

Five out of the six analyses run above, showed children who ranked as below average in terms of prior experience of non-formal learning venues tended to demonstrate better change in knowledge scores than children who ranked as above average. However, none of the results were found to be statistically significant, even at the lower confidence interval of 90%.

Again, this would appear to suggest that for my participants there was no particular relationship between prior experience of non-formal learning venues and learning achieved during the aquarium trip. These findings could be interpreted as providing

some evidence that prior experience of non-formal learning venues should not alone be treated as a reliable gauge of cultural capital.

5.7 Discussion of quantitative findings on prior experience

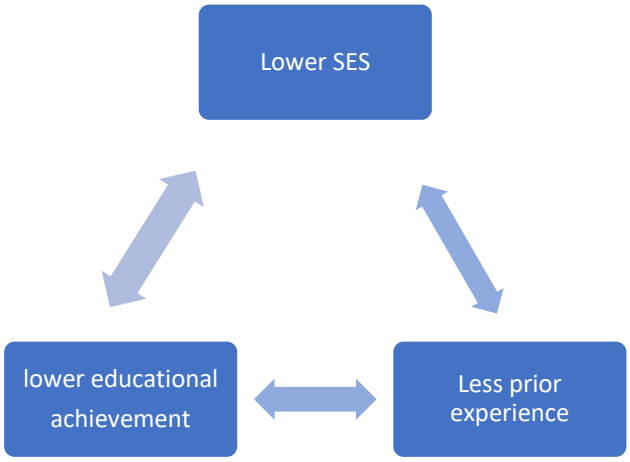
As outlined in the introductory chapter, I proposed that science centres, zoos, aquariums and other non-formal learning venues should be evaluated in much the same way that Bourdieu considered the role of the beaux-arts, as important contemporary sites of the production of forms of capital which have the potential to influence educational attainment. I suggest this due to the similar sets of skills visitors are required to practice in both types of venues and the higher participation in non-formal science learning venues by middle class families.

As a key principle of cultural capital is the idea that those with reduced capital tend to have lower educational attainment, it follows that that individuals visiting an aquarium with less prior experience - in other words less capital- may learn less during their visit as they do not know how to behave and perform to get the most out of the opportunity. This idea is complimentary to the research of Falk and Dierking who found prior experience to be an important factor in how much learning was achieved during visits to non-formal learning venues. However rather than attributing the experience advantage to specific skills being developed during visits, they considered how a lack of experience could result in anxiety and, as a result, behaviours that were damaging to learning – the 'novelty effect'.

As discussed in the literature review, individuals from lower socio-economic households tend to be under-represented in visitor audiences to museums, zoos, aquariums and other non-formal learning venues (Dawson, 2014b; Feinstein & Meshoulam, 2014; Ganzeboom, 1982) and so, could be considered to have reduced cultural capital in this area. My own data mirrored these findings for visitors to the NMA, with children from lower SES households reporting having significantly less prior experience of non-formal learning visits those from priviledged households. Whilst this finding is expected, it is the first time that this has been studied within

an aquarium context and goes some way to show that my sample population was 'normal'.

Figure 5.1 Diagram of assumed relationship between prior experience, SES and educational achievement



Given that socio-economic status at the school level was found to have some influence on learning achieved during trips, and that low SES. households tended to have less prior experience of non-formal learning venues, I therefore wanted to investigate the third side of the triangle as represented in diagram 5.1. I expected to find a relationship between prior experience and learning, with those with reduced prior experience being found to demonstrate lower change in learning scores pre to post visits. However, this was not found to be the case.

None of my four indicators of prior experience were found to have correlation with any of the three change in learning measures pre to post visit. This apparent lack of evidence for a link between prior experience and learning could be viewed as proof that the '*novelty effect'* – the anxiety of a new setting interfering with learning – was not at play during my study. However, since only cognitive learning was investigated in this study, such a claim can only be made for this particular for of learning and for this particular study. It is also possible that the novelty effect was in play but that it was actually having a positive influence on the children with less prior aquarium experience, in a similar way to that described by Luckner and Nadler (1997) where exposure to the new environment heightened the children's

senses. To go back to the example used in the literature review, the children could be so excited, and maybe even fearful, of their first encounter with a shark that they want to learn as much about the creature as possible so make an effort to listen to the aquarium guide, ask questions or read signage around the tanks. If this was the case, any disadvantage children without prior experience may have had, could be offset by the excitement of this novel experience resulting in an overall effect of equal learning between those with and without prior experience.

Bourdieu did not conceptualise cultural capital to be something that was specifically measurable and as result much of the previous research around this theory has tended to categorise individuals or rank individuals rather than assign actual 'capital' scores. The work by the Enterprising Science team for instance used various variables, including prior experience of non-formal learning institutions, to assign participants in their studies as being into one of four Likert categories for science capital. Given my sample size I decided to simplify my ranking system and categorise my participants as either above or below average for prior experience. As I knew that prior experience levels were significantly different between my schools (from the MDI and prior experience analysis results I decided to rank students as above or below average for both the overall average for the study and against their specific school. When these two 'cultural capital' style prior experience markers were run against the three learning measures, once again no significant differences were found for change in knowledge for any of the learning measures. This finding means that I cannot state with any certainty that prior experience of non-formal learning should be treated as useful indicator of cultural capital as, from my study at least, it does not appear to have been influential on the learning achieved by the participants. Of course, this does not mean that visits to non-formal learning venues do not influence an individual's capital as studies such as those undertaken as part of the afore-mentioned Enterprising Science research have found prior experience of such venues to be a useful part of a larger framework with which to investigate the role of science capital.

PART TWO – QUALITATIVE RESULTS

5.8 Introduction to major theme 2: Prior experience of non-formal learning

Like in the previous findings chapter, the interview data analysed and discussed in this section was also collected during the primary research period and consist of the pre and post interviews with the seven teachers from the six participating schools. Interview scripts were analysed as per the method described in Chapter 4 and in the methodology chapter.

During the analysis, two sub-themes emerged relating to my second research question: "*How does prior exposure to such venues affect subsequent experiences and learning processes for students on school trips to an aquarium?"*

- trips as levelling tools
- influence of prior experience during school trips

Again, like Chapter 4, a template provides insight into how each of the themes came about, listing the relevant interview questions, my key interpretations / findings for each, links to existing knowledge in this area and where applicable how this links to my quantitative analysis.

Pertinent quotes are provided as testimony for each theme, with my analysis of each being provided. Each quote is labelled with the synonym of the speaker and the school and the school's Multiple Deprivation Index decile (MDI). Alternative interpretations and potential limitations in the depth of my understanding of each quote are also considered. This is followed by a general discussion of the theme which, where appropriate, incorporates my quantitative data through comparison of the teacher's perceptions of school trip learning and my own statistical findings.

5.9 Sub-theme 4: Trips as levelling tools

As part of the overall investigation into prior experience of non-formal learning institutions, it was important to understand if children from different backgrounds tended to have differing levels of experience of such venues. Even before being directly asked about their thoughts on children's previous experience of trip venues, teachers began commenting on this when answering more general questions around how they felt about taking students on trips and the value they saw in them.

Table 5.3 Overview of sub-theme 4

SUB-THEME 4 **Gaps in prior experience and trips as levelling tools**
RELEVANT INTERVIEW QUESTION(S): Pre-visit questions • Why are you taking your students to the NMA? • How do you feel about taking students on school trips and why? • What, if anything, do you think is valuable about school trips? • Do you think many of the children in your class will have been to an aquarium before?
OVERVIEW OF RESULTS • 4 out of 6 schools said it gave children an experience they otherwise would not have • 2 out of 6 schools talked about this in terms of deprivation / SES status
INTERPRETATION/ FINDINGS • Teachers from schools across the MDI spectrum all believe that some children are not getting taken to non-formal learning venues by parents and that school trips are a vital tool in providing these students with such experiences that they would otherwise not have.
LINKS TO LITERATURE • This supports existing literature that children from low SES backgrounds have lower exposure to informal learning venues

LINKS TO QUANTITATIVE FINDINGS

- My analysis found children from lower SES families tended to have less experience of non-formal learning institutions
- I also found children from lower MDI schools tended to have less experience than those from higher MDI schools

5.9.1 School trips offering new opportunities

Most teachers, regardless of their school's decile in the multiple deprivation index, commented on how trips enabled children to take part in experiences that they otherwise would not have. When asked how he felt about taking students on school trips, Mr D stated:

"Well I think it enriches their learning which is why we do it, a ***lot of children also never have the opportunity to go and visit these places,*** *so we think it's a good chance for them to see things that they wouldn't normally see"*

Quotation: Mr. D, School A (MDI 8, Yr.5), pre-aquarium interview in school, Nov 2016.

Given that the interview was set up around his school's aquarium trip, when Mr D. talks of children not having the opportunity to visit these places, I am interpreting "*these places*" to be referring to aquariums and similar types of venues typical for school trips such as zoos, museums etc. In this case I am interpreting his use of the word "we" to be referring to his school, but it is possible that he was referring to the wider teaching community. Mr D. was very succinct in all his interview answers and did not go on to define what he meant by "*a lot of children*" but the use of this phrase would suggest it is a significant number. Similarly, he does not expand his answer into confirming why he believes some children would not have the opportunity to make such visits other than during school trips.

In her response to the same question, Mrs B also replied in terms of trips offering students the opportunity to have new experiences:

*"**they seem to go from their school to home and rarely get to see anything else,** so it's good to see them out the classroom, getting a lot out of that and making memories for them"*

Quotation: Mrs B. School F (MDI 4, Yr. 6), pre-aquarium visit, telephone interview, July 2017

Again, as Mrs B. is responding to a question specifically about school trips, it seems safe to assume that when she refers to it being "*good to see them outside the classroom*" she is referring to trips similar to the aquarium visit. Elsewhere in her interviews, Mrs B. talks of the importance she puts on experiences involving nature and "*being in the great outdoors"* so the "*anything else*" she mentions could actually be referring to lessons held elsewhere in the school grounds which would not come under the banner of a school trip. At MDI level 4, School E falls within the top 50% of the nation's most deprived schools, however even schools from far less deprived circumstances reported similar issues around children lacking experiences outside the home and school.

5.9.2 Rich in finances, poor in time

Mr M from School E, on what makes it worth taking children on school trips:

*"Just in the way that it increases their awareness of stuff, **stuff that they wouldn't normally experience**. So obviously **some of the kids on our roll would never go there with their family** so to give them the opportunity to do that it's a different experience"*

Quotation: Mr. M, School E (MDI 9, Yr.6), pre-aquarium visits phone interview, May 2017.

Once again, given the context of the interview and the question being asked, here I am interpreting "***stuff** they wouldn't experience*" and "go ***there***" as being the locations and experiences that school trips provide children with. At MDI level 9,

School E is in the lowest 20% of schools in England in terms of deprivation and yet even here, Mr M. is referring to some of the children from his school not having these kinds of experiences with their families. Mr M. does not go on to explain what he believes is the reason for this. Given the high MDI decile of the school, it could be assumed that it was factors other than money that was limiting these particular families from making visits to non-formal learning venues. However, demographic data supplied for classes participating in the study, showed that out of 43 students, four were eligible for pupil premium, suggesting that there are at least some children from School E living in lower income households. It is therefore possible that Mr M. was specifically thinking of these children and their financial limitations when he made the comment "*some of the kids on our roll"*.

Mrs G. from School C, from one of the least deprived schools in the country believed that whilst money was not the only limiting factor to children's previous experience of non-formal learning venues, it was an issue even in this relatively privileged school:

"You talk about things in the classroom and for some students that would be it; they ***won't get the opportunity to experience it****. To actually take them to specific areas or to specific museums or activities where they can go and get that in real life, hands on, it is very important.* ***I think there are a lot of instances now when children are not taken out on the weekends by their parents, for whatever reason financially or otherwise****, and so children are now getting a lot of their information from the internet, TV, computer-based things and not hands on.* ***For some of our children they absolutely rely on external visits"***

Quotation: Mrs G. School C (MDI 10, Yr.6), pre -aquarium visit, telephone interview March 2016.

Where she talks about "*being taken out on the weekends"* I think that Mrs G is referring to all kinds of visits outside the household (away from the TV / internet she goes on to talk about) including, but not limited to non-formal learning venues. The use of the word "*lots"* to describe instances of children who were not taken out at weekends, would suggest that Mrs G. believes the issue to be a

substantial one, however, it is not actually clear that this particular statement is specifically commenting on students attending School C as it is quite generic and so could be referring to children more generally. Later in the quote however she does talk about "*our*" children relying on their school trip experiences which I can more confidently believe is directly referring to students from her own school. Like the others, Mrs. G. doesn't quantify the use of the word "*some*" so we cannot be sure how many students she believes are in this position of being so reliant on school trips to provide non-formal experiences.

By mentioning finances as one possible reason for why children are not being taken out at weekends, it suggests that Mrs G. thinks that there are, at least some, families where money may be the limiting factor. Going simply by the number of children receiving pupil premium at School C (seven out of 43 participating students), it would appear that there may actually be more students from low income households per class in School C than School B (the lowest MDI level). Mrs G. goes onto talk further about the financial side of school trips later in her interview when asked about the value she sees in them:

*"**It's become harder and harder to keep doing it because of the financial implications for parents and we do subsidise some of our trips for some families. The costs of coaches and entrance fees has shot through the roof in recent years** and that can be a challenge but we're still maintaining it here and trying to keep it going but it can be quite a challenge but still vitally important to our curriculum"*

Quotation: Mrs G. School C (MDI 10, Yr.6), pre-aquarium visit, telephone interview March 2016.

The fact that Mrs G's mentions how the school was subsidising the cost of trips for some of their families, could be seen to corroborate the idea that even in this relatively privileged school, there are still some families who are struggling financially.

5.9.3 Poor in finances and motivation

Whilst clearly still an issue for the more advantaged schools, the issue of lack of family led experiences of non-formal learning, and school trips having to plug this gap, was a recurring issue during the staff interviews for School B (one of the top 20% most deprived schools). When asked about how they felt about taking children on school trips, the teachers from School B, like Schools A, C and E, replied in terms of how important trips were, particularly for children who would otherwise not have the opportunity to visit such places:

> *Ms F: "I love it, I think it's a wider opportunity, so yeah,* ***especially children from here, some don't go to places,*** *I think it's one of the most important parts of their education to be honest.*
>
> *Mr O: "It becomes a* ***massive leveller*** *doesn't it"*
>
> Quotation: Mr. O and Ms F. School B (MDI 2, Yr. 5), pre-aquarium visit, in school interview, Nov. 2016

The phrase, "*a massive leveller*", is a particularly interesting one. I am interpreting it as Mr O suggesting that trips provide children, who are not taken by their families, an equivalent visit experience when attending with the school, resulting in them being on a more even playing field, experience wise, post-trip.

Whilst Ms F. is not clear about what she means by "children from here", I believe this is clarified in the next quote where, in response to being asked about what they think is valuable about trips, she talks about School B being in a deprived area.

Ms F: "Oh everything"
*Mr O: "Its experience isn't it, its experiencing going to places and seeing things that not all the children will ever see, you know****, if we didn't take the children to the aquarium, it sounds horribly clichéd but if we didn't take them, they would probably never go until they're adults***

Mr O: "But yeah, they just get so much from it, they get so many valuable experiences don't they"
*Ms F: "**Yeah but I think if we lived in a different place , then it would be a different matter, you'd get a different response but because of where the kids live here, it is a deprived area, and a lot of the parents don't do anything with their kids so you know, you can live 5 miles inland, even less, and you won't go to the beach in the summer. A lot of our kids wouldn't go"***
Mr O: "That's it"
*Ms F: "**You know because their parents can't be arsed to take them, and you think, what!** So, you know **if you don't take the opportunity to take them, as teachers they won't get the opportunity will they"***
*Mr O: "I was working in mid Devon last year, and bear in mind that's 30 minutes from xxx (*popular beach resort*) right, there was kids in my class had never seen the sea. Farming families that had never been"*
Ms F: "Yip"
Mr O: "I was like 'wow' – so this is why you go on them isn't it"
Ms F: "Yeah"

Quotation: Mr. O and Ms F. School B (MDI 2, Yr.6), pre-aquarium visit, in school interview, Nov. 2016

On this occasion Mr O. does initially answer the question with regards to visits to aquariums, however, the discussion moves on to more general out of school/home experiences.

The fact that Mr O. describes this idea of some children not getting to visit an aquarium without the school taking them as "*horribly cliched*" seems consistent with so many of the teachers having referred to this apparent trend in their answers.

In this quote, and the one previous, Ms F. in particular appears to be attributing the deprivation level of the local area as an influencing factor in why some children are not taken on outings by their families. However, Mr O. and Ms F's responses can simultaneously be interpreted as aligning with Mrs G's statement around it being more than just a lack of finances that prevents parents from taking children

on activities outside the home. Both teachers communicated their disbelief that some children from School B - and other schools in the local area – were not being taken on beach trips by their families.

Ms F: "I said earlier, ***they live 5 minutes from a beach, but they don't know what a limpet*** *looks like! I mean they could walk 5 minutes down the road and see one and know about them, but they have to go to an aquarium to see one and that a bit sad actually isn't it"*
Mr O: "Yeah, it is, but like I said ***they wouldn't get these experiences unless we took them on a school trip****"*
*Mrs F: "****No cause a lot of parents wouldn't take them"***

Quotation: Mr. O and Ms F. School B (MDI 2, Yr.5), pre-aquarium visit, in school interview, Nov. 2016

I am interpreting Mr. O .and Ms. F's surprise, being attributed to them viewing a beach trip as a financially accessible activity due to the school's close proximity to the coast and their not being an entrance fee. In the previous quote, Ms. F. has provided a possible alternative explanation for why more parents might not taking their children to the beach –apathy. There are of course other possible explanations, but it is interesting that this is what Ms F. has attributed it to. It would of course not be possible to test Ms. F's assumption without asking parents about their reasons directly, and as explained in the methodology, questioning parents proved difficult due to the low return rate for parental/guardian questionnaires.

5.9.4 Summary of sub-theme 4 findings

These quotes from Schools A, B, C, E and F all appear to demonstrate that the teachers in this study see value in school trips in providing children with experiences that, for one reason or another, they would not have outside a school organised experience. Whilst only one of the teachers used the phrase '*leveller',* most of the teachers talked about these trips in terms of the particular opportunity they offered to children who were not taken to such venues by their families. Finances was just one of the reasons given by teachers as to why children may not

have previously visited non-formal learning venues. A lack of motivation and a deficit of leisure time were also proffered by teachers as potential barriers to family visits. Given that finances were not the only barrier to family visits, it was perhaps unsurprising that teachers from the most privileged schools in the study also referred to their being some children in their classes who depended on school trips for their non-formal learning venue experiences. However, what was surprising was that the teacher from the most privileged school in the study, Mrs G. from School C, in the least 10% deprived schools in the country, still reported finances as being a barrier for some of their families, even in terms of affording to pay for their children's school-led experiences. It is of course important to remember that the deprivation index level of the school does not provide an accurate representation of the socio-economic status for all the families with children attending that school. For example, some of the children attending a 10th decile schools (the least deprived in the country) could be from low income households, and it could be such children that Mrs G. is specifically thinking about when answering questions around financial barriers, rather than commenting on the families in her catchment more generally.

5.9.5 Sub theme 4: Link to quantitative data –SES status and prior experience

As summarised above, the qualitative results of sub-theme four demonstrate that teachers from all the schools, regardless of the school's deprivation index, appear to believe that some children lack prior, family based, experience of non-formal learning venues and that school trips are a vital tool in providing these students with such experiences. Whilst only two of the six teachers appeared to directly link student's socio-economic status and reduced prior experience, most teachers did not appear to refer to a general inequality amongst students in this area.

My quantitative results seem to support the idea of a link between the socio-economic status of students and their prior experience of non-formal learning. As described in section 5.2.3, for two out of the four prior experience measures, children receiving pupil premium - a marker of lower socio-economic status -

reported having less prior experience of non-formal learning venues than those not in receipt of this benefit.

- **Visit total** – mean number of total visits to non-formal learning institutions for students on pupil premium was **7.85,** compared to **12.33** in those not eligible for the benefit**:** ***t (75.39) = -3.465, p= 0.001***
- **Scored total** – mean scored total visits to non-formal learning institutions for students on pupil premium was **15.74**, compared to **20.36** in those not eligible for the benefit: ***t (253) = -2.98, p = 0.003.***

Where SES is viewed at the school rather than the family level, my quantitative data also found a link between the deprivation level of the school and prior experience of non-formal learning. As described in sections 5.2.4 and 5.2.5, for two of the four experience measures, a positive correlation was found between multiple deprivation decile of the school and level of prior experience. That is to say that the less deprived a school was, the more prior experience of non-formal learning the students reported.

When the most and least deprived schools were directly compared, for four prior experience measures, pupils from the most deprived school were found to have significantly lower previous experience of non-formal learning venues, significantly different for two of the four measures.

These findings appear to support the teachers' assertions that children from less privileged backgrounds have less family-based experience of non-formal learning venues. This in turn aligns with existing research in this area, discussed in the literature review, which suggests that families from lower socio-economic backgrounds are less likely to visit non-formal learning venues (Dawson, 2014b; Ganzeboom, 1982; Feinstein & Meshoulam, 2014.) This finding will be reflected on later in this chapter.

The next sub-theme explores how teachers believe prior experience of non-formal learning venues may influence students' subsequent school trip experiences.

5.10 Sub-theme 5: The influence of prior experience during school trips

During the interviews, I was careful in how I broached the subject of students' prior experience of non-formal learning venues with teachers, in an attempt to limit biasing teacher's responses. In the pre-visit interviews my only reference to this was ask how many of their students they believed would have been to an aquarium before and what, if any, extra preparation they might do with students who had not visited an aquarium before. It was only towards the end of the post-visit interviews that I asked teachers directly to comment on how prior experience may be playing a role in children's experience of the aquarium trip.

Table 5.4 Overview of sub-theme 5

SUB-THEME 5 **The influence of prior experience during school trips**
RELEVANT INTERVIEW QUESTION(S): • Do you think many of the children from your class will have visited an aquarium before? • Is there any kind of special preparation you would do for children who hadn't been to an aquarium before? • How do you think individual children's experiences of the trip may have varied depending on whether they had been to the aquarium or not? • What, if any, behavioral differences did you notice between children who had been before and those who hadn't? • Do you think all the children learned equally during the trip? • Is there anything you think you could have done to make the trip more equitable?
OVERVIEW OF RESULTS • None of the schools reported a belief that children with less prior experience of aquariums may be at a disadvantage during the aquarium trip • 4 out of 6 schools answered questions around the possible influence of prior experience of a venue in terms of how children with previous experience may be at a disadvantage

• 1 out of 6 schools reported undertaking special preparations with children who had never visited a specific venue before • 2 out of 6 schools reported seeing behavioral differences between children who had been to an aquarium before and those who had not
INTERPRETATION/ FINDINGS • The teachers did not see a lack of prior experience of the venue as being a potential disadvantage and in fact felt that prior experience may be a hinderance as it could spoil the experience of the subsequent school trip. • Perhaps *because* they did not see a lack of prior experience as a disadvantage, the teachers did not, in general, deem it necessary to undertake any kind of special preparation with those who did not have prior experience • Two of the schools reported seeing behavioral differences in children who had not been to an aquarium before, but they did appear to believe these differences would influence learning or experience of trip.
LINKS TO LITERATURE • Previous research suggests that you learn more each time you visit a new non-formal learning venue suggesting that students with less prior experience are the ones who would be at a disadvantage.
LINKS TO MY QUANTITATIVE FINDINGS • I did not find any relationship between prior experience and learning outcomes from the aquarium trip

5.10.1 Prior experience as a disadvantage

When posed the question "*How do you think individual children's experiences of the trip may have varied depending on whether they had been to the aquarium or not*?", all but one of the responses was framed around the experience of children who had been to aquariums before. Teachers appeared to focus mostly on either how these children's prior experience would not have had much influence on the subsequent school trip, or perhaps even more surprisingly, about how having been to an aquarium before could in fact be a disadvantage to them. The fact that so many of the respondents answered

in this way suggests to me that the teachers may have construed the question to be leading them towards giving an answer around how prior experience might be a disadvantage. It is therefore important, during the analysis, to factor in how this may have influenced the responses.

Mr D: "**The ones who had been before knew what to expect**… but they still enjoyed it"

> Quotation: Mr D. School A (MDI 8, Yr.5), post-aquarium visit, phone interview, Nov. 2016.

Mrs W: *"I mean all of them,* ***whether they had come with families and stuff before, all of them got something out of it,*** *so you know. It didn't necessarily* ***change their attitude****… I don't think any children weren't looking forward to it or expecting to be, you know, to be repeating something they'd already done. What we haven't come across, is children who think* ***'I've been to the aquarium therefore I don't need to go again"***

> Quotation: Mrs W., School D (MDI 6, Yr.3-6), pre-aquarium visit, in school interview, March 2017

In both the above quotes, the teachers focussed their responses on children who had been before and how they believed they *were not* being disadvantaged by knowing what to expect or by repeating something they had already done. Whilst Mr D. replied in terms of the enjoyment of students not being influenced, Mrs W. refers to "attitude" towards the trip more generally (which I am assuming would include enjoyment) not being affected by previous experience of the aquarium. Mrs W. goes on to say that all students "*got something out of*" the trip which I am interpreting to be more holistic than just enjoyment and to include learning resulting from the trip. Getting "something" out of it does of course not mean that she believed all students to be getting an equal share out of the experience, but I am reasoning that her lack of specificity implies that Mrs. T. does believe the experience to be a relatively equal one between children with or without prior experience of aquariums. I believe that the overall absence

of any reference to children without aquarium experience in either of the responses infers that neither of these teachers saw this as a position of disadvantage. However, it is of course possible that the teachers simply did not answer in these terms as they thought they were only being asked to comment on those children *with* aquarium experience.

The response from the teachers from School B (MDI 2) does start off being structured around children with prior experience but progresses to consider those without:

Mr O: "Em, I think obviously that ***the ones who had been before knew what to expect*** *and knew they'd be seeing lots of the animals,* ***but I don't think it took anything away from their actual experience*** *you know of seeing them again.* ***They all came out of it buzzing****, you know* ***none of them were saying "oh I've seen that before****" or whatever"*

Ms F: "And I think that one of the things that ***the more you go the more you see*** *as well like you know, just because you went this time last year doesn't necessarily mean to say that you've seen it all and you've done it all.* ***I think the more you go, especially as child, the more you'll learn, then you can then put it towards that first-hand experience when you go there****... I think even if everyone went again next year, I think they'd get something from it"*

Mr O. "Yeah definitely. ***Especially ones that had never been before"***

Quotation: Mr. O and Ms F. School B (MDI 2, Yr.5), post-aquarium visit phone interview, Nov. 2016

In this dialogue, we once again appear to see teachers immediately choosing to explain how prior experience would not be cause a disadvantage. In this case all the pupils - regardless of whether they have been to an aquarium before or not – are described as "buzzing" post trip, which I am interpreting to mean excited 'chatter' about their joint experience. Perhaps most interesting here is Ms. F's statements about how more visits to venue result in increased learning. This would align with previous studies which showed that visitors learn more on subsequent visits to a non-formal learning institution than on their first. However, even having acknowledged this phenomenon, Ms. F. and Mr. O. do

not appear to be extrapolating this into an understanding that a lack of prior aquarium visits could be a disadvantaging factor for school trip learning.

Mrs. G. from School C (MDI 10): *"inevitably,* ***if you've been somewhere before, it takes that element of surprise away****, which, with children that young, it is a* ***bit of shame*** *sometimes"*

> Quotation: Mrs G. School C (MDI 10, Yr.6), post- aquarium visit, telephone interview March 2016.

By stating that it is a "*bit of shame*" for children who are not experiencing the trip venue for the first time, Mrs. G. appears to not only once again be scaffolding her reply around children with prior experience of the aquarium, she also appears to proposition that previous experience is a drawback. In her quote, we once again, see "*surprise*" being posited as positive outcome with no reference as to how it could in fact be detrimental to learning outcomes.

Mr M. School E (MDI 9): "I don't know for sure, but **I think it's often the more disadvantaged who get the most out of stuff** as if they haven't been before **they have a higher level of gratitude for it."**

> Quotation: Mr. M, School E (MDI 9, Yr. 6), post-aquarium visit, phone interview, July 2017.

5.10.2 Prior experience and privilege

Unlike the others, Mr M. does not shape his answer around children with experience, but instead around the concept of privilege. Given the nature of the question posed to him, about prior experience of aquariums, I am interpreting the "more disadvantaged" to be his way of referring to children with limited previous aquarium experience. Mr M. does not clarify what he means by '*the most out of stuff*" but again, given the nature of the question being answered, I am assuming he is referring to the receival of some form of benefit, emotionally and/or cognitively from the trip. Even with the alternative framing of his answer,

the crux of his response remains the same, a general assumption that children with less experience of aquariums have an advantage. In this case Mr M. seems to be suggesting that the children who have not been before are more grateful to be having the experience, however he is not clear in how exactly this might manifest as an advantage.

Mrs B. School F (MDI 4): *"If **they had been before, I think they would have still really enjoyed it**, they **would have had more confidence**, **they felt they had knowledge they could pass on to others** but still got enjoyment at seeing everything. They were sharing in moment "its brilliant isn't it… **it's a more level playing field during trips**, not all beginning at different levels."*

> Quotation: Mrs B. (MDI 4, Yr. 6), post-aquarium visit, telephone interview, July 2017

Here, again Mrs B. is framing her response around children with aquarium experience and the use of the phrase "***still** really enjoyed it*" suggests that she also believed the question to be asking how experience might be seen as a disadvantage. Mrs B. was the only of the teachers to identify the potential benefits prior experience may bring to the trip, such as increased confidence and relevant knowledge. Recognising such advantage could be construed as evidence that Mrs B believes prior experience to be an advantage but the fact that she continues on in the quote to talk about trips in terms of " *a more level playing field*" suggests that is probably not the case, and she in fact does not identify a deficit of experience as a particular disadvantage.

5.10.3 Preparing students with and without prior experience

Given that most of the teachers did not seem to recognise children without prior aquarium experience as being at any kind of disadvantage, it is therefore unsurprising that most of them confirmed that they did not tend to undertake any kind of special preparation with children who had not visited a particular venue before. One school, School F (MDI 4) confirmed that they would undertake specific preparation with an individual child if they had specific learning needs,

such as an autistic child but that this was not the case for the NMA trip. Only one other school, School D (MDI 6), confirmed that they would, undertake venue specific preparation for children without any prior knowledge of aquariums:

"*If I had a child who had absolutely no idea about a trip to the aquarium (**but they wouldn't though would they**!), but if I did have a child who really didn't have a clue, **I would put something in place to bring them up so that they could access it at a similar level to their peers or at a more similar level because obviously those that have been before will get something different out of it than those who've never been**, but at least they'd be on the same page,* so they had no idea what to expect from an aquarium **we would give them a bit of a dry run**"

Quotation: Mrs W. School D (MDI 6, Yr.3-6), post-aquarium visit, phone interview, March 2017

In stating that "*those that have been before will get something different out of it*", Mrs W. appears to be acknowledging that an absence of prior experience could be influential to the overall trip experience. Whilst she does not explicitly confirm if she believes a lack of prior experience would be a positive or negative influence, given that she states that her aim would be to "*bring them up"* to a similar level as their classmates, I am interpreting her reason to believe it to be a disadvantage. In terms of the preparation she would undertake with students, Mrs W. describes it as "*dry run*" which, I am assuming, given the limitations of what would be possible, means talking the children through what to expect at the aquarium. Given that Mrs W. appears to be sure that no child would have absolutely no idea of what an aquarium trip would involve, it seems safe to presume that preparation activities such as "dry runs" are not common place before School D's trips but Mrs W. did specifically confirm that she did not believe one to be required for any children before attending the NMA.

5.10.4 Prior experience and behaviour

In the post interviews teachers were also asked to reflect on whether they might have observed any behavioural differences during the trip between children who had been to an aquarium before and those who had not. Perhaps unsurprisingly, given their responses to the previous, related questions, in most cases the answer to this was that no, no differences were witnessed.

Ms F: *"the only behaviour difference was maybe in those who had been before who were* ***maybe not as excited - not leaping and jumping about as much****....* No, that's true…. ***maybe some that had been before stopped and looked a bit more at each thing rather than flicking between them so much****"*

Quotation: Ms F. School B (MDI 2, Yr.5), post-aquarium visits phone interview, Nov. 2016

This quote is particularly interesting when considered alongside Ms F. and Mr O's previous comment which alluded to them not believing a lack of prior experience to be a particular disadvantage. It would appear that "*leaping and jumping*" that Ms F. describes is not being identified as a potential hinderance to learning and that "*stopping and looking… more at each thing*" is similarly not being recognised as a likely benefit.

Mrs B: *"In terms of behaviour,* ***I don't think there is much difference*** *between the two groups****. Kids who haven't been before maybe show more amazement and astonishment****; it's got more of a wow factor for them****. Kids who have been before can be a bit calmer****. We have had children before in the past who have been very scared… but not this year, everybody just seemed really sort of excited I guess"*

Quotation: Mrs B. School F (MDI 4, Yr.6), post-aquarium visit, telephone interview, July 2017

Whilst this quote beings with Mrs B. stating that she doesn't believe there to be much difference in the actions children who have and have not been to an aquarium before their school visit, she actually goes on to provide examples of contrary behaviours. Even though she describes children with experience being "*a bit calmer*", Mrs B. does not seem to equate calmness as a favourable condition for learning or that "*amazement and astonishment*" could hamper knowledge construction. Certainly being "*very scared*" whilst on a trip would not be conducive to learning, but again Mrs B. does not go on to adapt her previous statement that there would not be much difference between children with and without prior experience of the venue.

5.10.5 Summary of sub-theme 5 findings

The quotes from all six schools suggest that none of teachers interpreted a lack of prior experience of non-formal learning venues as being a potential disadvantage to students during the school trip. Surprisingly, they instead appeared to view prior experience as a potential hinderance, suggesting that it could spoil subsequent school trips by restraining the awe and wonder experienced by the students. Perhaps *because* they did not see a lack of prior experience as a disadvantage, the teachers did not, in general, deem it necessary to undertake any kind of special preparation with children with reduced levels of non-formal learning experience. Two of the six schools reported seeing behavioural differences in children who had not been to an aquarium before, but they did not seem to consider these behaviours as having the potential to hinder the children's ability to learn or overall trip experience.

5.10.6 Sub-theme 5: link to quantitative data

As summarised above, the qualitative results of sub-theme 5 suggest that teachers do not appear to put much emphasis on their students' prior experience of non-formal learning venues and certainly did not see a lack of prior experience as a disadvantage to learning during the trip.

My quantitative data appears to confirm that teachers are right not to have specific concerns about the differing levels of non-formal learning prior experience amongst their students. My analysis did not find any conclusive evidence to support a correlation between prior experience of non-formal learning venues and the learning achieved during the aquarium trip. However, as previously discussed, this study was limited to measuring only cognitive learning, meaning it is possible that prior experience could still be found to influence other forms or learning such as affective learning.

5. 11 Discussion of findings around prior experience

In this chapter I have attempted to address the second of my research questions, "*How does prior exposure to such venues affect subsequent experiences and learning processes for students on school trips to an aquarium? Does such prior experience act as a form of cultural capital, underpinning differential learning outcomes from the aquarium experience?"* My quantitative results found no evidence of a link between prior experience of non-formal learning venues and cognitive gains during the subsequent school trip and no particular correlation was found between prior experience and learning achieved during the trips. My interview data around this topic however proved to be much more revealing suggesting that teachers are, in general, either unaware of, or unconcerned about, the potential influence of the 'novelty effect'.

The educators' opinions synchronised with the findings of the previously discussed research which identified the standard visitor profile of non-formal learning venues to be 'well off'. They reported a belief that children from low SES circumstances were less likely to be taken to venues such as zoos, aquarium, museums etc. by their families, something I confirmed to be true for the participating children, as discussed in the section above. Teachers also stressed how important school trips were as levelling tools, providing a vital opportunity for some children to have non-formal learning experience that they would otherwise would not have access to. What was unanticipated was that this was not exclusively an issue found in lower MDI schools. Even teachers from the most privileged school in the study, including

those in the top 10% of privileged schools in England, reported that they taught children they believed were missing out on non-formal learning experiences with their families. Along with comments made about parents not taking children even to free activities such as the beach, this suggests that finances are not the only barrier as to why children are not being taken to such venues. This correlates with the work of Emily Dawson and the ASPIRES team who found some hidden financial barriers to families accessing non-formal learning – cost of transport, cost of purchasing lunch etc.- and other non-monetary related reasons such as language accessibility issues and a general feeling that they did not belong in these spaces. This could very well apply to the families in my study from lower SES backgrounds. However, given the close proximity of the beach to some participating families, and that there was no entrance or transport fee but children were not being taken even there by their families, the teachers may well be right in proposing that lethargy on the parents part may play a role in children's access to non-formal learning. In the case of the most privileged families in my study, it seems to be a safe assumption that the teachers were correct in their claims that parents didn't take children to such venues due to being 'resource rich but time poor'.

What was unanticipated was that none of the teachers appeared to recognise that reduced prior experience of such venues could act as a potential disadvantage to a student's learning or overall experience. Even when teachers went on to describe behaviours that could be considered disruptive to learning that they had witnessed in children with no prior experience of the aquarium, behaviours that could most likely be attributed to Falk and Dierkings 'novelty effect', they did not then go onto connect this to any kind of disadvantage to these children. Whilst my own study did not find any connection between lack of prior experience and cognitive changes during the aquarium trip, many other studies have found such a link in other trips and so it seems concerning that the teachers do not appear to be aware of this theory. I believe this could be a useful addition to teacher training specific in the running of school trips which I proposed in the previous chapter. Again, the role non-formal learning venues could play in this training is discussed in the next chapter.

What was perhaps most surprising though, and potentially is one of the most important of my findings, was the teacher's assumption that prior experience, rather than being a positive, could actually be a negative thing, with children who had visited a venue before being the ones who were disadvantaged during subsequent school trips. The teachers' answers around this seemed to hinge around the idea of prior experience being detrimental to the 'awe and wonder' of the trip experience, removing the element of surprise and spoiling the overall experience. In this way we see teachers demonstrating concern about the affective learning taking place during the trip and providing yet more support for further research into the effect of prior experience on affective learning.

Because the teachers did not see lack of prior experience as a disadvantage, it was then unsurprising that they did not deem it necessary to undertake any kind of special preparation with children with reduced levels of non-formal learning experience. Given what we have discussed about cultural capital and how it can be accumulated through visits to non-formal learning venues, be them museums and galleries or zoos and aquariums, teaching children these kind of skills before a visit could be one way to break the cycle of social reproduction, at least for this specific form of capital.

Chapter 6 – *The influence of teacher practice on trips*

6.1 Introduction to findings on teacher's role during school trips

This final results chapter addresses my fourth research question *"What role do teachers' practices play during school trips in relation to meaning-making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capital?"*

As with the previous finding chapters, I firstly present the key findings from my quantitative data collection and analysis into how teacher's practices may influence school trip, specifically type of aquarium tour selected, whether a workshop is undertaken as part of the trip and the choice of whether to undertake any aquarium linked preparation activities with the class. Part one of this chapter again focuses on the analysis of the children's questionnaires with the three measures of knowledge being used to compare learning across different variables.

In the second part I present my findings from the educator interviews under the overarching theme of 'Teacher Practices'. This is broken down into two sub-themes:

- Preparation vs. Awe and Wonder
- Interactions with aquarium staff

Quantitative and qualitative findings are then brought together to be discussed.

PART ONE – QUANTITATIVE RESULTS

6.2 Teachers' practices – choice of tour and use of pre-visit activities

As discussed in the literature review, existing studies suggest that teachers' practice around school trips can strongly influence the learning experience for their students. For example, studies have found that undertaking related pre-visit activities with students, including simple venue familiarisation activities, can increase the learning potential of trips. Teacher interviews, along with in school observations, revealed that the kinds of pre-work being undertaken by the participating schools varied greatly, making it possible to investigate this factor quantitatively for my research sample population. The kinds of preparatory visit activities undertaken by each school is discussed in the school descriptions in the methodology section and will be considered in more detail in the qualitative part of this chapter, it is also summarised in table 6.1 below.

Previous studies, also outlined in the literature review, have found substantial experiential differences for students who have exposure to non-formal learning staff members during their visits either as part of guided tours of the facility or in the form of shows or workshops. With four out of the six participating schools opting for staff member guided aquarium experiences, and 3 out of 6 schools undertaking a workshop, it was therefore also possible to investigate these variables quantitively. Elected tour type and whether a workshop was undertaken by each school is also outlined in table 6.1.

As with the analysis in Chapters 4 and 5, the three knowledge measure scores, shark species, conservation and overall marine environment knowledge, were used to assess the learning across different groups, in this case students who undertook different kinds of pre-visit activities, those who took part in guided tours versus those on teacher-led aquarium experiences and those who took part in workshops compared to those who did not.

Table 6.1 Summary of participating schools pre-aquarium visit activities

School	Preparatory activities	Tour type	Additional workshop?
A	None	Guided	No
B	Undertook unit of related work 'Water World' in immediate lead up to visit	Teacher-led	No
C	None	Guided	Yes
D	None	Guided	Yes
E	Children asked to look out for specific animals during the trip	Guided	Yes
F	Some, limited, information provided about venue before trip	One group on guided tour, another on teacher-led	No

6.3 Shark Species Knowledge measure

As previously discussed, the shark listing activity was intended to ascertain whether students were taking in and retaining a specific fact – in this case the names of various species of sharks. A pre-visit, post-visit and change in species knowledge score was recorded for each participant.

6.3.1 Analysis

Schools were sorted into one of three categories; undertook topical, aquarium linked pre-work, undertook venue familiarisation techniques or undertook no relevant pre-visit activities. A one- way analysis of variance (ANOVA) was used

to compare the means for change in shark species knowledge scores across each of the fore mentioned groups.

With only binary categories for each, tour type (guided or teacher-led) and workshop participation (yes or no), independent sample t-tests could be used to compare the mean change knowledge in scores across these groups.

6.3.2 Results

Tour Type: For the shark species measure, students on guided tours of the aquarium (n=174) demonstrated a greater increase in knowledge (2.02 ± 1.85) pre to post visit than those on teacher-led tours (1.89 ± 1.88, n=81), a non-statistically significant difference of 0.13: **t (253) 0.514, p= 0.607** (equal variances assumed, 0.809)

Workshop Participation: Students who undertook workshops as part of their aquarium trip (n=119) demonstrated a greater increase in shark species knowledge (2.17 ± 1.82) pre to post trip than those who did not take part in a workshop (1.81 ± 1.86, n=136) but not at a statistically significant level, a non-statistical significance of 0.36**: t (253) 1.55, p = 0.123** (equal variances not assumed, 0.939)

Preparatory work: There was a significant difference found between the mean change in shark species knowledge pre to post visit across the 3 categories for pre-visit activities: **F (2, 251) = 7.323, p=0.001.** Students who undertook linked, topical pre-visit activities (n=92) demonstrated the biggest increase in shark species knowledge pre to post visit (2.38 ± 1.95), followed by those who undertook no pre-visit activities (2.03 ± 1.76, n=101) and those who undertook pre-visit familiarisation activities demonstrating the least pre to post visit increase (1.25 ± 1.95, n=61).

6.3.3 General Linear model with interactions

A univariate General Linear Model was conducted to examine the effects of each variable separately and interactions between variables including some of the demographic variables from Chapter 4.

The test revealed that the main effects of gender, ethnicity, MDI, age, workshop attendance and pre-work were found to explain the most significance in the model along with the 2-way interactions between pre work and gender and pre-work and age. (R^2 = 0.215, Adj. R^2 = 0.158). Gender, Ethnicity, MDI and Age*pre-work were all found to be statistically significant factors within the model.

GLM: gender, ethnicity, MDI, age, pre-work*age, pre-work*gender F= 9.65, 3.17, 5.87, 0.00, 4.36, 1.75; df = 1, 2, 2, 3, 2; p=0.002, 0.044, 0.003, 0.382, 0.005, 0.176. Full results are provided in table 6.2 below along with supporting plots.

A Kolmogorov-Smirnov test showed the residuals met the assumptions of normality and so validating the model, **D (254) = 0.036, p=0.200.**

Figure 6.1 below provides a visual representation of the significant interaction variable, age*pre-work where n= no pre-visit activities took place, y = topical linked classroom pre-visit activities took place, and f = familiarisation techniques were deployed. Visual analysis of the stacked side-by-side bar chart provides some evidence that there the type of pre-work undertaken, or indeed not undertaken, influences difference age groups in different way. As no 8-year olds undertook any pre-visit activities, that age group cannot be assessed. There appeared to be very little difference between the mean scores for 9- and 11-year olds across the three types of pre-work categories. Ten-year olds however demonstrate the biggest differences between categories with those who undertook linked, topical classroom work demonstrating the greatest change in score.

Figure 6.1 Bar chart of shark species, by age and pre-work

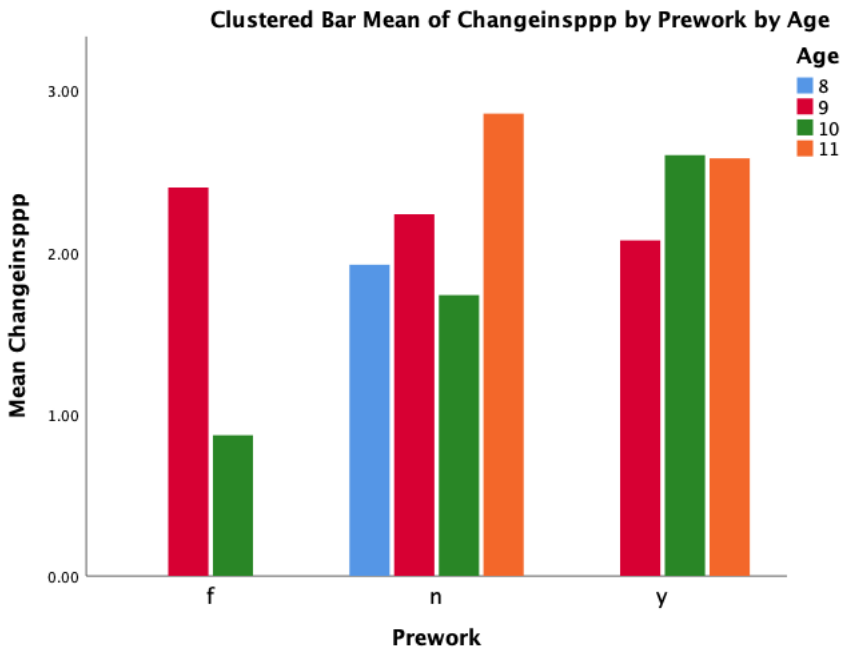


Table 6.2 Results of GLM for change in species vs teacher practice and demographic variables

Tests of Between-Subjects Effects

Dependent Variable: Changeinsppp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	183.794[a]	17	10.811	3.798	.000
Intercept	131.319	1	131.319	46.131	.000
Eth2	18.063	2	9.032	3.173	.044
MDI	39.960	3	13.320	4.679	.003
Gender	27.466	1	27.466	9.648	.002
Age	8.759	3	2.920	1.026	.382
Gender * Prework	9.968	2	4.984	1.751	.176
Age * Prework	37.232	3	12.411	4.360	.005
Error	671.812	236	2.847		
Total	1832.000	254			
Corrected Total	855.606	253			

a. R Squared = .215 (Adjusted R Squared = .158)

Figure 6.2 Histogram of residuals for change in species score

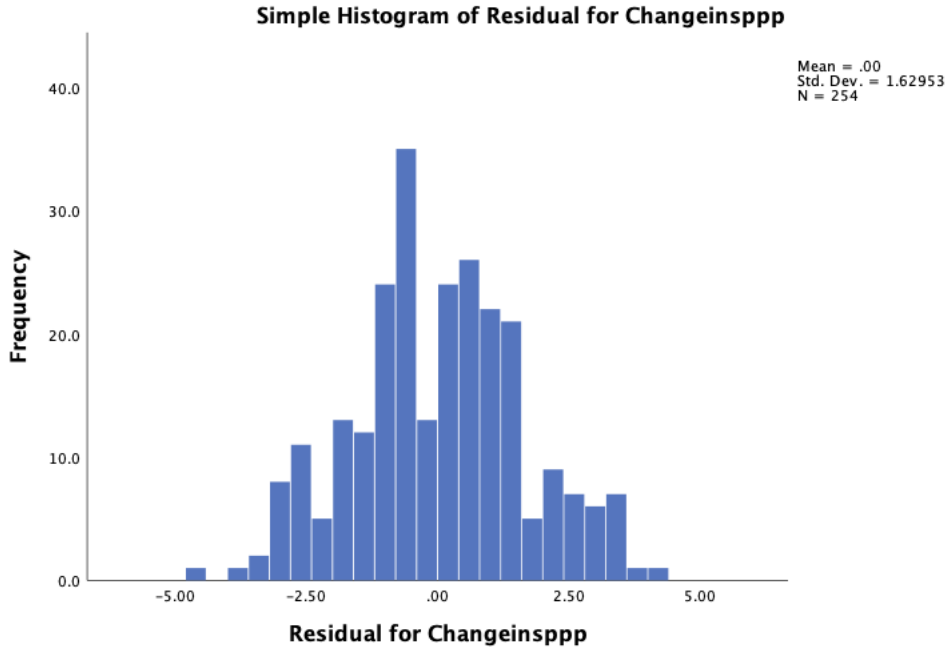


Figure 6.2 above provides a visual representation of the Kolmogorov-Smirnov results showing that the model meets the assumptions for normality.

Figure 6.3 Scatter plot of standardised residuals against predicted values for change in species score

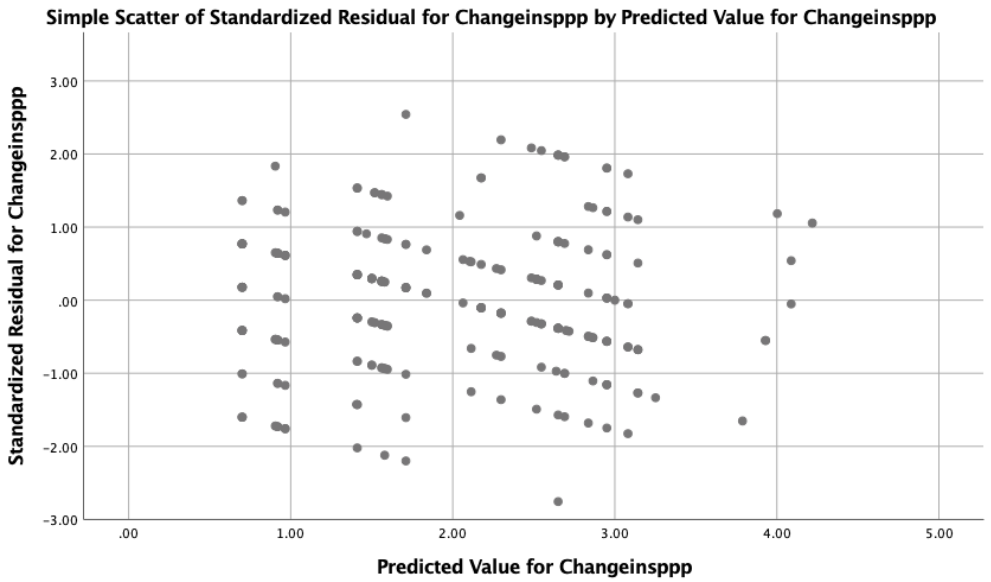


Figure 6.3 above demonstrates that the model meets the assumptions for heteroskedasticity and linearity. The plot is relatively shapeless without any clear patterns in the data. It is generally symmetrical around the 0 line without any particularly large residuals.

6.3.4 Summary of findings

For the shark species knowledge measure tour type and workshop attendance appeared to have no significant influence on the learning achieved during the trip. The type of pre-work during the aquarium visit did however appear to have an influence on learning achieved. Students who undertook topical pre-work activities appeared to learn significantly more examples of shark species during their visit than those who undertook no pre-work and those who undertook only venue familiarisation activities before their visit to the aquarium.

The GLM also found there to be a potential link between age and type of pre-work undertaken. Ten-year olds appeared to benefit the most from pre-work activities and nine-year olds the least. No significant interaction was found between the teacher practice variables and any of the other demographic variables including the proxies for SES.

6.4 Conservation Knowledge measure

As previously discussed, participants conservation knowledge was assessed by assigning them a score out of 4 depending on how many conservation related topics they had referred to in their survey answers. Scores were allocated for pre and post surveys and then and overall change scores was totalled.

6.4.1 Analysis

A one- way analysis of variance (ANOVA) was used to compare the means for the change in conservation knowledge score across each of the pre-visit activity

categories; topical linked pre-work, venue familiarisation and no relevant pre-visit activities.

Independent sample t-tests were used to compare the mean change in knowledge scores across the different tour types and workshop attendance groups.

6.4.2 Results

Tour Type: For the conservation measure, students on staff guided tours of the aquarium (n=174) demonstrated a greater increase in knowledge (0.75 ± 1.27) pre to post visit than those on teacher-led tours (0.25 ± 1.21, n=81), a statistically significant difference of 0.5: **t (253) 2.97 p= 0.003** (equal variances assumed, 0.293)

Workshop Participation: Students who undertook workshops as part of their aquarium trip (n=119) demonstrated a greater increase in conservation knowledge (1.03 ± 1.18**)** pre to post trip than those who did not take part in a workshop (0.21 ± 1.18, n=136), a statistically significant difference of 0.82 : **t (253) 5.4, p = 0.000** (equal variances assumed, 0.410)

Preparatory activities: There was a significant difference found between the mean change in conservation knowledge pre to post visit across the 3 different groups for pre-visit activities: **F (2, 251) = 10.63, p=0.000.** Students who undertook no pre-visit activities (n= 101) demonstrated the biggest increase in conservation knowledge pre to post visit (0.79 ± 1.03), followed by those who undertook linked, topical pre-visit activities (0.76 ± 1.3, n=92) and those who undertook pre-visit familiarisation activities actually demonstrating a negative change in pre to post visit knowledge (-0.05 ± 1.38, n=61).

6.4.3 – General Linear Model

As with the shark species knowledge, a univariate General Linear Model was conducted to assess the effects of each variable separately and interactions between variables including some of the demographic variables from Chapter 4.

A Kolmogorov-Smirnov test however revealed the residuals did not meet required assumptions of normality and so the model was not valid: **D = (254), 0.097, p=0.000.**

6.4.4 Summary of findings

For the conservation knowledge measure, tour type and workshop attendance both appeared to have a significant influence on the learning achieved during the trip. Attendance at a workshop appeared to be linked to a significantly bigger increase in conservation knowledge pre to post visit. Similarly, attendance on a staff-member led tour appeared to lead to significantly greater change in knowledge pre to post visit. The type of pre-work during the aquarium visit also appeared to a significant influence on the learning achieved, however with a difference effect to shark species knowledge. On this occasion those who did not undertake any pre-visit activities appeared to learn more about conservation during their visit than those undertaking linked, topical pre-visit activities and those who undertook only venue familiarisation activities before their visit to the aquarium. Conservation knowledge in fact appeared to decrease pre to post visit for students who undertook venue familiarisation techniques.

6.5 Overall marine environment knowledge

As previously discussed in the methodology section, participants drawings were analysed to create an overall marine environment knowledge score. Marine environment scores were allocated for pre and post surveys and then an overall change in scores was calculated.

6.5.1 Analysis

A one- way analysis of variance (ANOVA) was used to compare the means for marine environment score across each of the pre-visit work groups; topical pre-work, venue familiarisation and no relevant pre-visit activities.

Independent sample t-tests were used to compare the mean change knowledge in scores across the different tour types and workshop status.

6.5.2 Results

Tour Type: For the overall marine environment knowledge score, students on staff member guided tours of the aquarium demonstrated (n=174) a greater increase in knowledge (1.16 ± 4.64) pre to post visit than those on self-led tours (0.78 ± 4.36, n=81), a non-statistically significant difference of 0.38: **t (253) 0.621, p= 0.535** (equal variances assumed, 0.360).

Workshop participation: For this particular learning measure, students who participated in a workshop at the aquarium (n=119) demonstrated the greater increase in learning (1.85 ± 4.33) pre to post trip than those who did not take part in a workshop (0.34 ± 4.62, n=136), a statistically significant difference of 1.51**: t (253) 2.68, p = 0.008** (equal variances assumed, 0.475).

Preparatory activities: There was a however a significant difference found between the mean change in marine environment knowledge pre to post visit across the 3 different groups for pre-visit activities: **F (2, 251) = 3.45, p=0.033.** For this particular measure, students who undertook linked, topical pre-visits (n=92) demonstrated the biggest increase in marine environment knowledge pre to post visit (1.96 ± 3.69), followed by those who undertook no preparatory activities (0.73 ± 4.91, n= 101) and finally those who undertook familiarisation activities (0.11 ± 4.88, n= 61).

6.5.3– General Linear Model with interactions

As for shark species and conservation knowledge, a univariate General Linear Model was conducted to examine the effects of each variable separately and interactions between variables including some of the demographic variables from Chapter 4.

The test revealed that the main effects of MDI, Age, Ethnicity and tour type, along with the 2-way interaction variables of pre-work*pupil premium, pre-work*age, pre-work*ethnicity, pre-work*gender, ethnicity*tour-type, ethnicity*workshop, gender*workshop, and workshop*pupil-premium, were found to explain the most significance in the model (R^2 = 0.267, Adj. R^2 = 0.18)

Ethnicity was however the only variable found to be statistically significant within the model.

GLM: MDI, age, ethnicity, tour type, pre-work*pupil premium, pre-work*age, pre-work*ethnicity, pre-work*gender, ethnicity*tour-type, ethnicity*workshop, gender*workshop, workshop*pupil-premium F= 3.031, 1.765, 6.624, 0.903, 1.695, 1.873, 0.968, 1.377, 3.783, 3.3, 3.305, 2.6; df = 2,3,2,1,2, 3, 2, 2, 1, 1, 1, 1; p=0.05, 0.155, 0.002, 0.343, 0.186, 0.135, 0.381, 0.255, 0.053, 0.071, 0.07, 0.108.

Full results are provided in table 6.3 below along with supporting plots.

A Kolmogorov-Smirnov test showed the residuals met the assumptions of normality and so validating the model, **D (254) = 0.039, p=0.20**

Table 6.3 Results of GLM for change in marine environment knowledge vs teacher practice and demographic variables

Tests of Between-Subjects Effects

Dependent Variable: Changedraw

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	1474.517[a]	27	54.612	3.063	.000
MDI	108.083	2	54.041	3.031	.050
Age	94.379	3	31.460	1.765	.155
self_guided	16.098	1	16.098	.903	.343
Eth2	236.185	2	118.093	6.624	.002
Prework * Pupilpremium	60.429	2	30.215	1.695	.186
Age * Prework	100.184	3	33.395	1.873	.135
Eth2 * self_guided	67.448	1	67.448	3.783	.053
Eth2 * Prework	34.519	2	17.260	.968	.381
Eth2 * workshop	58.838	1	58.838	3.300	.071
Gender * Prework	49.087	2	24.543	1.377	.255
Gender * workshop	58.927	1	58.927	3.305	.070
workshop * Pupilpremium	46.351	1	46.351	2.600	.108
Error	4046.962	227	17.828		
Total	5521.480	254			

a. R Squared = .267 (Adjusted R Squared = .180)

Figure 6.4 Histogram of residuals for change in species score

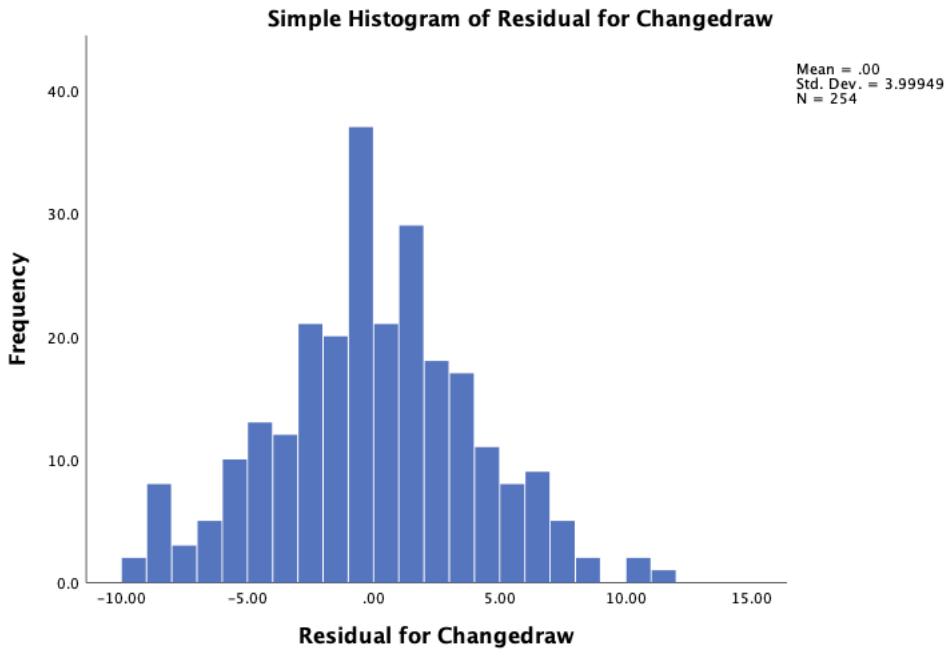


Figure 6.4 above provides a visual representation of the Kolmogorov-Smirnov results showing that the model meets the assumptions for normality.

Figure 6.5 Scatter plot of residuals against predicted values for change in marine environment knowledge

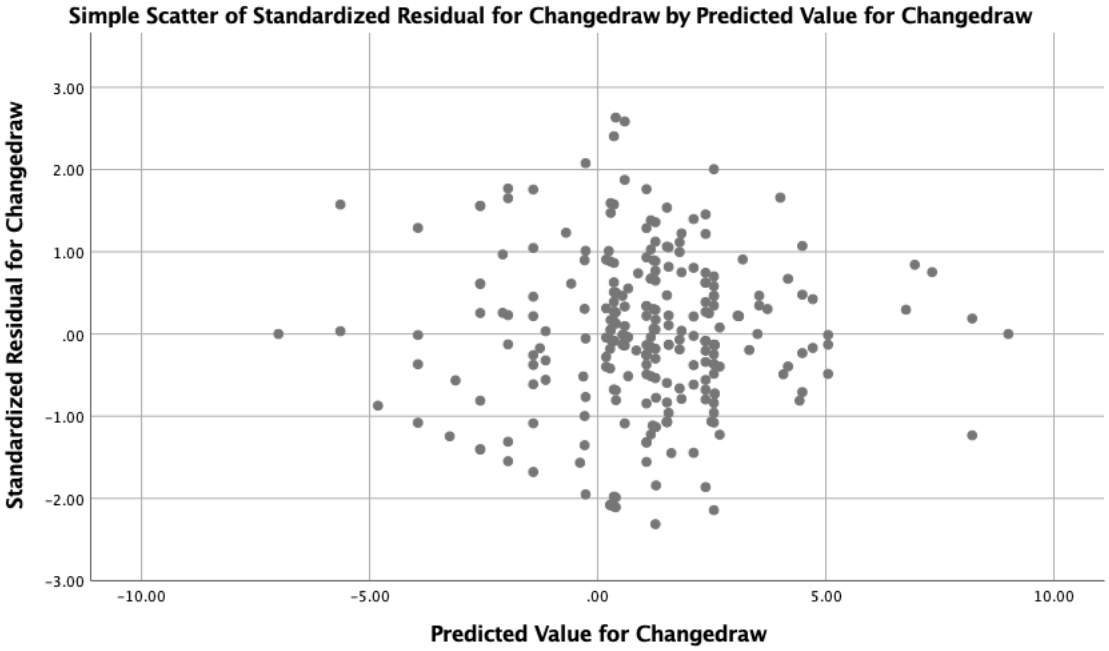


Figure 6.5 above demonstrates that the model meets the assumptions for heteroskedasticity and linearity. The plot is relatively shapeless without any clear patterns in the data. It is generally symmetrical around the 0 line without any particularly large residuals.

6.5.4 Summary of findings

Where the marine environment knowledge measure is concerned, tour type did not appear to have a significant influence on the learning achieved during the trip. Children attending a workshop did appear to have a significantly bigger increase in knowledge than pre to post visit than those who did not. The type of preparatory activities undertaken also appeared to have a significant influence on the learning about the marine environment. With this learning measure, those who undertook linked, topical pre-visit activities appeared to learn more about the general marine

environment during their visit than students who undertook no relevant pre-visit activities and those who undertook only pre-visit venue familiarisation activities

The GLM did not find any significant interactions between the teacher practice variables and the demographic variables.

6.6 Student enjoyment of trips

As discussed in the literature review, there has been some debate around whether guided trips of informal learning institutions result in an overall less enjoyable experience for students. I therefore decided to compare the self-reported post-visit enjoyment of the participants between groups who had formal interactions with aquarium staff and those who did not. This used data from the post-questionnaires which asked students to circle one of five faces on an increasing, Likert scale to indicate which best represented how they felt about their trip to the aquarium. This was scored into number form with 1 = a very sad face, 2 = a moderately sad face, 3= neither happy or sad, 4 = a moderately happy face and 5 = very happy face.

6.6.1 Analysis

Independent sample t-tests were used to compare the mean Likert scores for the reported enjoyment of the aquarium trip between students who undertook guided and self-led tours, and between students who participated in workshops and those who did not.

6.6.2 Results

Workshop participation – students who participated in workshops (n=119) reported a greater mean level of enjoyment of the trip (1.42 ± 0.73) compared to those who did not take part in a workshop (1.38 ± 0.68, n=136), a non-statistically significant difference of 0.04: **t (253) -0.512, p= 0.609** (equal variances assumed, 0.408)

Tour type – students on teacher-led tours of the aquarium (n=81) reported a greater mean level of enjoyment of the trip (1.41± 0.74) compared to those on staff member guided tours (1.39 ± 0.69, n= 174), a non-statistically significant difference of 0.02: **t (253) -0.176 p= 0.861** (equal variances assumed, 0.685)

6.6.3 Summary of findings

Tour type and workshop participation appeared to have no statistically significant influence on the participants self-reported enjoyment of the aquarium trip.

6.7 Overview of quantitative findings around teacher practices

Statistical analysis suggests that the different teacher practices investigated in this study – selection of tour type, opting whether to book an additional workshop or not and choice of pre-visit activities- appears to have some influence on the learning achieved during the aquarium trip.

Table 6.4 Overall change of knowledge measures against teacher practice variables

Knowledge measure	**Tour Type**	**Preparatory activities?**	**Workshop?**
Shark species	Guided	Linked, topical pre-work	Yes
Conservation	Guided	No-prework	Yes
Marine environment	Guided	Linked, topical pre-work	Yes

Table 6.3 (above) provides an overall picture for the findings of the analysis of knowledge measures against the three teacher practice variables. As well as identifying which of the variables were found to be statistically significant (shaded in grey), it identifies which of the categories within each variable showed the greater increase in knowledge pre to post visit.

There was a general trend suggesting that children on staff member guided tours of the aquarium learnt more than children on teacher guided experiences, although this was only found to be a significant difference for the conservation learning measure. Tour type was not found to have any significant difference on the children's reported enjoyment of the trip but children on self-led trips did report slightly higher levels of enjoyment.

Another general trend found was that children who undertook a workshop as part of their aquarium experience, appeared to learn more than those who did not. The difference in learning between those who participated in a workshop and those who did not was found to be significant for both the conservation and marine environment learning measures.

As shown in table 6.3, for all three learning measures, the type of preparatory activities undertaken appeared to have a significant influence on the learning that occurred during the aquarium visit. For both shark species and marine environment knowledge, students who undertook linked pre-work appeared to learn the most during the trip. For conservation knowledge, students who undertook no pre-visit activities appeared to learn the most.

PART 2 – QUALITATIVE FINDINGS

6.8 Introduction to Theme 3: Teachers' practices around school trips

As with the two previous results chapters, the interview data analysed and discussed in this section was collected during the primary research period and consist of the pre and post interviews with the seven teachers from the six participating schools. Interview scripts were analysed as per the method described in Chapter 4 and in the methodology chapter.

During the analysis, two sub-themes emerged relating to my second research question: "*What role do teachers' practices play during school trips in relation to meaning making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capital?*".

- Preparatory work versus 'awe and wonder'
- Guided or unguided non-formal experiences

Once again, a template is used to provide insight into how each theme came about, listing the relevant interview questions, my key interpretations / findings for each, links to existing knowledge in this area and where applicable how this links to my quantitative analysis.

Pertinent quotes are provided as testimony for each theme, with my analysis of each being provided. Each quote is labelled with the synonym of the speaker and the school and the school's Multiple Deprivation Index decile (MDI). Alternative interpretations and potential limitations to the depth of my understanding of each quote are also considered. This is followed by a general discussion of the theme which, where appropriate, incorporates my quantitative data through comparison of the teacher's perceptions of school trip learning and my own statistical findings.

6.9 Sub theme 6: Preparatory work versus 'awe and wonder'

As the quantitative data aimed to measure pre to post visit knowledge change, prior levels of knowledge of the marine environment, shark species and conservation knowledge was gauged using the knowledge measures in the student surveys. As part of the overall investigation of prior experience however, it was deemed necessary to obtain an indication from teachers about the levels of preparation they had undertaken with the students before the aquarium trip. When teachers were asked about this in their interviews it became clear that preparation for the visit was not a priority for most of the teachers with only half having undertaken any kind of relevant lessons or familiarisation techniques and some in fact, went on to provided reasons why they actively avoided undertaking such activities.

Table 6.5 Overview of sub-theme 6

SUB-THEME 6 **Preparatory work versus 'Awe and wonder'**
RELEVANT INTERVIEW QUESTION(S): • Do you view school trips as stand-alone events or linked into class lessons? (pre-visit) • Please tell me about any preparation for trips that you normally with students • Is there any special preparation you would do for children who had not been to an aquarium before?
OVERVIEW OF RESULTS • 3/6 schools reported not doing any kind of preparation with students for trips • 1/6 schools reported undertaking venue specific preparation • 4/6 talked about trips providing an 'awe and wonder' experience • 3/6 schools specifically talked in terms of the pre-work potentially spoiling the overall experience
INTERPRETATION/ FINDINGS • The teachers' preference seemed to be to not undertake preparatory work with the children before the trip.

• One reason given for avoiding pre-visit work is that it may spoil the trip by removing an element of surprise and/or detracting from the 'awe and wonder' side of the overall trip experience.
LINKS TO LITERATURE • Such an approach by teachers goes against advice from previous studies which suggest that pre-work, including venue specific familiarisation activities, is beneficial to children during trips promoting learning during trips.

6.9.1 Topical pre-work

In terms of associated classroom work before the aquarium visit, School B appeared to have completed the most groundwork having undertaken an entire topic of work called Water World which covered all aspects of water on planet earth including the Oceans. The trip was seen as the culmination of this project and, in the post-visit interview, Ms. F explained her reason for the timing of the trip:

"I think having it at the end, towards the end of our unit of work, instead of having it at the beginning was a good idea ***cause then they have a bit of background knowledge about the creatures and I think they enjoyed that.*** *Cause we did discuss having it as our ground starter at the beginning, but I think having it at the end was a bit nicer… I think it was better"*

Quotation: Ms F. School B (MDI 2, Yr. 5), pre-aquarium visit, in school interview, Nov. 2016

It is clear from this quote that Ms F. saw value in arming her students with prior knowledge before their visit, specifically of the animals they would be seeing during the aquarium trip. The fact that she states that herself and Mr. O. did discuss having the trip at the start of the Water World topic suggests that they did consider the timing of the trip to be important. Ms. F. only comments on the perceived benefit of the pre-visit work from an enjoyment perspective, so it is not clear whether she believes that such preparatory work would also have had any influence

on the learning achieved during the trip. When asked about the pre-work they had done with students in terms of trip specific skills or familiarisation to the aquarium as a venue, Mr. O. and Ms F. explained that this was not something that they had undertaken with their students:

Mr. O: "No. ***I suppose it's just literacy and numeracy isn't it? - which they do every day****. I suppose that's like the preparation for it."*
Ms. F: "***No, I haven't even shown them the website*** *like I did last year but that's because the money wasn't coming in last year to go, so I showed the website to try and enthuse them to get to go but* ***this year I haven't needed to****"*
*Mr. O: "****the less you tell them the more excited they get****"*
*Ms F: "****yeah*** *when you get there,* ***you want the awe and wonder****, you get the gasp moment"*

Quotation: Mr. O and Ms F. School B (MDI 2, Yr.5), pre-aquarium visit, in school interview, Nov. 2016

Whilst Mr. O does mention literacy, he does not refer to practicing skills with the children more specific to non-formal learning institute visits such as reading signs, listening to guides, asking questions, spending time observing exhibits etc. It is of course possible, and indeed likely, that the school does foster some of these skills more generally throughout the school year. Mr O's response, however, leads me to believe that such skills were not being presented to the children as important to utilise during the aquarium trip. School B was not alone in this respect. None of the teachers participating in the study reported doing any preparation with children in the form of visit-specific skill building.

In this dialogue, Mr O. and Ms F. both seem to suggest that they see a benefit in restricting the amount of pre-trip information that children are given. This was a common theme across the interviews, with teachers from 3 out of 6 schools commenting that they believed that providing information about the aquarium took away from the excitement or, a commonly used phrase 'awe and wonder' of the trip.

6.9.2 Venue familiarisation techniques

As described in the literature review, previous research has shown that providing students with prior knowledge of a venue through power points, videos, maps etc. can improve the learning outcomes of trips (Gennaro, 1985; Anderson & Lucas, 1997). Ms. F's response about not having needed to share the website with students this year, suggests that she only sees venue specific familiarisation techniques as useful for exciting and motivating children to want to go on a trip, rather than recognising their potential benefit to learning.

Out of all six schools, only one, School F, commented on having done any venue familiarisation work with students. They reported showing some pictures to students via a PowerPoint presentation and telling them what the aquarium would be like before their trip. This venue familiarisation was in fact the only trip preparation that Mrs B reported conducting with her students. Mrs B. stated that this approach of telling children about the venue they were going to visit was standard practice for preparing the children for the overall residential trip, with each activity being presented to them in advance. When asked about her reasons for undertaking this form of pre-visit preparation Mrs. B. appeared to believe it might have actually added to the children's excitement rather than hindering it:

*"I think **it added to the excitement and anticipation** for some of the children but also gave the other children an **idea of what it would be like**, whether it worked or not, I don't know, **maybe it took away some of the shine**… I don't think it did. I think when you walk round and see that first big tank, and it's just awesome and you get it at that point"*

Quotation: Mrs B. (MDI 4, Yr.6), post-aquarium visit, telephone interview, July 2017

The reference here to the venue familiarisation having given some "*other children an idea of what it would be like*" is important as it is the only example of a teacher, before prompting, considering the different experience that the trip may offer a child with no prior experience of aquariums.

6.9.3 No relevant pre-visit activities

Due to the whole-school nature of the trip, School D, like School F, were not linking the aquarium visit to any specific classroom topic. When asked about any trip preparation students had undertaken, Mrs W. seems to suggest that their school's coastal location meant that students were already reasonably well prepared for an aquarium trip:

"I think maybe that's less relevant down here. ***There's much more awareness of marine life because we live on the coast"***

Quotation: Mrs W. School D (MDI 6, Yr.3-6), pre-aquarium visit, in school interview, March 2017

I interpret this quote as confirmation that the only type of preparation that Mrs. W. considers undertaking before trips is knowledge / content. Whilst living by in a seaside town *may* result in a better overall knowledge of a specific marine environment i.e. the UK coastline, it is unlikely to have any influence on a person's visit-specific skills and knowledge of how to best behave and perform to get the most out of an aquarium experience.

Like School A, School C was also using the trip to introduce a related topic, in this case habitats and had chosen not to do any relevant pre-trip classroom work. In the pre-visit interview, when asked about preparing children for the aquarium trip, Mrs. G. concurred with the teachers from School A that too much prior information can have a negative effect on the trip:

"It's a new experience for the children so ***we don't want to spoil that by doing a whole lot of work around "what you' re going to see when you get there" or "what you're going to do when you get there****". Instead, we let the children enjoy the moment as a new experience"*

Quotation: Mrs G. School C (MDI 10, Yr. 6), pre-aquarium visit, telephone interview March 2016.

In this quote, Mrs G. specifically cites familiarisation activities as having the potential to "spoil" the children's enjoyment of the trip. When asked in the post-visit interview about whether she might now have changed her mind about her decision not to undertake any pre-visit activities, Mrs G. remained steadfast in her opinion.

"Em, no I don't think so, I think I explained before that because of where we are situated, ***a sea-based trip is quite novel*** *for our children, or at least not in the realms of their immediate experience, so* ***to leave an element of surprise is quite important for those trips so there is a little bit of awe and wonder in the experience*** *and then we can reflect on that afterwards… We don't want to* ***spoil the sparkle****"*

Quotation: Mrs G. School C (MDI 10, Yr 6), post-aquarium visit, telephone interview March 2016.

In describing the aquarium visit as a "sea-based" trip and "novel" due to the school location, Mrs G. seems to be suggesting that the school's inland positioning will mean students have less prior experience of marine environments and so will be more astounded by the aquarium. Again, this phrase "awe and wonder" is used, this time being linked to the idea of less knowledge about a venue resulting in an 'element of surprise', which is alluded to be a positive reaction.

6.9.4 Summary of sub-theme 6 findings

The teacher interviews suggested that teachers are not universally embracing the practice of pre-trip activities with their students, with four out of six schools choosing not to undertake any topical, aquarium link preparatory work. Only one of the schools chose to undertake venue familiarisation techniques with their students and none of the schools reported having done any practice with the students of skills that might be useful during the visit. A recurring reason given

as to why teachers had opted not to undertake relevant pre-visit activities was the idea of preparatory work spoiling the '*awe and wonder'* of the trip, also referred to in terms of the *surprise* or *shine* of seeing the aquarium for the first time. This would appear to be a contradictory approach to that recommended by previous education literature which advocates for undertaking both venue familiarisation and linked topical pre-visit work to increase the learning potential of trips, something that most of the teachers claimed was an important outcome for the aquarium trip.

6.9.5 Sub-theme 6 links to quantitative results

As outlined above, the qualitative results of sub-theme six suggest that the teachers participating in this study did not put particular value on pre-visit activities with their students with only one school opting to undertake venue familiarisation and two undertaking any relevant aquarium linked pre-work with their students.

Whilst my quantitative results do provide some evidence to suggest that pre-visit activities can influence - and improve - learning achieved during school trip, they did not provide consistent evidence of where and for what kind of learning such practices might best be utilised by teachers.

The fact that change in shark species knowledge scores were found to be significantly higher in students who undertook linked, topical pre-visit activities, (**F (2, 204) = 8.777, p=0.000, mean of 2.36 compared to 1.57)** could be taken as an indication that teachers should consider undertaking pre-visit work where they want students to learn specific facts during their visits.

As the overall marine environmental knowledge change was highest in students who undertook venue familiarisation techniques prior to their visits, **F (2, 249) = 6.994, p=0.001, mean of 3.25 compared to mean of 0.725)** this could be interpreted as an indication that teachers should consider undertaking these kind of

preparatory activities where they are looking for a more general, overall learning to occur during a trip.

However, as the highest change in conservation knowledge scores were actually found in the students who undertook no pre-visit activities at all, **F (2, 226) = 7.126, p=0.001, mean of 0.71, compared to mean of -0.005)** we cannot, at least in this context, say with any confidence that pre-work is always a positive influence on school trip learning.

6.10 Sub-theme 7: Interactions with aquarium staff

Sub-theme 6 looked at one specific area of teacher practice on school trips- the choice of whether to undertake linked pre-trip activities or not. This second theme looks at another important aspect of school-trip planning that teachers have to consider, whether to engage the expertise of institution staff during a visit or to self-lead students around the venue. In the pre-visit interviews teachers were asked to comment on why they had elected for a specific tour type, guided or self-led, and why they had elected to have a workshop or not. In the post-visit interviews teachers were asked to reflect on their choice of tour type and whether, with the benefit of hindsight, they were happy with their decision.

Table 6.6 Overview of sub-theme 7

SUB-THEME 7 **Interactions with aquarium staff**
RELEVANT INTERVIEW QUESTION(S): Pre-visit questions • You have elected for a staff member guided tour, why did you choose this particular type of tour? *(guided tours only)* • You elected for a self-led, explorer, tour, why did you choose this particular type of tour? *(self-led tours only)* • What role do you expect aquarium staff members to play during your visit? • Why did you choose (not) to book a workshop as part of your aquarium trip?

Post-visit questions

- What did you think of your aquarium tour? Do you think it met your expectations? *(guided tours only)*
- How do you think your aquarium experience may have been affected by having a staff member lead you around the aquarium? *(guided tours only)*
- Can you please describe any interaction you had with aquarium staff whilst self-touring around the aquarium? *(self-led tours only)*
- Reflecting back on your trip, are you happy with the choice of tour your made?
- Would you recommend the staff-led/ self-led aquarium tour to others taking trips to the NMA?
- Having now taken part in a guided tour of the aquarium would you now feel able to lead a tour yourself next time? (*guided tours only)*

OVERVIEW OF RESULTS

- Out of 6 schools participating in the study, only 2 partook in self-led tours and 3 partook in workshops in addition to their aquarium tour
- All classes who participated in workshops also experienced a staff member guided tour of the aquarium.
- Reasons given for not taking guided tours included the additional cost, lack of availability and wanting a more intimate/fun experience.
- Reasons given for partaking in workshops were all around a desire to extend the learning experience and provide the children with a 'hands-on' activity
- Reasons given for not booking a workshop were again down to the additional cost and not wanting to 'waste' valuable time in a classroom, away from the actual aquarium tanks.

INTERPRETATION/ FINDINGS

- Teachers who elected for a guided aquarium experience appeared to be confident that this was the best choice for their students with most commenting on the extra depth of knowledge that aquarium staff could provide
- The 2 schools electing for self-led trips believed that the overall experience may have been better for the students than the guided tours. However, one of these

schools also conceded that it was likely that more learning would have occurred during the staff member led tour. • Regardless of their choice of tour, all the teachers saw the aquarium staff members as a valuable resource during their aquarium trip, particularly when it came to answering student questions. • Teachers who opted for guided tours reported feeling more relaxed and able to connect with children in a different way and valued being able to spend more time with children who needed extra support.
LINKS TO LITERATURE • Existing literature in this area tends to find non-formal learning staff member interactions promote learning achieved during school trips. However, there is also a body of work which suggests that self-led/ teacher-led trips are a more positive experience for students.
LINKS TO MY QUANTITATIVE FINDINGS • My analysis did find some significant differences to the learning between groups and on guided and teacher-led tours and between groups who undertook workshops and those who did not.

6.10.1 Guided or self-led tours

All of the teachers who elected solely for guided tours talked about them very positively and confirmed that they would both book a guided tour again for any future visits and recommend this type of tour to other teachers taking classes to the NMA. They tended to talk about the guided tours in terms of providing something 'more' or 'extra' to the trip experience.

When asked why he selected a guided tour of the aquarium, Mr. D replied:

*"well, I think the children **get the most** from that, I couldn't give them **as much details**"*

Quotation: Mr D. School A (MDI 8, Yr. 5), pre-aquarium visit, in-person, Nov. 2016

Whilst '*get the most'* could be referencing enjoyment or other experiential factors, in this case I am interpreting Mr D. to be referring to the tour content in the form of facts and other information due to the quote going on to refer to 'details' being provided by the aquarium staff member. Mrs G. similarly answered the same question in terms of the what the aquarium staff could provide compared to her and her fellow teachers:

"they are very, very good and have a ***vast amount of knowledge*** *and seem to be* ***able to answer every question*** *that the children ask. So,* ***knowledge really****. I think they do a* ***much better job than what we would be able to do****, they are usually brilliant"*

Quotation: Mrs G. School C (MDI 10, Yr.6), pre-aquarium visit, telephone interview March 2016.

Here I am interpreting the '*vast amounts of knowledge'* Mrs G. refers to as the same as Mr D.'s '*details'* – facts and general information supplied during the tour. Given that nature of the question, I am confident that the 'they' Mrs G. refers to is the aquarium staff and the 'we' is herself and the other teachers guiding the tour.

Mrs W. from School D. also referred to the guided tours in terms of the additional source of knowledge they supplied and comparing aquarium staff to teachers:

"*the experience is improved by* ***having someone more knowledgeable*** *than you, they can speak about all sorts of things, aquarium routines, feeding, the creatures…****they can offer much more than we ever could…*** *children liked* ***the personal touch*** *from the staff****, the background stuff*** *like how the octopus plays games to get its food.* ***That's not something I could tell*** *them unless I had some very extensive support materials"*

Quotation: Mrs W, School D (MDI 6, Yr.3-6), post- visit, telephone interview March 2016

Again, given the nature of the question, I am presuming that the 'someone more knowledgable' Mrs W. refers to is the aquarium staff members. In this quote Mrs W. goes on to be more specific about the types of additional knowledge she believes are on offer referring to venue specific background information that only staff members would be party to.

Mr M. from School E also compared the aquarium knowledge he could provide to the aquarium staff members but also went on to compare this to the information available through other aquarium sources:

*"**I probably could do it myself** as I've been enough times and I have the gift of gab, but **I'd be making up facts and telling them rubbish** ... also **there's only so much you can take from an information panel next to a tank** – the tour guides are useful and tell them the stuff they really want to know, rather than **just facts that are generic**"*

Quotation: Mr M, School E (MDI 9, Yr. 6), post- visit, telephone interview July 2016

As this was a reply to the question about whether he, Mr M., would pick a guided tour again for future trips, I am interpreting the 'it' he believes he could do himself to be referring to guiding students around the aquarium. From this quote it would appear that Mr M. believes there to be two important skills involved in leading aquarium tours, being good communicators or as he put it '*having the gift of the gab'* and knowing enough *'facts'.* Whilst he feels he would have the communication skills, he believes it's the tour guides who have the interesting facts and knowledge, more than he could glean from the information provided in the signage around the tanks. I am interpreting his use of the word '*generic'* to suggest that the most valuable knowledge the aquarium staff can provide is the background, institution specific information that Mrs W. alluded to. Of course, the non-generic 'stuff' he suggests the students '*really want to know'* could be referring to more detailed species or habitat information, but either way, it is extra knowledge that he views the aquarium staff as holding, not him or the aquarium's interpretation boards.

The two schools who opted for unguided experiences of the aquarium provided multiple reasons for their choice of tour. School B reported that the higher cost of the guided tour was a factor in their choice whilst School F stated that their second class, who visited the aquarium on a Saturday, had no option to have a guided tour as education tours are not available over the weekends. However, both schools also indicated they were happy with the self-led tour. When explaining her choice of tour post-visit, Ms F. stated that it:

"*was nice that* ***it wasn't too structured*** *for them and that* ***it didn't have timescales*** *we had to run to and I* ***had to keep them to, like in school*** *…* ***they spent time*** *in the* ***places they wanted*** *to spend time in rather than where adults thought they would want to"*

Quotation: Ms F. School B (MDI 2, Yr. 5), post-aquarium visit, phone interview, Nov. 2016

Ms F's use of the word 'nice' indicates a positive attitude towards the self-led tours lack of structure and timetabling, suggesting to me that she appreciated the lack of formality in this type of aquarium experience. With the use of 'like in school' Ms F. appears to be comparing the guided tour experience as a more formal, structured learning experience similar to school-based learning and stating her preference for trips to be more informal and relaxed. I am interpreting the 'they' and 'them' as referring to the students and therefore, that she believed it was the children who had the freedom to dictate how much time they spent in certain areas of the aquarium. I am also concluding, given the context, that Ms F. sees such a student-centred approach to the tour as a positive thing, and that she believes that the staff member guided tours would have been more formulaic and less focussed on the children's preferences.

Mrs B. also talked about School F's self-led tour in terms of the freedom it allowed in how their time was spent within the aquarium:

"we ***enjoy doing self- led more****, more* ***freedom****, seemed like* ***more time to look at things*** *and was nicer to be split into* ***smaller groups, feels more intimate*** *and easier*

to manage, but does rely on the teacher or parent leader's knowledge… The ***kids enjoy the tour*** *but being forced to listen to somebody* ***is like a classroom activity*** *and they are being turned away from the* ***awe and wonder****"*

Quotation: Mrs B. School F (MDI 4, yr. 6), post-aquarium visit, telephone interview July 2017

As School F undertook one of each type of tour, I believe it to be a safe assertion that, in this quote, Mrs B. is directly comparing the self-led and staff guided experiences. Mrs B. appears to be referring to the teacher-led tour as 'self-led' and the staff-member guided experience as 'the tour'. She used the word 'enjoy' for both tours, however, she states that they enjoyed the self-led tour 'more'. For this reason, I am interpreting that conditions Mrs B. refers to, such as the smaller group sizes and 'more time to look at things' are factors she believes are beneficial to the trip experience. Like Ms F from School B, Mrs B. also appears to compare the guided tour to classroom learning in an unfavourable way. Where she says 'listen to somebody', I am interpreting this be referring to the aquarium guide, and her use of the word 'forced' has negative connotations suggesting she does not believe that children actively wish to listen to the tour-guides commentary. Mrs B. appears to be comparing this requirement by the students to listen to an educator to the more formal style of in school learning and suggests that this is negatively impacting the students experience of the aquarium, using the previously discussed concept of 'awe and wonder' to explain this. Interestingly though, in questions specific to the learning aspect of the trip Mrs B. reported her belief that the guided tour group were at an advantage:

*"****Factually wise I think the led group got the better deal****. In the guided group they had specific things they would all have remembered, the fins, the starfish, they would have* ***retained more facts****. The guided group would have* ***more knowledge at the end*** *about what they had seen"*

Quotation: Mrs B. School F (MDI 4, yr. 6), post-aquarium visit, telephone interview July 2017

When these quotes are considered side by side, it would appear that Mrs B. sees the self-led experiences as more enjoyable for students but the guided tours as being more productive from a cognitive learning perspective.

6.10.2 Workshops

Out of the six schools participating in the study, three chose to partake in an additional workshop. The reasons given for adding a workshop to the aquarium visit included wanting to make the most out of the experience, to provide a hands-on activity and to increase the learning potential of the trip. Perhaps more interesting however was the reasons given for *not* choosing to book a workshop for their students. Mr D. explained why they had chosen to have a workshop previously but had decided against it for this particular trip:

"Um well, we've had one before where ***we sat in the classroom for a while*** *but I,* ***they were just itching to get going and look around*** *and its, it's a lovely place to* ***wander*** *about isn't it?"*

Quotation: Mr D. School A (MDI 8, yr.5), pre-aquarium visit, in school interview, Nov. 2016.

Here Mr D. appears to be suggesting that being in the aquarium classroom, where the majority of their workshops are held, was not a good use of their time in the venue and that 'they' - which I am interpreting to mean the children – would have preferred to spend that time out in main aquarium exhibit area. His use of the word 'I', immediately corrected to 'they' suggests it is possible that Mr D. may also have been keen to get out of the classroom, although of course it could also have been a genuine slip of the tongue. Finally, his use of the word 'wander' suggests that Mr D. was looking for a more informal viewing of the aquarium making it interesting that he elected for the more structured guided tour option.

Ms F. provided a similar reason as to why they had not opted to include a workshop in their aquarium visit:

"Yeah, we don't want any workshops, **we want to be out there looking at stuff**. It's like when we've been to the zoo before, sometimes we've been **stuck inside doing workshop** and the kids are like, we wanna go out and see the giraffes. Never seen a giraffe before and **they wanna just be experiencing it**"

Quotation: Ms F. School B (MDI 2, Yr 5), pre-aquarium visit, in school interview, Nov. 2016

Given the context of the interview as a whole, I am interpreting the 'stuff' to which Ms F. is referring to be the aquarium tanks and other exhibits. Her use of the word 'stuck' has negative connotations suggesting that undertaking workshops is not seen as an enjoyable activity during school trips. When describing the previous zoo-workshop she states that the students wanted to get out of the workshop and start 'experiencing' the zoo animals. Ms F's apparent support of the children's stance, exhibited in her decision not to book a workshop for this trip, could be interpreted as suggesting that even she, the teacher, does not see the workshops as part of the trip 'experience' but instead something that must be tolerated before the real 'experience' of the exhibits can begin.

It is clear that not all teachers view the guided tours and workshop experiences as less enjoyable for students. School D, the one school who declared their primary aim for the trip to be 'fun' selected both a guided tour and a workshop for their students. Nevertheless, this idea of self-led meaning equalling more fun and guided offering bigger learning opportunities align with some of the previous research in this area and will be discussed in detail in the next chapter.

6.10.3 Role of aquarium staff

There was consensus amongst the teachers that the aquarium staff were a valuable resource during their trip, even to the group self-exploring around the aquarium. In the case of the guided tours, the teacher's comments were exclusively about the particular staff members that led them around the aquarium. The two schools who undertook the self-led tours both reflected on their interactions with the aquarium hosts who are positioned at various locations around the venue.

Appreciation of the staff members' specialist status and subject knowledge was raised by a number of the teachers. When asked what role she expected the aquarium staff member to play during the visit Mrs G (School C) replied:

*"The **role of expert really** and they usually are. They are very, very good and have a **vast amount of knowledge** and seem to be able to **answer every question** that the children ask"*

Quotation: Mrs G. School C (MDI 10, Yr. 6), pre-aquarium visit, telephone interview March 2016.

Mr M. (School E) replied to the same question in a similar manner:

*"It's the **level of expertise** that the tour guides have, **it's better to give them real information** rather than me making up information about jellyfish"*

Quotation: Mr M. School E (MDI 9), pre-aquarium visit, telephone interview July 2017

Both quotes highlight the teachers' view of the aquarium staff as experts in this field and an appreciation for the depth of information they are able to able to impart to the students. Teachers specifically commented on the value of the staff's insider status knowledge:

Mrs W (School D) provides further examples of the kinds of behinds the scenes knowledge the aquarium staff can provide:

"*the experience is improved by **having someone more knowledgeable than you**, they can speak about all sorts of things, **aquarium routines, feeding, the creatures**…they can offer much more than we ever could"*

Quotation: Mrs W. School D (MDI 6- yr3-6), pre-aquarium visit, in school interview, March 2017

Here Mrs W (School D) provides some examples of the kinds of behinds the scenes information that only the aquarium staff could provide. Mrs G. from School C provided more detail in her response to how aquarium staff influence their visits:

"my teachers are very competent people and could read up, but ***they couldn't provide the behind the scenes knowledge and anecdotal stuff about the aquarium…*** *the children liked* ***the personal touch from the staff, the background stuff*** *like how the octopus plays games to get its food. That's not something I could tell them unless I had some very extensive support materials"*

Quotation: Mrs G. School C (MDI 10, Yr. 6), pre-aquarium visit, telephone interview March 2016.

Here, in the form of the octopus anecdote, Mrs G. (School C) provides a specific example of the kind of background, aquarium or animal specific information she believes her students engage well with. On a few occasions the aquarium staff were described in terms of being an alternative for signage and interpretation boards around the aquarium. When commenting on whether they had used signage around the aquarium, Mr M. (School E) responded:

*"****we looked at signs****, but not much* ***- the leader was the port of call*** *really"*

Quotation: Mr M. School E (MDI 9), post-aquarium visit, telephone interview July 2017

This coupled with Mr M's previous cited comment "*there's only so much you can take from an information panel next to a tank*", suggest that they saw staff member knowledge as superior to that provided by the signage. This also appeared to be the case for School B, one of the self-led groups:

"It was ***particularly good to have staff around as the kids weren't reading the long-winded signs****… children seemed to get more out of having them around"*

Quotation: Mr. O, School B (MDI 2, Yr 5.), post-aquarium visit, phone interview, Nov. 2016

Mr O's colleague, Ms F, then went on to expand on the children's lack of interaction with aquarium signage:

When we were going round, sometimes they would ask me about things and I'd say well go and read the label and see what it says and ***actually then they were switched off, they were not interested in reading it at all*** *they just wanted to see the things"*

Quotation: Ms F, School B (MDI 2, Yr 5.), post-aquarium visit, phone interview, Nov. 2016

Here I am interpreting the 'they' Ms F. refers to as the children on the visits and the 'things' they wanted to see as the aquarium tanks and other exhibits. This is particularly interesting as it appears to identify a potential difference between the guided and unguided groups. If the children are not reading the information, and there is no aquarium staff member to provide it in their commentary, then it is down to the teachers to convey it and as the previous quotes have identified, they are not always the best placed to be undertaking this task.

Interestingly, although neither of the self-led schools mentioned the availability of the host aquarium staff when justifying their reasons for not selecting the more formal guided tour, in the post-interviews both schools expressed a preference for this kind of interaction with staff:

"I think it was really helpful, ***the children got a lot more out of the experience of seeing the animals in their tanks explained by the guide****, em, rather then you know just us doing it all the time, yeah it was quite helpful having the staff there"*

Quotation: Mr. O, School B (MDI 2, Yr 5.), post-aquarium visit, phone interview, Nov. 2016

In this quote Mr O. refers to the aquarium hosts they interacted with during their visits as a 'guide', a term strongly associated with tour-leaders. This could suggest

that Mr O. still felt that aquarium staff would.be part of their aquarium experience regardless of the tour type and could provide a reason why they did not feel it necessary to pay the extra cost for a specific aquarium staff member to take them around the venue. However, it is also possible that this is simply an entirely independent retrospective reflection on the benefit of having these host staff available to them. An interesting variable to investigate would be whether the teachers would still see value in self-led experience if no host staff were available to them during their visits.

In the next quote, Mrs B. from School F, the other school who experienced a self-led tour, expressed her desire for more opportunities to engage with aquarium staff outside the guided tour scenario:

*"I did enjoy the guided trip – **she's more sussed as to where to take children**, but she seemed to have to spend a lot of time getting kids **attention and focussed and behaviour and engaging** them which is harder with so many kids… **It's nice like this, in the smaller groups**, **It's less, formal, less like a lecture**. It would be great to have **more of this, strategically positioned people around the exhibits**, less of a school setting"*

Quotation: Mrs B. (MDI 4, Yr. 6), post-aquarium visit, telephone interview, July 2017

Here, once again we find Mrs B.'s unique position as a participant of both kinds of tours, allowing her to directly compare the guided and self-led experiences. Whilst she states that she did 'enjoy' the guided trip, she also outlines some limitations which she appears to attribute to the larger group size that guided tours have to move around in. The use of the words 'formal' and 'lecture' have negative connotations here and Mrs B. aligns the guided tours to school setting style learning which she appears to see as an undesirable approach. In indicating her preference for more strategically positioned staff around the aquarium, Mrs B. appears to be advocating for more interaction with non-formal learning staff but just not in the formal, guided tour scenario that most participating teachers opted for.

6.10.4 Summary of sub theme 7 findings

Regardless of whether they opted for a guided or self-led tour of the aquarium, teachers appreciated having aquarium staff members available to provide information to students and answer questions. The expert status of the aquarium staff members was recognised and the extra depth of knowledge they were able to provide was welcomed. The teachers reported particularly enjoying the anecdotal, background information about the running of the aquarium and quirks about certain animals that they would not have been able to access even with prior research or through signage in the aquarium.

The two schools who self-led around the aquarium provided various reasons for their choice but both also appeared to believe that it resulted in a better overall experience for their students. Reasons given were that it was less like a formal lecture, provided freedom for children to dictate their own movement around the aquarium based on their interests and allowed for smaller, easier to manage group sizes. Both the self-led schools appeared to see that ideal scenario for a trip to be smaller groups wandering around with teachers/chaperones and for aquarium staff to be made available to them, informally, at designated points around the aquarium.

For the teachers who did not book one, the aquarium workshops were seen as too formal for a school trip as they took place in a classroom away from the actual aquarium exhibits. In my participating schools, neither of the schools who took self-led tours participated in a workshop meaning that their students had no formal, pre-arranged interaction with aquarium staff.

6.10.5 Sub-theme 7: link to quantitative findings

As discussed above, sub-theme one found that teachers put a lot of value into students interacting with the aquarium staff, however those who opted for self-led aquarium experience preferred more informal interactions with the staff outside tours or workshops. The teachers who booked guided tours appeared to believe that

this gave their students more access to information via the staff members' additional knowledge. The one teacher who experienced both types of trips across her two visiting classes also believed that the students on guided tours had more access to knowledge but that the self-led groups would have had a better experience overall.

My quantitative data found some evidence to support the idea that children on guided tours were learning more. For all three learning measures, children on guided tours were found to demonstrate a greater increase in score pre to post visit, although this was only significant for conservation knowledge. My quantitative data also found some evidence, although again not statistically significant, to support the idea that children on teacher-led tours enjoyed their experience more than those on guided tours.

The qualitative results above also appear to suggest that teachers who booked workshops for their classes did so in the belief that this experience increased the learning potential of the trip. Teachers who did not book a workshop on the other hand stated their conviction that workshops were not particularly enjoyed by their students.

As with tour type, my quantitative data found some evidence to suggest that participation in workshops resulted in increased learning in students. For all three learning measures, students who undertook workshops appeared to learn more than those who did not, this was a statistically significant difference for two of the three measures. In terms of enjoyment, students on the workshops reported higher levels of trip enjoyment, but not at a statistically significant level.

6.11 Discussion of findings around teacher practices

Teachers are key players in school trips having control over nearly every aspect of a visit from location selection, to transportation to organising financing of the trip and perhaps, most importantly, in setting up the children's expectations and attitude

towards the visit and readying them for the learning that could take place. As discussed in the introduction, there is currently no compulsory requirement for school trips with the UK education system and so, to put it simply, without teachers will for them, school trips would not take place.

In my conversations with teachers I was struck by how passionate most seemed to be about taking children on trips. Trips clearly increase a teacher's workload. Between the paperwork involved in consent forms and risk assessments and the additional responsibilities during the trip itself, having to be extra vigilant taking student into new environment with new safety concerns, most would not blame teachers if they approached school trips with dread rather than the optimism and enthusiasm I encountered. This positive attitude towards trips is especially important when you consider the research of Price and Hein (1991), Jarvis and Pell (2005) and Griffin and Symington (1997) which found teachers attitudes towards trips were mirrored in their students which in turn influenced how much benefit children got from the experience.

Teachers are more likely to be positive about a trip if they have agency over it (Tal et al., 2005) and certainly this seemed to be the case for my study with all of the teachers confirming that they had at least some autonomy in the selection of the aquarium as the location for the trip. If a teacher if a has selected a trip location themselves, it is likely that they have at least some interest or prior knowledge in that subject area and this could influence their trip practices. In particular, it is likely to influence a teacher's decision into whether to utilise the services of venue staff members during their visits. If a teacher has selected a trip venue because they are already familiar with a venue and confident in their knowledge of its associated topics, it stands to reason that they might be more willing to take on the challenge of leading the trips themselves. On the other hand, if a teacher has a had trip foisted upon them and knows little about the venue or subject, it is far more likely that they would want to engage the expertise of staff members during the trip.

As a practitioner of science communication, and someone who has worked as an explainer in visitor attractions, as well as producing pre and post visit materials for science learning venues, I was particularly interested in finding out what influence

such resources make to school trip learning. A number of studies have looked at the influence of various teacher practices on school trips including choice of tour and whether to undertake trip related activities in the classroom, but none had investigated how such practices might affect children from different backgrounds in differential ways - something I have attempted to remedy in my research.

Over this chapter I have set out to address the third of my research questions, *"What role do teachers' practices play during school trips in relation to meaning making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capital?"* Given the limitation in the information available to me, in answering this question I focussed on three elements of teachers practice; tour selection, workshop participation and the undertaking of pre-visit activities. As they both involved interaction with non-formal learning staff, tour type and workshop participation are discussed together, separate from preparatory activities.

6.11.1 Preparatory activities

In this study two categories of preparatory activities were considered in line with those discussed in the literature review – venue familiarisation techniques and linked, topical classroom work. It is now common practice for education teams of non-formal learning venues to create and distribute materials to schools to support their visits. This tends to take the form of linked lesson plans, but some venues also provide video or slide show introductions to their venue. Such materials may be sent out to the schools as part of the booking process or in some cases are open access through the organisation's website. However, across the board, uptake of these pre and post-visit materials is reported to be poor even though research has found that use of such materials increases the learning achieved during school trips (Cox- Petersen & Pfaffinger, 1998; Kisiel 2016; Storksdieck 2006).

Due to a focus of my project being around prior experience and knowledge and the influence this may have on school trip learning, and because I was surveying students directly after their aquarium visit before any post-visit work would have

been conducted, I was most interested in the role of pre-visit materials on aquarium trips. My quantitative findings supported those of the previous studies, revealing that pre-work was found to increase the learning achieved during the trip across all three learning measures.

Given that it seems to be fairly accepted knowledge that both associated classroom work and venue familiarisation techniques increases the learning potential of a visit, it was particularly interesting to establish the reason that only three of the six schools had opted to undertake such activities. I had expected teachers to explain their decision in terms of a lack of available classwork time before the trip, and this was indeed one of the reasons the teachers gave. However, teachers also reported making an active decision not to undertake pre-work as they felt it was detrimental to the overall experience of the trip, removing an element of surprise which was believed to be detrimental to, as discussed previously, the teachers referred to as the '*awe and wonder'* of the trip. This interpretation of pre-work from teachers was completely unexpected and is arguably another key finding resulting from my research.

As discussed in Chapter 5, 'awe and wonder' seems to be somewhat of a buzzword phrase in education, likely stemming from an OFSTED report (OFSTED, 2004). It would appear that teachers are interpreting the concept of '*awe and wonder'* specifically as surprise and, as such, are structuring their trip practice around the idea that the less a child knows about a venue before they go, the more exciting and special it will be for them. This might offer an explanation as to why, as discussed previously, teachers appear to believe that a child who has been to a venue before could be at a disadvantage when they repeat that experience as part of a school trip.

What is particularly interesting here is the apparent discord between theories around 'awe and wonder' and previous research into the 'novelty effect'. The excitement and surprise that teachers appear to believe is the optimum conditions under which to attend a trip, aligned perfectly with the emotional conditions that Falk and Dierking describe as being detrimental to a child's learning. The 'novelty effect' theory proposes that the unknown can result in nervousness and a general

lack of ability to focus, which distracts from ability to listen and learn. As discussed in Chapter 5, and above, teachers were able to provide examples of where children who hadn't been to an aquarium before displayed such behaviours, describing them as "*leaping and jumping*", compared to the calm manner with which more experienced students moved around the aquarium, taking time to stop and look at things. Teachers did not however appear to make a connection between this difference in behaviour and differential learning or experiential outcomes, and certainly did not perceive novelty behaviours as a potential disadvantage.

If the overall aim of the school trip is affective learning, then it is of course possible that the excitement of the unknown may be most conducive to that meeting that goal. If, however, cognitive learning is the goal, as was confirmed to be the case by almost all the teachers, then preparation and familiarisation are likely to be more beneficial. This apparent contradiction between the teachers' reported values towards trips and their actual practice in delivering trip, leads to me to make a further recommendation for the teacher training around school trips to include advice for teachers to use agenda for trips to guide their practices around preparatory activities.

Whilst my quantitative data could not provide any evidence of a link between low prior experience of non-formal learning and reduced cognitive gains during the aquarium trip, it did provide evidence that the children from lower SES households had the least experience in these kinds of venues. Whilst it is not witnessed in my own results, if the novelty effects was to have a detrimental effect during aquarium trips, say on affective learning not investigated in my study, it therefore stands to reason that would be children from less privileged households who would be most affected as they have less prior experience. As preparatory activities, particularly venue familiarisation techniques, are found to minimise the novelty effect, not employing such activities could be viewed as a social inequality issue, further disadvantaging children from lower SES households who have less non-formal learning experience. This potential phenomenon, particularly the influence on affective learning, would benefit from further research.

6.11.2 Workshops and tours: interactions with non-formal learning staff

Before I began this research, I wrongly assumed that, when the choice was available, teachers would always opt to have venue staff take a big role in trips whether that be as a guide or running an activity such as a workshop. Whilst there is no question that guided experience are more popular at the NMA (as explained in the methodology 85% of schools eligible for the study opted for the 'interactive' staff member guided tour of the aquarium) some teachers were able to provide compelling reasons why they preferred to act as the tour guides themselves. These included wanting to avoid a more formal lecture style of learning experience, believing that smaller groups were advantageous and that it allowed children to manage their own learning depending on their interests. Teachers who chose guided experience on the other hand always explained their decision in terms of the extra knowledge that came from having the aquarium staff members expertise as part of their trip. This could be read as teachers making their decision on tour type based on whether they were prioritising cognitive or affective outcomes and would align with Stronck's 1983 research which suggested that guided tours tended to offer better learning outcomes whilst overall experience was better in less structured non-formal learning experiences. My findings therefore contradict the more recent Cox-Petersen et al. (2013) and Heimlich and Meyer (1999) studies which found the opposite to be true.

The results of my quantitative analysis in this area provided some evidence to suggest that this was true for the aquarium trip. For all three of my learning measures, students on the guided aquarium tours appeared to learn more pre to post visit, although this was only found to be a statistically significant difference for change in conservation knowledge. Where mean enjoyment level of trip was concerned, students who participated in teacher-led tours of the aquarium were found to report a higher level of enjoyment than those on the staff member guided tours, although this was not a statistically significant finding.

The other keyway that students interact with aquarium staff members was during participation in one of the aquariums education workshops, which three out of the six schools booked as part of their trip. Where analysis for learning and enjoyment

was run for this variable, children who participated in a workshop were found to demonstrate a greater increase in learning across all three learning measures (statistically significant for conservation and marine environment scores) but also reported a higher mean level of enjoyment of the trip (not statistically significant). This would suggest that perhaps it is the formal nature of the lecture guided tour which is off-putting to some students and that interacting with staff in a different, less formal, more hands-on way could be the ideal compromise, allow students to benefit from the expertise knowledge of the aquarium staff but in a non-formal learning style. This would align with the findings of Cox-Petersen et al. (2013) and Heimlich and Meyer (1999) that a middle ground should be found between guided tours and self-exploration. I would recommend where possible that further research in this area creates a third test group where students move freely through the aquarium with their teachers, allowing them to chat freely with each other and allocate their time depending on their interests, but who also undertake workshops or presentation with aquarium staff at some point during their visits. This information could be used by non-formal learning venues to create the most effective school trip experience which meet cognitive and affective learning goals.

6.11.3 Teachers practices around social inequalities

To fully answer my research question, it was important for me to consider how teacher choices around the running of school trips may influence children from different backgrounds in different ways. I attempted to do this using General Linear Models to look for relationships between the learning measure scores and interactions between teacher practice variables and key demographic variables. Unfortunately, only one GLM, that for the Shark Species learning measure was viable to use. This model suggested that different age groups benefit differentially from being exposed to pre-visit activities, with ten years seemingly benefitting the most and nine-year olds the least and that girls may benefit more from pre-visit activities than boys do, which if true would widen the gap in learning which already falls in the girls favour. Perhaps more interesting however is the lack of evidence to suggest any significant interaction between teacher practices around trips and the SES or prior experience indicator variables. This was particularly surprising as

I had set out expecting to find a relationship between pre-work and prior-experience and that students from lower SES groups (who we know have less experience of non-formal learning venues) benefitting more from preparatory activities. However, this is not a hypothesis that is supported by my data.

The major limitation in this part of my research was that the lack of validity in my GLMs for conservation and marine environment learning measures which meant I could not look for interactions for these specific learning tasks. There is also an issue around how the treatment groups were set up with each measure (workshop or not, guided tour or self-led) being assigned to a whole class. Since we know each class will have been exposed to very different sets of conditions, validity could have been improved by each participating class being split into different treatment groups. Even though my results did not find any correlation between pre-work, prior experience and SES, I believe that this is an interesting area of research which would require further studies, ideally with participants coming from a wider pool of schools, to corroborate or deny my findings.

6.11.4 Building relationships between formal and non- formal learning

Some criticisms of school trips have included a general uncertainty of the pedagogy of trips from both formal and non-formal educators' perspectives, poor synergy between their agendas and a general lack of understanding of what the other party wants to get out of the trip experience (Griffin, 2004). Tran, and Allen and Gutwill, both espouse the need for stronger links between teachers and non-formal learning venues, recommending the development of a shared pedagogy and even shared professional language where non-formal learning is concerned. (Allen & Gutwill, 2014; Tran, 2007). One practical method of working together would be for teachers to have a say in the content of the activities and materials that are available to them and their students during school trips. For various reasons including logistical, financial and habitual convention, this has not traditionally been the case, which could be one factor in why pre-, post- and even during-trip materials tend to be poorly taken up by schools. (Cox-Petersen & Pfaffinger, 1998; Kisiel, 2016;

Storksdieck 2006). If teachers were involved in the process of creating such materials, then it is possible that they would be more useful and appealing rather than teachers seeing them as just 'creating extra work' for themselves. In an ideal world, materials and activities would be bespoke, with teachers having direct input for their school trip, however this is not realistic unless venues opted for sustained engagement with only a very small number of schools (Kisiel, 2014, 2016).

In the discussion sections 4.11.5 and 5.11, I set out my evidence corroborating the calls by Gupta et al. (2010), Kisiel (2016), Storksdieck (2001) and Tal and Morag (2009) for educators to be offered formal training in the pedagogy, management and delivery of school trips. The existing literature and my own interviews suggest that teachers are open to, and in some cases even eager for, such training (Kisiel, 2013, 2016) and that there is a willingness from non-formal learning venues to be involved in this. Non-formal learning centres commonly offer professional development sessions, although there is not always a good take up rate for these offerings (McLeod & Kilpatrick, 2001). Exploratorium, a US-based science centre and arguably one the most eminent non-formal science learning venues in the world, annually engages 10,000 teachers from 37 states in their teaching and learning programs (Behrendt & Franklin, 2014). In their 2001 paper, McLeod and Kilpatrick outline various examples of formal and non-formal science learning partnerships. Such partnerships included the CLUSTER project, a model which linked the New York Hall of Science with a local teacher training college to support the training of pre-service teachers, and the Orlando Science Centre's teacher residency, where teachers spend up to 2 years working within the centre to developing their non-formal learning skills and create education materials for the centre. The Orlando Science Centre also has a less intensive ambassador programme where teachers get a free annual pass to the centre along with access to professional development sessions in return for acting as a liaison between the centre and local schools (MacLeod & Kilpatrick, 2001).

Kisiel reports a general desire by non-formal learning institutions to move beyond only hosting one-off, annual visits and to build stronger relationships with educators. Kisiel also notes, however, that teachers tend to be unaware that such venues have anything extra to offer schools by way of support (Kisiel, 2013). It

would, therefore, seem that non-formal learning centres have a responsibility to further promote their range of educational offerings, perhaps through the avid teacher users as demonstrated by the aforementioned ambassador scheme (Kisiel 2014, 2016; McLeod & Kimberly, 2001). For such relationships to be a success it is important that there is a strong desire for success on both sides and good communication between both parties (Kisiel, 2014). My specific recommendations on how teachers and aquariums could work together are provided in section 7.6.

Chapter 7 – Conclusions

7.1 Introduction

In this final chapter I will bring together the findings from my three supporting research questions (questions two, three and four) to address my overarching research question, "*Are school trips to non-formal learning venues a potential source of replication of educational inequalities*". To assist in this process, tables 7.1 and 7.2 provide an overview of my quantitative and qualitative findings.

I will then go on to outline the strengths and weaknesses of my study as whole and how my findings relate to the theoretical framework on which the study was based. I will conclude the chapter, and my thesis, by making some recommendations for both professional practice in the area of school trips and future research in this area.

7.2 Summary of Research Findings

7.2.1 Research question 2

What role do social factors such as ethnicity, gender and social class have on learning during such trips and do teachers recognise, and mitigate against, inequalities in this area?

From my quantitative findings, social factors did appear to have some influence on learning achieved during trips to the NMA. Gender and ethnicity were both found to have some significance on the concept-based learning that occurred during the trips. What was unusual about this finding, however, was the direction of the effect with girls outperforming boys and children from BME backgrounds outperforming white children. Another unexpected result was that no link was found between SES status and learning at the individual level. A potential correlation was, however, found at the school level, with children from higher MDI-decile schools appearing to learn more during trips than those from lower-decile schools. Whilst no statistically-significant differences were found for the other demographic variables (nationality, EAL status, pupil premium and free school meal status), it is important

to acknowledge the relatively small sample groups involved in some of the variables and the limitations of the SES proxies that were used. Whilst previous studies on conceptual learning have been undertaken at the NMA, this was the first to consider the potential influence of social factors in this setting and will provide useful insight to the education team at the aquarium when planning resources and activities.

Teachers participating in the study appeared to be relatively unconcerned about the potential influence of social factors on trips and so, understandably, did not report taking any measures to mitigate against any potential inequalities. When pressed, most could come up with specific examples of where social factors might have influenced a student's trip experience, but overall this was not something which the teachers appeared to take into account when planning and executing trips.

7.2.2 Research question 3

How does prior exposure to such venues effect subsequent experiences and learning processes for students on school trips to an aquarium? How might prior experience act as a form of cultural capital, underpinning differential learning outcomes from the aquarium experience?

My quantitative data found no statistically-significant relationship between prior experience of non-formal learning venues and cognitive learning during the school aquarium trips. Therefore, I cannot make any assertions about prior experience of non-formal learning in *itself* being a form of accumulated cultural capital and having an influence on school trip learning. This was the first study to investigate the role of prior experience on learning, not only specifically within the NMA, but also on school trips to an aquarium setting more generally. Testing this hypothesis around prior experience and cultural capital involved the development and application of a scoring system that awarded points for both the number of non-formal learning visits as well as the types of institutions visited. Whilst this scoring system was not fruitful in proving any link between prior experience and learning

in this particular study, it may be useful for it to be trialled in future studies at the NMA or in other non-formal learning institutions.

7.2.3 Research question 4

What role do teachers' practices play during school trips in relation to meaning-making and learning processes for students with different backgrounds, particularly those with reduced prior experience and/or capital?

My quantitative data proved that teacher practices, and particularly their choices around preparation for and delivery of the aquarium trip, were found to have significant influence on the learning achieved during the visit. I found some evidence to suggest that children on guided tours of the aquarium, those who undertook workshops and those who undertook linked, pre-visit classroom work may have learnt more during their NMA trip compared to those who did not have access to these resources. As table 7.1 outlines however, this influence varied depending on the aquarium-related concept being tested for. Previous studies into tour types and pre-work have found similar effects at play in various types of non-formal learning venues, but this was the first time such research has been conducted at the NMA, the largest and arguably the most important aquarium in the UK from an educational perspective. Findings in this particular area of research should be useful to both the aquarium education team and, if disseminated correctly, to teachers who are planning trips to the NMA.

Interestingly, I did not find any evidence to suggest that children from different backgrounds benefited differently from the school trip teaching practices considered in the study. This could be viewed as a positive outcome suggesting that teachers' choices around tour types, workshops and pre-work do not create inequalities in trips between students from different social groups. I believe that this particular area of study, looking specifically at how teachers' practices during school trips to an aquarium may impact the learning experience for different social groups, was relatively unique and contributes to the body of literature on school trips.

Table 7.1 Overview of major quantitative findings

	Age (in years)	**Gender (male or female)**	**Ethnicity (White or other)**	**Pupil Premium Eligibility (yes or no)**	**Free school meal eligibility (yes or no)**	**MDI of school**	**Prior experience (higher or lower than overall average)**	**Tour type (guided or teacher led)**	**Preparatory activities (linked pre work, venue familiarisation or none)**	**Workshop attendance**
Change in shark species	Older	Females	BME backgrounds	No	Yes	Higher deciles	Lower than average	Guided	Linked, topical pre-work	Yes
Change in Conservation	Older	Females	BME backgrounds	Yes	Yes	Higher deciles	Lower than average	Guided	No- prework	Yes
Change in Marine Env.	Older	Females	BME backgrounds	No	No	n/a	Lower than average	Guided	Linked, topical pre-work	Yes

The table above provides an overview of all analysis against the three change in knowledge measures pre to post visits. As well as identifying which of the variables were found to result in statistically significant changes to the learning measure score (those shaded grey), it identifies which of the categories within each variable demonstrated the greater ***increase*** in knowledge pre to post visits

Table 7.2 Overview of major qualitative themes and sub-themes arising from teacher interviews

School Trip Learning	**Prior experience of non-formal learning**	**Influence of Teacher Practice**
Learning is a key objective of school trips	Teachers believe school trips are a levelling tool, providing some students with non-formal learning experiences	The teachers' preference seemed to be to not undertake preparatory work with the children and to undertake post-visit activities if any linked work was to be undertaken
School trips must have clear, curriculum links	Teachers did not see lack of prior experience of non-formal learning as a particular disadvantage on during school trips	Teachers appeared to believe that undertaking pre-visit activities may spoil the trip by detracting from the 'awe and wonder' of the aquarium visit.
Teachers are easily able to recognise and provide examples of cognitive learning taking place during trips	Teachers felt that prior experience may be a disadvantage as it could spoil the 'surprise' of the subsequent school trip	Teachers who elected for guided aquarium experiences believed the aquarium staff offered an extra depth of knowledge.
Teachers recognise, and value, the other forms of learning which occur during trips – but not to the same extent as cognitive learning	Teachers did not, in general, deem it necessary to undertake any kind of special preparation with children with reduced non-formal learning experiences	Teachers electing for self-led trips believed the overall experience may have been better for the students as it was less formal but conceded the children probably learnt less on this type of tour
Teachers were able to provide limited anecdote of where social factors might have influenced learning on trips but didn't see this as a major concern.	Even when behavioral differences in children who had not been to an aquarium before were identified, teachers did appear to believe this would influence learning during the trip	Regardless of their choice of tour, all the teachers viewed aquarium staff members as a valuable resource during their aquarium trip.

7.2.4 Research question 1

"Are school trips to non-formal learning venues a potential source of replication of educational inequalities?"

Given that the overarching aim of this thesis was to address the lack of research into how inequalities may be influencing the learning experience for students visiting aquariums on school trips, Bourdieu's social reproduction theory was the obvious choice for my theoretical framework. I wanted to establish whether school trips were benefitting some children more than others depending on their demographic background or their prior experience of non-formal learning, reproducing pre-existing inequalities in education by widening the gap between those with experience (or capital) and those without. Going into this study, the anecdotal experiences that inspired my research led me to hypothesise that school trips could be a source of inequality, but that equally they, along with other forms of non-formal learning, had the potential to be used to address inequalities by engaging non-traditional audiences in education.

Collating the results of the three supporting research questions provides an answer to my overall research question, and I believe I have found some evidence to suggest that school trips can indeed be a source of inequalities, but perhaps not with as great a negative effect as might have been expected. Whilst my results do not appear to prove any link between prior experience and learning achieved during aquarium visits, there is some evidence that gender, ethnicity and socio-economic status do influence aquarium learning outcomes but this appears to fall in the favour of both females and ethnic minorities, two groups which are more often aligned with disadvantage. The influence of socio-economic status, the basis of social reproduction, was a little less clear-cut, with significant influence only being found at the school level rather than at the individual level.

Perhaps the most interesting aspect of potential school trip inequalities comes from the attitudes and practices of the teachers involved in organising the trips. Whilst

they were found to be very positive about trips and to have conviction that learning is occurring, they don't appear to be concerned about potential inequalities around social factors or prior experience and so, understandably, are not taking any action to mitigate against these effects. In the context of my own study, which found very little evidence of social factors influencing children's trip learning, this approach by the teachers seems entirely reasonable. However, concern over lack of recognition and mitigation actions may still be warranted given that many previous studies have found social factors to have an impact on the overall school trip experience.

7.2.5. Incidental conclusions

Whilst not part of the key research questions, an important finding for this study was the evidence to suggest that the NMA is meeting its goals of education, specifically in imparting information on marine conservation issues. As discussed in the findings for Chapter 4, on average, pre- to post aquarium visit, children demonstrated a statistically-significant increase in scores across all three knowledge measures, including the conservation-specific gauge. It would, therefore, appear that this aquarium, at least, is successfully educating their young visitors on both marine conservation issues and the marine environment more generally. As my evidence for this particular result comes from a rigorously-tested, substantially-sized, quantitative data set, I believe that my findings add weight to the NMA's claims that they are an educational site and are raising awareness of conservation issues. I also hope that my work goes some way towards refuting any claims of aquariums being only entertainment venues and being overzealous in their claims around their educational value.

Arguably, some of the most interesting findings in this study came from the teacher interviews and were not directly linked to the answers to the research questions. These surprising findings emerged during questioning around the teachers' thoughts on the children's prior experience of non-formal learning venues and suggest a potential discord between teachers' reported aims and values for school trips, and the practices which they use to deliver them.

Whilst most of the teachers reported a primary goal of learning, and specifically classroom-linked, cognitive learning, for the trip, some also appeared to be pre-occupied with inspiring '*awe and wonder'* in their students. Teachers appeared to be associating awe and wonder with surprise and 'the unknown' and therefore reported that they were actively avoiding doing pre-work or venue-familiarisation activities, so that the children would be as surprised as possible on their arrival at the aquarium. As previous literature and, to a small degree, my own research has shown, pre-visit activities can be a useful tool in increasing the learning potential of trips, so it would, therefore, appear that the teachers' choices are more aligned with enabling awe and wonder rather than meeting their purported goal of conceptual learning.

Awe and wonder also seemed to be at the core of another unexpected finding, with some teachers expressing a belief that a lack of prior experience of a venue was actually beneficial to children during school trips. As the existing literature points towards students learning the most on repeat visits, it was expected that the teachers would recognise there to be a potential disadvantage to children who were attending a venue for the first time during their school visit. Instead, teachers again seemed to be focussed on the 'surprise and amazement' aspect of the trip and expressed how unfortunate they felt it was for the children who had been to the aquarium before not to be experiencing it for the first time. Whilst some teachers reported witnessing novel behaviours in their students who were attending the aquarium for the first time, they did not appear to associate these with being potentially detrimental to learning. Whilst my own quantitative data did not find evidence of relationship between prior experience and learning, previous studies have proven such a link and so it was surprising that teachers did not appear to be concerned about how this may be influencing their trips.

The conclusions I have drawn in answering my research questions have led me to make a number of recommendations regarding professional practice around school trips for both formal and non-formal educators. These are presented in section 7.6.

7.3 Strengths of this research

By considering the positives and negatives of the work that had gone before mine, I have attempted to build various strengths into my own research in terms of the research design and methodology.

I believe one of the main strengths of my research has come from its mixed methods design. By utilising both quantitative and qualitative methods I was not restricted by the limitations of either and was able to answer my research questions in a more comprehensive way. As has already been stated, there is a current trend for qualitative based educational research and much of the research considered in my literature review followed this pattern, with very few utilising both qualitative and quantitative methods. Given my backgrounds in the natural sciences it was natural that I would be drawn more to quantitative methods and it is probably true to say that I could have superficially addressed my research questions using only survey data and statistical analysis. In practice however it has been the inclusion of my qualitative methods which have resulted in some of the most unexpected and interesting of my findings.

This brings me to another perceived strength of the study, providing a space to hear the voices of teachers and their thoughts about school trips, something that I found to be quite limited in my review of the existing literature. Whilst previous studies in this area have investigated the role teachers play on trips, few have actually asked for and analysed teacher's opinions and values on school trips, particularly in an aquarium specific setting. Given that the data that came out of the teacher interviews was so fruitful, the relatively small number of teachers involved in the study became a limitation of the study, something that is discussed in the section 7.4.

Conversely, the sample size of approximately 250 for the quantitative data can be viewed as somewhat of a research strength. Whilst other related studies have included much bigger samples, for example the work of the Enterprising Science team or Jensen's 2014 zoo-based study, others have involved sample sizes of as little as 30 participants (Bowker, 2007). A sample population of 255, and over 500 drawings, made for a breadth of data that supported statistical analysis and for

generalisations to be made. Even with this relatively large sample size there was still some limitations within the data set, this is also discussed in section 7.4

Whilst my research was not unique in using drawings as a tool to analyse children's learning, I do still see this method as a particular strength of my project. The drawings provided both depth and breadth to my study, being a rich source of data in the first instance, something that could be analysed at various levels, but which could ultimately be converted into quantitative data for statistical analysis. Perhaps its biggest strength however is its child centred nature, providing the young participants with an activity that was hopefully more enjoyable than simply filling out survey answers (and so hopefully reducing the effect of survey fatigue) and provided children with less developed literacy skills a chance to convey their thoughts on the marine environment. A good example of this is occasions where children chose, or were not able to, list conservation issues within their open-ended questions - and so would have scored zero for that particular knowledge measure - but did draw images of oil spills or fishermen hunting sharks - hence earning marks.

Throughout the lifecycle of this research I have had ongoing dialogue with non-formal learning institutions, including the aforementioned Exploratorium, which has revealed a demand for more research in the area of school trips. Whilst such literature does exist, I believe mine is relatively unique in its positioning within an aquarium setting and certainly the evidence to suggest that conservation education goals are being met will be of interest to aquariums, and zoos, more generally. Perhaps most importantly, I believe my research is the first to investigate school trips to an aquarium from a sociological perspective and I hope that my research will provide a useful contribution to knowledge into the role social factors may be playing on school trip learning. I believe my research has created a platform on which other research can build, this will be discussed in section 7.5

7.4 Limitations of research

Whilst there were a number of strengths to this research, there was also several limitations which must be acknowledged.

As noted in the introduction, one limitation of this study was the restriction on where field work was conducted. Due to the collaborative nature of project, the research site was fixed as the NMA in Plymouth and in many ways, this was an excellent site in terms of access and support for the research. Given the NMA's iconic status as the largest aquarium in the United Kingdom, it is a very extremely worthy of study and there was much to be learned from its school visits program. Devon however is not an area known for its diversity in terms of ethnicity and culture and this is reflected in the demographics of the visitors to the NMA and therefore in my research population. This lack of diversity diminished the claims I could make about my findings around the influence of ethnicity on trips and may have prevented the emergence of findings around nationality and English language status.

Whilst sample size was relatively large for my quantitative data, as touched upon in the previous section, the opposite was true for the qualitative research. As the importance of the teacher interview data grew throughout the analysis stage, it became clear that having interviews with only seven teachers from the six participating schools, was a limitation to the study. Whilst a number of themes did emerge from the interviews, I believe that more participants would likely have resulted in more revealing findings and may have allowed for generalisations to be made.

Another limitation of the study was around my ability to effectively engage research with theory, primarily due to the lack of a responses to the parental surveys. As well as being a concept that was being investigated within my research, Bourdieu's cultural capital provided a framework on which to base my research. Whilst I believe that cultural capital provided a solid foundation for my work, I was less successful in operationalising it, being unable to find any evidence of visits to non-formal learning venues acting as a form a capital. To rigorously test this theory would have required more information about each participant's family backgrounds and experiences. Due to the age and limited access I had to the young participants, I was dependent on the parental surveys to gain such information but the low return rate of just 13% prevented this aspect from being included in the study in a meaningful way.

Similarly, age and access to participants influenced the types of learning that could be investigated within my research. Many studies have proven that is it possible to measure affective learning through surveys, however the age of my participants and the limitations in their literary skills, would have made it very difficult to assess this is a rigorous and meaningful way. Affective learning would have been more efficiently investigated with my chosen age group using qualitative methods such as interviews or focus groups. During initial discussions with teachers during the pilot research stage, however, it became clear that teachers would be less willing to commit their students to a study which would involve interviews or focus groups due to the additional time this would keep students away from regular class activities and the extra levels of consent that would have be to arranged for me to work with students one or one or in small groups. The combination of these factors meant that it was most appropriate for me to focus solely on cognitive learning but, as described in the literature review, it is acknowledged that this is not the only form of learning that occurs during school trips.

If I had known more about the participants before the trip, and was therefore able to observe for differences in the behaviours or dialogue between students with and without prior experience, or indeed any difference in how teachers worked with students from these differing experience levels, I believe observation could have proved a much more important part of my research toolkit. I believe that in a smaller study, less focussed on working with the large numbers of participants I wanted for robust quantitative analysis, more could have been learnt about participants prior to the visit and individuals with higher and lower levels of non-formal learning experience could have been identified and targeted during observations. I still believe that observations were an important part of my overall methodology even if not directly used as a source of data the same way as my interviews and questionnaires.

7.5 Recommendations: Future Research

As explained in the previous section, my research was somewhat constrained the by both external factors and my own methodological choices. Considering both the

strengths and limitations of my work, I would make the following recommendations for future research in this area.

Future studies should, where possible, aim to draw their participants from a wider and more diverse community. This is probably best achieved by considered selection of the location in which is the research site is based and could involve sampling at more than one non-formal learning institution. For research sites where visitor profiles are more diverse overall, random sampling may gather a diverse enough research population but targeted approaches to certain schools could also be utilised. Where there is a larger pool of visiting schools to sample from, it would also be recommended that future research only worked with schools who met all the requirements of the study, namely that they were able to conduct surveys at the venue, immediately before and after their visits.

Whilst overall, I believe that 250 participants was an appropriate sample size for this research, I believe that future studies would benefit from working with a bigger range of schools. Ideally more than one school should be present for each MDI decile represented in the study to allow stronger claims to be made regarding potential differences between various deprivation levels. For the same reason children from each age group represented in the study should also be coming from more than one school.

Where possible, future studies should attempt to overcome the barriers which prevented me from undertaking focus groups or interviews with my young participants. This could potentially be achieved by offering schools free or supported visits to non-formal learning venues in return for more intense participation in the research. Such an approach could open up the research to evaluate affective learning and may enable a deeper investigation into cultural capital through gaining a better understanding of the child's background. However, as previously discussed elsewhere in the thesis, targeting schools to entice them into visit a non-formal learning institution would have ethical implications which would need to be carefully considered before taking such an approach.

During the course of my data collection and analysis, a number of interesting themes arose that were outwith the scope of my own study but could be considered for future research projects.

I believe there is potential to look more into the role teachers play during school trips from a sociological perspective, specifically looking at the shift in power dynamics involved in teachers handing over their classes to non-formal educators such as aquarium tour guides. Anecdotal evidence from my time with teachers suggests that they tend to fall into two camps, those who are relieved to hand over the responsibility of being in upfront and gladly move to a backseat role during their tour and those who struggle to relinquish the leader position. In my interviews with them, aquarium staff commented on this polarisation within visiting teachers and how they feel it influences the type of tour they are able to deliver. The relationship between formal and informal educators has been investigated in other studies but not within an aquarium setting.

I also believe there is potentially rich data around teachers' own childhood out of school experiences and how this goes on to shapes their teaching practices. Previous research has looked at how teachers own experience influences the frequency of school trips they lead and their general attitude towards trips, I believe it also plays into the decisions they make around where to go and what format the trips should take. For example, anecdotes from my own research suggests that the reason one teacher avoided taking her students to zoo was her experience perceiving animals as being trapped and distressed behind bars during a school trip. Another teacher refrains from using worksheets during her classes trips due to her own experience of being bored by such an activity during a childhood trip to a museum.

I believe that it would be enlightening to undertake an aquarium based action research style project comparing three types of non-formal learning experience; staff member guided tours, teacher-led tours and a hybrid experience involving teachers leading students around a set tour route with scheduled points where staff members deliver short presentations or workshops to students. Learning achieved and attitude towards the trip could then be compared across the three tour types,

with the aim of ascertaining which can best promote learning and enjoyment for participants.

Finally, I believe it would be interesting to compare different aquariums in terms of the conservation learning achieved by students visiting these institutions on school trips. For instance, the school trip experience offered at the NMA could be compared with one or more other aquariums, particularly those with more hands-on interactive content and a greater focus on entertainment. Whilst I recommend the use of drawings as a research tool, I would also advise the use of observations to monitor how children choose to divide their time between interactives and aquarium tanks.

7.6 Recommendations: Professional Practice

The outcomes of this thesis have led me to make the following recommendations to formal and non-formal educators involved in the professional practice of designing, delivering and evaluating school trips. Whilst I am making recommendations specifically around aquarium trips, some of these could also be applied to zoos and potentially to other kinds of non-formal learning venues as well.

First and foremost, I would recommend that there needs to be a greater synergy between schools and aquariums, with schools having more input into the aquariums' educational offerings and aquariums offering more than just a venue for isolated, one-off visit experiences. Teachers should be actively involved in the development of aquarium education programmes in terms of the content and how they link, not only to the curriculum, but also to the delivery method. This would ensure that aquarium trips were meeting the needs of teachers and their students as well as the mission and aims of the aquariums themselves.

As some teachers appeared to be undecided about which tour type was best for their students, a practical change which aquariums may wish to consider is supplying a third option of tour-type. This tour would sit somewhere between guided and self-exploration, where staff are positioned around the aquarium to deliver short speeches and answer questions, but students and teachers are still able to set their

own timescales and agenda. When building new centres, aquariums could look at the design of their education-specific spaces and how they could be less classroom-like and feel less removed from the tanks and animals, which the teachers see as the main draw of the visit. For existing aquariums this could possibly be achieved by delivering some of their school shows and workshops on the aquarium floor itself, so that children could learn whilst surrounded by the exhibits rather than in a setting that feels similar to their schools. This may sound impractical, but as most aquariums are also set up for corporate events and weddings, there is often ample space to have tables and chairs in front of tanks and under viewing tunnels. This would alleviate teachers' concerns expressed in this study about not selecting additional workshops as it meant time "stuck in a classroom".

Another area where formal and non-formal education could build connections is in the training of teachers in the management and practice of trips. In this thesis I have outlined instances where this kind of training has been provided by non-formal learning institutions such as museums and science centres and I would encourage aquariums to follow suit. None of my participants reported having any formal training in this area, having instead learnt '*on the job'* by watching the practice of fellow teachers. Given the importance that is placed on out-of-school experiences by education bodies and by the teachers themselves, this lack of formal training feels imprudent. I would recommend that training in school trips should be made a required element of continuous professional development and/or integrated into pre-service teacher training. Such training should include school trip pedagogy as well as more practical advice on best practice around trips, such as using the agenda for the trip to dictate practical decisions on how the trip should be run. For instance, when it is best to use a staff member guided experience versus free exploration, based on the outcomes the teacher wants from the trip. Non-formal learning venues are well placed, not only to advise teachers on how to get the most out of trips to their home venue, but also on how to use non-formal learning resources more generally, as many school trip practices are transferable to all kinds of different locations. To improve uptake of any such training offered as professional development, it would be important for such courses to be accredited to ensure they were a worthwhile use of teachers' time.

Arguably, the most concerning finding of my study was the idea that teachers may be viewing prior experience of non-formal learning venues as a disadvantage rather than acknowledging the potentially detrimental role of the novelty effect. It would therefore be my recommendation that aquariums provide information to teachers on the novelty effect and its potential to disrupt learning either as part of the aforementioned training or even as part of the standard booking process. Under cultural capital theory, is possible for parents to be building capital during family visits to non-formal learning venues through the demonstration of visit related skills and by generally fostering appreciation for this form of learning. It therefore should also be possible for teachers to convey such skills and build this appreciation in the classroom. Aquariums could encourage and support schools to assess whether any of their students may be lacking in trip-associated experience and skills. They could provide pre-visit materials aimed at bridging the gap in experience, such as stories, videos or even interactive games that demonstrate the importance of observation during trips, including reading labels and asking questions. This could be treated as a third form of pre-visit activity, not topically-linked to lessons or specific to the venue being visited, but rather the teaching and practice of trip-specific skills. In this way aquariums and teachers could work together to prepare students and go some way to levelling the playing field between those with experience and those without, but whilst still retaining the surprise 'awe and wonder' moments of the unknown elements of the trip.

Whilst it is not the case for the NMA, some non-formal learning venues, particularly in the United States, do offer free passes to students from low SES backgrounds to return to the venue with their families after the school trip. A simple act to counter the novelty effect and create a level playing field in terms of prior experience may be for such centres to issue these free passes to students in advance of the school trip. Whilst it is recognised that ticket cost is not the only barrier to entry of such venues, supplying the ticket before the trip may have more positive outcomes for student learning than having the same ticket supplied post-trip.

Finally, I would also recommend that aquariums consider using children's drawings in their evaluation programs for both school trips and the general public, as these produced rich, detailed data which can capture a range of different issues with only

minimal prompting. I plan to make my aquarium-specific scoring system freely available and it is, in fact, already in use in one other UK aquarium. Furthermore, this scoring system can also be adapted for use in other kinds of non-formal science learning activities and is already being used by an educational charity to evaluate science shows. This leads me into how I plan to disseminate my findings.

7.7 Dissemination of findings

As a practitioner of non-formal science learning, and particularly in my role as creating education materials for non-formal learning institutions, my research is already having impact in the wider world through its influence on my own work. However, it is my hope and my intention that my findings will have impact beyond my own practices.

Whilst no two non-formal learning venues, or indeed no two aquariums, are the same, some of the findings raised in my thesis should be relatable to a range of venues that host school visits. Similarly, and without appearing to claim complete generalisability, I expect that my findings around school trips will resonant for many teachers. There is clearly an existing demand by informal science learning venues for new research in the area of school trips and so it is my intention to submit articles to publications relevant to both the teaching and non-formal learning communities such as Education today, the Association of Zoos and Aquarium's Connect magazine and the Science Education journal. I have already been invited to have my findings circulated in the Scottish Schools Education Research Centre (SSREC) teacher's newsletter and I will look for other similar lines of dissemination with other related organisations. Finally, it is also my aim to present on my findings at relevant conferences such as the Association of Science Educators, the Primary Science Network and the British and Irish Association of Zoos and Aquariums annual conference.

References

Adelman, L. M., Falk, J. H., & James, S. (2000). Impact of National Aquarium in Baltimore on visitors' conservation attitudes, behaviour, and knowledge. *Curator: The Museum Journal*, *43*(1): 33-61

Ainsworth, H.L. and Eaton, S.E. (2010) *Formal, Non-Formal and Informal Learning in the Sciences*. (Report No. APR2018) Canada. (ERIC Document Reproduction Service No. ED511414).

Alexander, K. L., Entwisle, D. R. & Olson, L. S. (2007) Lasting consequences of the summer learning gap. *American Sociological Review*, 72 (2): 167-180.

Allen, S., & Gutwill, J. (2004). Designing with multiple interactives: Five common pitfalls. *Curator: The Museum Journal*, *47*(2), 199-212.

Alon, N. and Tal, T. (2015) Student self-reported learning outcomes of field trips: The pedagogical impact. *International Journal of Science Education*, *37* (8):1279-1298.

Anderson, D. (1997) *A commonwealth: Museums and learning in the United Kingdom*. London: Department of National Heritage.

Anderson, D. (1999) Understanding the impact of post-visit activities on students' knowledge construction of electricity and magnetism as a result of a visit to an interactive science centre. *Unpublished doctoral dissertation, Queensland University of Technology, Brisbane, Australia*.

Anderson, D., Kisiel, J. & Storksdieck, M. (2006a) Understanding Teachers' Perspectives on Field Trips: Discovering Common Ground in Three Countries. *Curator*, 49 (3): 365-386.

Anderson, D., Lawson, B. & Mayer-Smith, J. (2006b) Investigating the Impact of a Practicum Experience in an Aquarium on Pre-Service Teachers. *Teaching Education*, 17 (4): 341-353.

Anderson, D. & Lucas, K. B. (1997) The effectiveness of orienting students to the physical features of a science museum prior to visitation. . *Research in Science Education*, 27, 485-495.

Anderson, D., Lucas, K.B. and Ginns, I.S. (2003) Theoretical perspectives on learning in an informal setting. *Journal of research in science teaching*, 40 (2):177-199.

Anderson, D., Lucas, K. B., Ginns, I. S. & Dierking, L. D. (2000) Development of knowledge about electricity and magnetism during a visit to a science museum and related post-visit activities. *Science Education*, 84 (5): 658-679.

Anderson, D. & Zhang, Z. (2003) Teacher perceptions of field-trip planning and implementation. *Visitor Studies Today*, 6 (3): 6-11.

Anon. (2010) *Transforming Education Outside the Classroom*. www.parliament.uk/csf/: London: The Stationery Office Limited.

Anon. (2006) *Learning outside the classroom manifesto.* http://www.lotc.org.uk/wp-content/uploads/2011/03/G1.-LOtC-Manifesto.pdf. Department for Education and Skills.

Ansbacher, T. (1998) John Dewey's experience and education: Lessons for museums. *Curator: The Museum Journal*, 41 (1): 36-50.

Archer, L. (2008) The impossibility of minority ethnic educational 'success'? An examination of the discourses of teachers and pupils in British secondary schools. *European Educational Research Journal*, 7 (1): 89-107.

Archer, L., Dawson, E., DeWitt, J., Godec, S., King, H., Mau, A., Nomikou, E. & Seakins, A. (2017) Killing curiosity? An analysis of celebrated identity performances among teachers and students in nine London secondary science classrooms. *Science Education*, 101 (5): 741-764.

Archer, L., Dawson, E., DeWitt, J., Godec, S., King, H., Mau, A., Nomikou, E. & Seakins, A. (2018a) Using Bourdieu in practice? Urban secondary teachers' and students' experiences of a Bourdieusian-inspired pedagogical approach. *British Journal of Sociology of Education*, 39 (3): 283-298.

Archer, L., Dawson, E., DeWitt, J., Seakins, A. & 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): 922-948.

Archer, L., Dawson, E., Seakins, A., DeWitt, J., Godec, S. & Whitby, C. (2016b) "I'm being a man here": Urban boys' performances of masculinity and engagement with science during a science museum visit. *Journal of the Learning Sciences*, 25 (3): 438-485.

Archer, L., Dawson, E., Seakins, A. & Wong, B. (2016a) Disorientating, fun or meaningful? Disadvantaged families' experiences of a science museum visit. *Cultural Studies of Science Education*, 11 (4): 917-939.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. & 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): 881-908.

Archer, L., & Francis, B. (2005). 'They never go off the rails like other ethnic groups': teachers' constructions of British Chinese pupils' gender identities and approaches to learning. *British Journal of Sociology of Education*, *26*(2), 165-182.

Archer, L., Nomikou, E., Mau, A., King, H., Godec, S., DeWitt, J. & Dawson, E. (2018) Can the subaltern 'speak'science? An intersectional analysis of performances of 'talking science through muscular intellect'by 'subaltern'students in UK urban secondary science classrooms. *Cultural Studies of Science Education*, 1-29.

Aschaffenburg, K. & Maas, I. (1997) Cultural and educational careers: The dynamics of social reproduction. *American sociological review*, 573-587.

Ash, D. (2004) Reflective scientific sense-making dialogue in two languages: The science in the dialogue and the dialogue in the science. *Science Education*, 88 (6): 855-884.

Astrachan, O. (1998, August). Concrete teaching: hooks and props as instructional technology. In *Proceedings of the 6th annual conference on the teaching of computing and the 3rd annual*

conference on Integrating technology into computer science education: Changing the delivery of computer science education (pp. 21-24).

Avraamidou, L. (2015) Reconceptualizing elementary teacher preparation: A case for informal science education. *International Journal of Science Education*, 37 (1): 108-135.

AZA (2015) [online] Available from: https://www.aza.org/conservation-education (Accessed August).

Ballantyne, R. & Packer, J. (2016) Visitors' perceptions of the conservation education role of Zoos and Aquariums: Implications for the provision of learning experiences. *Visitor Studies*, 19 (2): 193-210.

Ballantyne, R., Packer, J. & Falk, J. (2011) Visitors' learning for environmental sustainability: Testing short-and long-term impacts of wildlife tourism experiences using structural equation modelling. *Tourism Management*, 32 (6): 1243-1252.

Ballantyne, R., Packer, J., Hughes, K. & Dierking, L. (2007) Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, 13 (3): 367-383.

Balling, J. D. & Falk, J. H. (1980) A perspective on field trips: Environmental effects on learning. *Curator: The Museum Journal*, 23 (4): 229-240.

Bamberger, Y. & Tal, T. (2007) Learning in a personal context: Levels of choice in a free choice learning environment in science and natural history museums. *Science Education*, 91 (1): 75-95.

Bamberger, Y. & Tal, T. (2008) An experience for the lifelong journey: The long-term effect of a class visit to a science center. *Visitor Studies*, 11 (2): 198-212.

Bandura, A. (1977) *Social learning theory*. Prentice-Hall. Englewood Cliffs: NJ

Bandura, A. (1986) Social foundations of thought and action: A social cognitive theory. Prentice-Hall. Englewood Cliffs: NJ

Bell, P., Lewenstein, B., Shouse, A. & Feder, M. (2012) Learning Science in Informal Environments: People. Places, and Pursuits. *Washington, DC: National Academic Press, 336.*

Behrendt, M. and Franklin, T., 2014. A review of research on school field trips and their value in education. *International Journal of Environmental and Science Education*, *9* (3):35-245.

Bell, R. L. (2009) Teaching the nature of science: Three critical questions. *Best Practices in Science Education*, 22, 1-6.

Bellamy, K. & Oppenheim, C. (2009) *Learning to live. Museums, young people and education* IN: Institute for Public Policy Research and National Museum Directors' Conference. London,

Bhaskar, R. (2012) Considerations on "Ken Wilber on critical realism". *Journal of Integral Theory and Practice*, 7 (4): 39-42.

BIAZA [online] Available from: http://www.biaza.org.uk/education (Accessed August 2015).

Bilton, H. (2010) *Outdoor learning in the early years: Management and innovation*. Routledge.

Bloom, B. S. (1956) Taxonomy of educational objectives: The classification of educational goals. *Cognitive domain*.

Bourdieu, P. (1974) The school as a conservative force: Scholastic and cultural inequalities. *Contemporary research in the sociology of education*, 32, 46.

Bourdieu, P. (1986) 'The forms of capital' in Richard, J. *Handbook of Theory and Research for the Sociology of Education* (1986), Westport, CT: Greenwood, pp. 241–58.

Bourdieu, P. (1999) *Bourdieu: a critical reader*. Oxford: Blackwell.

Bourdieu, P. (2011) The forms of capital.(1986). *Cultural theory: An anthology*, 81-93.

Bourdieu, P. and Boltanski, L., 1981. The Educational System and the Economy: Titles and Jobs. Teoksessa CC Lemert. French Sociology. Rupture and Renewal since 1968.

Bowker, R. (2007) Children's perceptions and learning about tropical rainforests: an analysis of their drawings. 13 (1): 75-96.

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative research in psychology*, 3 (2): 77-101.

Braund, M. & Reiss, M. (2006) Validity and worth in the science curriculum: Learning school science outside the laboratory. *The Curriculum Journal*, 17 (3): 213-228.

Bryman, A. (2007) Barriers to integrating quantitative and qualitative research. *Journal of mixed methods research*, 1 (1): 8-22.

Bryman, A. (2015) *Social research methods*. Oxford university press.

Bätz, K., Wittler, S. & Wilde, M. (2010) Differences between boys and girls in extracurricular learning settings. *International Journal of Environmental & Science Education*, 5 (1).

Cain, L. & Meritt, D. (2007) The demand for zoos and aquariums. *Tourism Review International*, 11 (3): 295-306.

Cainey, J., Bowker, R., Humphrey, L. & Murray, N. (2012) Assessing informal learning in an aquarium using pre- and post-visit drawings. *Educational Research and Evaluation: An International Journal on Theory and Practice*, 18 (3): 265-281.

Calabrese Barton, A., Kang, H., Tan, E., O'Neill, T. B., Bautista-Guerra, J. & Brecklin, C. (2013) Crafting a future in science: Tracing middle school girls' identity work over time and space. *American Educational Research Journal*, 50 (1): 37-75.

Calarco, J. M. (2014) Coached for the classroom: Parents' cultural transmission and children's reproduction of educational inequalities. *American Sociological Review*, 79 (5): 1015-1037.

Caldas, S. J. & Bankston, C. (1997) Effect of school population socioeconomic status on individual academic achievement. *The Journal of Educational Research*, 90 (5): 269-277.

Castro, J. I., Woodley, C. M. & Brudek, R. L. (1999) *A preliminary evaluation of the status of shark species*. Food & Agriculture Org.

Claussen, S. & Osborne, J. (2013) Bourdieu's notion of cultural capital and its implications for the science curriculum. *Science Education*, 97 (1): 58-79.

Clayton, S., Fraser, J. & Saunders, C. D. (2009) Zoo experiences: Conversations, connections, and concern for animals. *Zoo Biology: Published in affiliation with the American Zoo and Aquarium Association*, 28 (5): 377-397.

Clayton, S., Luebke, J., Saunders, C., Matiasek, J. & Grajal, A. (2014) Connecting to nature at the zoo: Implications for responding to climate change. *Environmental Education Research*, 20 (4): 460-475.

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). What makes great teaching. *Review of the underpinning research*, 1-57.

Cohen, L., Manion, L., Morrison, K. (2011) Research Methods in Education (7th edition). Abingdon: Routledge.

Coleman, J. S. (1966) *Equality of educational opportunity [summary report]* US Department of Health, Education, and Welfare, Office of Education.

Collins, J. (2009) Social reproduction in classrooms and schools. *Annual review of Anthropology*, 38, 33-48.

Cox-Petersen, A. M., Marsh, D. D., Kisiel, J. & Melber, L. M. (2003) Investigation of guided school tours, student learning, and science reform recommendations at a museum of natural history. *Journal of research in science teaching*, 40 (2): 200-218.

Cox-Petersen, A. M. & Pfaffinger, J. A. (1998) Teacher preparation and teacher–student interactions at a discovery center of natural history. *Journal of Elementary Science Education*, 10 (2): 20-35.

Creswell, J. W. (2011) Controversies in Mixed Methods Research. In: Denzin, N. K. & Lincoln, Y., S., eds. *The SAGE Handbook of Qualitative Research*. SAGE:

Creswell, J. W. & Clark, V. L. P. (2017) *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., Clark, V. L., Gutmann, M. L. & Hanson, W. E. (2003) Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, 209 240.

Crook, C. J. (1997) *Cultural practices and socioeconomic attainment: The Australian experience*. Greenwood Publishing Group.

Cubukcu, Z. (2012). The effect of hidden curriculum on character education process of primary school students. *Educational Sciences: Theory and Practice*, *12*(2): 1526-1534.

Dale, A. (2006). Quality issues with survey research. *International Journal of Social Research Methodology*, *9*(2)`: 143-158.

Davidson, S. K., Passmore, C. & Anderson, D. (2010) Learning on Zoo Field Trips: The Interaction of the Agendas and Practices of Students, Teachers, and Zoo Educators. *Science Education*, 94 (1): 122-141.

Dawson, E. (2014a) Equity in Informal Science Education: Developing an Access and Equity Framework for Science Museums and Science Centres. *Studies in Science Education*, 50 (2): 209-247.

Dawson, E. (2014b) “Not Designed for Us”: How Science Museums and Science Centers Socially Exclude Low-Income, Minority Ethnic Groups.". *Science Education*, 98 (60): 981-1008.

Dawson, E. (2018) Reimagining publics and (non) participation: exploring exclusion from science communication through the experiences of low-income, minority ethnic groups. *Public Understanding of Science*, 27 (7): 772-786.

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

De Graaf, N. D., De Graaf, P. M. & Kraaykamp, G. (2000) Parental cultural capital and educational attainment in the Netherlands: A refinement of the cultural capital perspective. *Sociology of education*, 92-111.

Deckard, M. F. (2008) A sudden surprise of the soul: The passion of wonder in Hobbes and Descartes. *The Heythrop Journal*, 49 (6): 948-963.

Delamont, S. (2002) *Fieldwork in educational settings: Methods, pitfalls and perspectives*. Psychology Press.

Department for Education (2013) Science programmes of study: key stages 1 and 2: National curriculum in England. Reference: DFE-00182-2013. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425618/PRIMARY_national_curriculum_-_Science.pdf (Accessed: March 2020).

Dewey, J. (1925) The challenge of democracy to education. *The later works*, 1953, 1935-1937.

DeWitt, J. & Archer, L. (2017) Participation in informal science learning experiences: the rich get richer? *International Journal of Science Education Part B-Communication and Public Engagement*, 7 (4): 356-373.

DeWitt, J., Archer, L. & Mau, A. (2016) Dimensions of science capital: exploring its potential for understanding students' science participation. *International Journal of Science Education*, 38 (16): 2431-2449.

DeWitt, J., Archer, L., Osborne, J., Dillon, J., Willis, B. & Wong, B. (2011) High aspirations but low progression: The science aspirations–careers paradox amongst minority ethnic students. *International Journal of Science and Mathematics Education*, 9 (2): 243-271.

DeWitt, J. and Hohenstein, J., 2010. School trips and classroom lessons: An investigation into teacher–student talk in two settings. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 47 (4):454-473.

DeWitt, J. & Osborne, J. (2007) Supporting teachers on science-focused school trips: Towards an integrated framework of theory and practice. *International journal of science education*, 29 (6): 685-710.

DeWitt, J. and Osborne, J., 2010. Recollections of Exhibits: Stimulated-recall interviews with primary school children about science centre visits. *International Journal of Science Education*, 32 (10):1365-1388.

DeWitt, J. & Storksdieck, M. (2008) A Short Review of School Field Trips: Key Findings from the Past and Implications for the Future. *Visitor Studies*, 11 (2): 181.

Devon County Council (2017). Facts and Figures. [online] . Avalable from https://www.devon.gov.uk/factsandfigures/ (Accessed July).

Diamond, J. (1999) *Practical evaluation guide: Tools for museums and other informal educational settings*. Rowman Altamira.

Dierking, L. & Griffin, J. (2001) Perceptions of learning in formal and informal environments. *National Association for Research in Science Teaching Annual Meeting*. St Louis.

Dierking, L. D., & Falk, J. H. (2009). Learning for life: The role of free-choice learning in science education. In *the World of Science Education* (pp. 179-205). Brill Sense.

Dierking, L. D. & Falk, J. H. (1994) Family behavior and learning in informal science settings: A review of the research. *Science Education*, 78 (1): 57-72.

Dierking, L. D., Luke, J. J. & Büchner, K. S. (2003) Science and technology centres–rich resources for free-choice learning in a knowledge-based society. *International Journal of Technology Management*, 25 (5): 441-459.

Dori, Y. J. & Tal, R. T. (2000) Formal and informal collaborative projects: Engaging in industry with environmental awareness. *Science Education*, 84 (1): 95-113.

Dorph, R., Shields, P., Tiffany-Morales, J., Hartry, A. & McCaffrey, T. (2011) High hopes-few opportunities: The status of elementary science education in California. *Sacramento, CA: The Center for the Future of Teaching and Learning at WestEd*.

Downey, D. B., Von Hippel, P. T. & Broh, B. A. (2004) Are schools the great equalizer? Cognitive inequality during the summer months and the school year. *American Sociological Review*, 69 (5): 613-635.

Dweck, C. (2015) Carol Dweck revisits the growth mindset. *Education Week*, 35 (5): 20-24.

Ebersole, R. S. (2001) *The new zoo*. Audubon.

Edgerton, J. D. & Roberts, L. W. (2014) Cultural capital or habitus? Bourdieu and beyond in the explanation of enduring educational inequality. *Theory and Research in Education*, 12 (2): 193-220.

Department for Eduation (2008) *Charging for School Activities*. www.gov.uk/government/publications. Accessed August 2017.

Egan, K. (2005) An imaginative approach to teaching. *San Francisco*.

Egan, K., Cant, A. I. & Judson, G. (2013) *Wonder-full education: The centrality of wonder in teaching and learning across the curriculum*. Routledge.

Egerton, M. (1997) Occupational inheritance: the role of cultural capital and gender. *Work, Employment & Society*, 11 (2): 263-282.

Elmesky, R. & Tobin, K. (2005) Expanding our understandings of urban science education by expanding the roles of students as researchers. *Journal of Research in Science Teaching*, 42 (7): 807-828.

English Indices of deprivation (2015). [online] Available from: https://www.gov.uk/guidance/english-indices-of-deprivation-2015-mapping-resources (Accessed July 2017).

Entwisle, D. R., Alexander, K. L. & Olson, L. S. (1994) The gender gap in math: Its possible origins in neighborhood effects. *American Sociological Review*, 822-838.

Eshach, H. (2007) Bridging In-School and Out-of-School Learning: Formal, Non-Formal, and Informal Education. Springer Science & Business Media, Inc. 2:171.

Esson, M. (2009) Being in a hard place. *BIAZA Res News*, 10 1-3.

Fadigan, K. A. & Hammrich, P. L. (2004) A longitudinal study of the educational and career trajectories of female participants of an urban informal science education program. *Journal of Research in Science Teaching*, 41 (8): 835-860.

Falk, J. & Dierking, L. (1992) The museum as a leisure-time experience. *The Museum Experience*, 11-28.

Falk, J. H. (1983) Field trips: A look at environmental effects on learning. *Journal of Biological Education*, 17 (2): 137-142.

Falk, J. H. (2014) Evidence for the educational value of zoos and aquariums. *WAZA Magazine*, 15: 10-13.

Falk, J. H. & Dierking, L. D. (2000) *Learning from museums: Visitor experiences and the making of meaning*. Altamira Press.

Falk, J. H., Martin, W. W. & Balling, J. D. (1978) The novel field-trip phenomenon: Adjustment to novel settings interferes with task learning. *Journal of Research in Science Teaching*, 15 (2): 127-134.

Falk, J. H., Osborne, J., Dierking, L. D., Dawson, E., Wenger, M. & Wong, B. (2012) *Analysing the UK science education community: The contribution of informal providers.* London: Wellcome Trust.

Farmer, J., Knapp, D. and Benton, G.M. (2007) An elementary school environmental education field trip: Long-term effects on ecological and environmental knowledge and attitude development. *The journal of environmental education*, *38*(3):33-42.

Feilzer, Y.M. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of mixed methods research*, *4*(1): 6-16.

Feinstein, N. W. & Meshoulam, D. (2014) Science for What Public? Addressing Equity in American Science Museums and Science Centers. *Journal of Research In Science Teaching*, 51 (3): 368-394.

Ferry, B. (1993) Science centers and outdoor education centers provide valuable experience for preservice teachers. *ournal of Science Teacher Education*, 4, 85-88.

Fisher, P. (1998) *Wonder, the rainbow, and the aesthetics of rare experiences*. Harvard University Press.

Foucault, M. & Rainbow, P. (1984) The Foucault Reader. New York. *Pantheon*.

Frost, W. & Roehl, W. S. (2007) Zoos, aquaria, and tourism: extending the research agenda. *Tourism review international*, 11 (3): 191-196.

Fűz, N. (2018) Out-of-school learning in Hungarian primary education: Practice and barriers. *Journal of Experiential Education*, 41 (3): 277-294.

Ganzeboom, H. (1982) Explaining differential participation in high-cultural activities: a confrontation of information-processing and status-seeking theories. *Theoretical models and empirical analyses*, 186-205.

Garibay, C. (2009) Latinos, leisure values, and decisions: Implications for informal science learning and engagement. *The Informal Learning Review*, 94, 10-13.

Gennaro, E. D. (1981) The effectiveness of using pre-visit instructional materials on learning for a museum field trip experience. *Journal of Research in Science Teaching*, 18 (3): 275-279.

Gerber, B. L., Cavallo, A. M. & Marek, E. A. (2001a) Relationships among informal learning environments, teaching procedures and scientific reasoning ability. *International Journal of Science Education* 23 (5)

Ghaill, M. A. (1994) *The making of men: Masculinities, sexualities and schooling*. McGraw-Hill Education (UK).

Giddens, A. (1984) *The constitution of society: Outline of the theory of structuration*. Univ of California Press.

Gillborn, D. (1997) Ethnicity and educational performance in the United Kingdom: Racism, ethnicity, and variability in achievement. *Anthropology & Education Quarterly*, 28 (3): 375-393.

Gillham, B. (2000) *The Research Interview*. London: Continuum.

Giroux, H. (1983) Theories of reproduction and resistance in the new sociology of education: A critical analysis. *Harvard educational review*, 53 (3): 257-293.

Godec, S. (2018) Sciencey Girls: Discourses Supporting Working-Class Girls to Identify with Science. *Education Sciences*, 8 (1): 19.

Godec, S., King, H., Archer, L., Dawson, E. & Seakins, A. (2018) Examining Student Engagement with Science Through a Bourdieusian Notion of Field. *Science & Education*, 27 (5-6): 501-521.

Goffman, E. (1959) *The presentation of self in everyday life*. Garden City, NY: Anchor.

Goldthorpe, J. H. (2007) " Cultural Capital": Some Critical Observations. *Sociologica*, 1 (2)

Gorard, S. & Taylor, C. (2004) *Combining methods in educational and social research*. McGraw-Hill Education (UK).

Gottfried, J. L. (1980) A naturalistic study of children's behaviour in a free-choice learning environment.

Graetz, B. (1988) The reproduction of privilege in Australian education. *British Journal of Sociology*, 358-376.

Grajal, A. (2013) 35. Zoos as ecotourism experiences. *International handbook on ecotourism*, 464.

Green, L. (2017) *Music, informal learning and the school: A new classroom pedagogy*. Routledge.

Greene, J. C. & Caracelli, V. J. (1997) Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms. (Vol. 74). San Francisco, CA: Jossey-Bass Publishers.

Greene, J. P., Kisida, B. & Bowen, D. H. (2014) The educational value of field trips: Taking students to an art museum improves critical thinking skills, and more. *Education Next*, 14 (1): 78-87.

Griffin, J. (2004) Research on students and museums: Looking more closely at the students in school groups. *Science Education*, 88, 59-70.

Griffin, J. (2007) Students, teachers, and museums: Toward an intertwined learning circle. *In principle, in practice: Museums as learning institutions*, 31-42.

Griffin, J. & Symington, D. (1997) Moving from task-oriented to learning-oriented strategies on school excursions to museums. *Science Education 81*, 763-779.

Gupta, P., Adams, J., Kisiel, J. and Dewitt, J. (2010) Examining the complexities of school-museum partnerships. *Cultural Studies of Science Education*, *5*(3): 685-699.

Gutek, B. A. (1978) Strategies for studying client satisfaction. *Journal of Social Issues*, 34 (4): 44-56.

Gutwill, J. P. & Allen, S. (2012) Deepening students' scientific inquiry skills during a science museum field trip. *Journal of the Learning Sciences*, 21 (1): 130-181.

Hadzigeorgiou, Y. (2013) Reclaiming the value of wonder in science education. In: *Wonder-Full Education*. Routledge: 48-73.

Hall, R. (2012) Mixed methods: In search of a paradigm. *Vortrag. Download (am 10.01. 2013) unter: http://www. auamii. com/proceedings_Phuket_2012/Hall. Pdf.*

Halsey, A. H., Lauder, H., Brown, P. & Wells, A. S. (1997) *Education: culture, economy and society*. Oxford University Press.

Hammersley, M. (2003). Recent radical criticism of interview studies: any implications for the sociology of education?. British Journal of Sociology of Education, 24(1): 119-126.

Hammersley, M. & Atkinson, P. (2007) *Ethnography: Principles in practice*. Routledge.

Hartley, J. & Davies, I. K. (1976) Preinstructional strategies: The role of pretests, behavioral objectives, overviews and advance organizers. *Review of Educational Research*, 239-265.

Hauan, N.P., DeWitt, J. and Kolstø, S.D. (2017) Proposing an evaluation framework for interventions: focusing on students' behaviours in interactive science exhibitions. *International Journal of Science Education, Part B*, *7*(2):103-120.

Hauan, N.P., DeWitt, J. and Kolstø, S.D. (2017) Proposing an evaluation framework for interventions: focusing on students' behaviours in interactive science exhibitions. *International Journal of Science Education, Part B*, *7*(2): 103-120.

Heimlich, J. E. & Meyers, R. B. (1999) Method boundness among zoo and park educators. *Environmental Education Research*, 5 (1): 67-56.

Hoadley, U. (2008) Social class and pedagogy: A model for the investigation of pedagogic variation. *British Journal of Sociology of Education*, 29 (1): 63-78.

Hooper-Greenhill, E. (2006) The power of museum pedagogy. *Museum philosophy for the twenty-first century*, 235-245.

Hooper-Greenhill, E., Phillips, M. & Woodham, A. (2009) Museums, schools and geographies of cultural value. *Cultural Trends*, 18 (2): 149-183.

Hoover, J. D., Giambatista, R. C., Sorenson, R. L., & Bommer, W. H. (2010). Assessing the effectiveness of whole person learning pedagogy in skill acquisition. *Academy of Management Learning & Education*, *9*(2): 192-203.

Howe, K. R. (1988) Against the quantitative-qualitative incompatibility thesis or dogmas die hard. *Educational researcher*, 17 (8): 10-16.

Huffman, T. (2013) Pragmatic fieldwork: Qualitative research for creative democracy and social action. *Journal of Social Justice*, 3, 1-24.

Hutson, T., Cooper, S., & Talbert, T. (2011). Describing connections between science content and future careers: Implementing Texas curriculum for rural at-risk high school students using purposefully designed field trips. *Rural Educator*, *33*, 37-47.

Jarvis, T. & Pell, A. (2005) Factors Influencing Elementary School Children's Attitudes toward Science before, during, and after a Visit to the UK National Space Centre. *Journal of Research in Science Teaching*, 42 (1): 53-83.

Jensen, E. (2014) Evaluating Children's Conservation Biology Learning at the Zoo. *Conservation Biology*, 28 (4): 1004-1011.

Johnson, R. B. & Onwuegbuzie, A. J. (2004) Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33 (7): 14-26.

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007) Toward a definition of mixed methods research. *Journal of mixed methods research*, 1 (2): 112-133.

Katsillis, J. & Rubinson, R. (1990) Cultural capital, student achievement, and educational reproduction: The case of Greece. *American sociological review*, 270-279.

King, H. & Nomikou, E. (2018) Fostering critical teacher agency: the impact of a science capital pedagogical approach. *Pedagogy, Culture & Society*, 26 (1): 87-103.

King, H., Nomikou, E., Archer, L. & Regan, E. (2015) Teachers' understanding and operationalisation of 'science capital'. *International Journal of Science Education*, 37 (18): 2987-3014.

Kisiel, J. (2003) Teachers, museums, and worksheets: A closer look at learning experience. *Science Teacher Education*, 14, 3-21.

Kisiel, J. (2005) Understanding elementary teacher motivations for science fieldtrips. *Science Education*, 89 (6): 936-955.

Kisiel, J. (2006) An examination of fieldtrip strategies and their implementation within a natural history museum. *Science Education*, 90, 434-452.

Kisiel, J. (2013) Introducing Future Teachers to Science Beyond the Classroom. *Journal of Science Teacher Education*, 24 (1): 67-91.

Kisiel, J.F. (2014) Clarifying the complexities of school–museum interactions: Perspectives from two communities. *Journal of Research in Science Teaching*, *51*(3): 342-367.

Kisiel, J. (2016) 'The Promise of Collaboration: Classroom Teachers and the Use of Informal Science Resources' in *Intersections of Formal and Informal Science* (pp. 227-242). Routledge.

Kızıltaş, E. & Sak, R. (2018) Integrating field-trip activities with other activities in the preschool curriculum: its effects on the preschoolers' social–emotional skills. *International Journal of Child Care and Education Policy*, 12 (1): 8.

Klenosky, D. B. & Saunders, C. D. (2007) Put me in the zoo! A laddering study of zoo visitor motives. *Tourism Review International*, 11 (3): 317-327.

Klopfer, E., Perry, J., Squire, K., Jan, M. F., & Steinkuehler, C. (2005). Mystery at the museum: a collaborative game for museum education. In *CSCL* (Vol. 5, pp. 316-320).

Knapp, D. (2000) Memorable experiences of a science field trip. *School Science and Mathematics*, 100 (2): 65-72.

Kolb, D. A. (2014) *Experiential learning: Experience as the source of learning and development*. FT press.

Krombass, A. & Harms, U. (2008) Acquiring knowledge about biodiversity in a museum - are worksheets effective? *Journal of Biological Education*, 42 (4): 157-163.

Lindemann-Matthies, P. & Kamer, T. (2006) The influence of an interactive educational approach on visitors' learning in a Swiss zoo. *Science Education*, 90 (2): 296-315.

Linke, S. & Winter, C. (2011) Conservation, education or entertainment: What really matters to zoo visitors. *Zoos and tourism: Conservation, education, entertainment*, 69-81.

Lucas, K. B. (2000) One teacher's agenda for a class visit to an interactive science center. *Science Education*, 84 (4): 524-544.

Luckner, J. L. & Nadler, R. S. (1997) *Processing the experience: Strategies to enhance and generalize learning*. Dubuque, IA: Kendall/Hunt Publishing.

Luebke, J. F. & Grajal, A. (2011) Assessing mission-related learning outcomes at zoos and aquaria: prevalence, barriers, and needs. *Visitor Studies*, 14 (2): 195-208.

Löhne, C., Friedrich, K. & Kiefer, I. (2009) Natur und Nachhaltigkeit: Innovative Bildungsangebote in Botanischen Gärten, Zoos und Freilichtmuseen–Naturschutz und Biologische Vielfalt 78. *Bundesamt für Naturschutz, Bonn-Bad Godesberg*.

Mackenzie, N. & Knipe, S. (2006) Research dilemmas: Paradigms, methods and methodology. *Issues in educational research*, 16 (2): 193-205.

Malone, K. (2008) Every Experience Matters: An evidence based research report on the role of learning outside the classroom for children's whole development from birth to eighteen years. *Report commissioned by Farming and Countryside Education for UK Department Children, School and Families, Wollongong, Australia*.

Marino, L., Lilienfeld, S. O., Malamud, R., Nobis, N. & Broglio, R. (2010) Do Zoos and Aquariums Promote Attitude Change in Visitors? A Critical Evaluation of the American Zoo and Aquarium Study. *Society and Animals*, 18, 126-138.

Martin, L. M. (2004) An emerging research framework for studying informal learning and schools. *Science Education*, 88 (1): 71-82.

Mason, J. (2006) Mixing methods in a qualitatively driven way. *Qualitative research*, 6 (1): 9-25.

Mason, P. (2000) Zoo Tourism: The need for more research. *Journal of Sustainable Tourism*, 8 (4): 333-339.

Maxcy, S. J. (2003) Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism. *Handbook of mixed methods in social and behavioral research*, 51-89.

McDonough, P. M. & Nunez, A.-M. (2007) Bourdieu's sociology of education: Identifying persistent inequality, unmasking domination, and fighting social reproduction. *Critique and utopia: New developments in the sociology of education in the 21st century*, 139-154.

Medrich, E., Roizen, J., Rubin, V. & Buckley, S. (1982) The serious business of growing up. Berkeley. *Journal of Personality and Social Psychology*, 45, 84-93.

Miglietta, A. M., Belmonte, G. & Boero, F. (2008) A summative evaluation of science learning: A case study of the Marine Biology Museum "Pietro Parenzan"(South East Italy). *Visitor Studies*, 11 (2): 213-219.

Milfont, T. L. (2012). Cultural differences in environmental engagement. In S. D. Clayton (Ed.), *Oxford library of psychology. The Oxford handbook of environmental and conservation psychology* (p. 181–200). Oxford University Press.

Miller, B., Conway, W., Reading, R. P., Wemmer, C., Wildt, D., Kleiman, D., Monfort, S., Rabinowitz, A., Armstrong, B. & Hutchins, M. (2004) Evaluating the conservation mission of zoos, aquariums, botanical gardens, and natural history museums. *Conservation Biology*, 18 (1): 86-93.

Miller, S. (2006) Mixed methods as methodological innovations: Problems and prospects. *Methodological Innovations Online*, 1 (1): 29-33.

Mills, A. J., Durepos, G. & Wiebe, E. (2010) *Encyclopedia of case study research: L-Z; index*. Sage.

Mills, C. W. (2000) *The sociological imagination (1959)*. Oxford University Press.

Mohr, J. & DiMaggio, P. (1995) The intergenerational transmission of cultural capital. *Research in social stratification and mobility*, 14, 167-200.

Morgan, D. L. (2013) *Integrating Qualitative and Quantitative Methods*. Sage Inc.

Mortensen, M.F. and Smart, K. (2007) Free-choice worksheets increase students' exposure to curriculum during museum visits. *Journal of Research in Science Teaching*, *44*(9):1389-1414.

Moss, A. & Esson, M. (2013) The Educational Claims of Zoos: Where do we go from here? *Zoo Biology*, 32 (1): 13-18.

Mujtaba, T., Lawrence, M., Oliver, M. & Reiss, M. J. (2018) Learning and engagement through natural history museums. *Studies in Science Education*, 54 (1): 41-67.

Murray, I. & Reiss, M. (2005) The student review of the science curriculum. *School Science Review*, 86 (318): 83.

Nabors, M. L., Edwards, L. C. & Murray, R. K. (2009) Making the case for field trips: What research tells us and what site coordinaators have to say. *Education*, 129 (4): 661-667.

National-Marine-Aquarium (2015) [online] Available from: https://www.national-aquarium.co.uk/mission/ (Accessed August).

National-Marine-Aquarium (2017) [online] Available from: https://www.national-aquarium.co.uk/about-us/ (Accessed July 2017).

Nomikou, E., Archer, L. & King, H. (2017) Building'science capital'in the classroom. *School Science Review*, 98 (365): 118-124.

National Audit Office (2016) *Financial sustainability for schools*. HC850.

Ofsted (2004) Promoting and evaluating pupils' spiritual, moral, social and cultural development. HMI2125. [online] Available from https://dera.ioe.ac.uk/4959/1/Promoting_and_evaluating_pupils'_spiritual,_moral,_social_and_cultural_development_(PDF_format).pdf. (Accessed June 2018).

Packer, J. (2006) Learning for fun: The unique contribution of educational leisure experiences. *Curator: The Museum Journal*, 49 (3): 329-344.

Packer, J. & Ballantyne, R. (2004) Is educational leisure a contradiction in terms? Exploring the synergy of education and entertainment. *Annals of Leisure Research*, 7 (1): 54-71.

Patrick, P. G., Matthews, C. E., Ayers, D. F. & Tunnicliffe, S. D. (2007) Conservation and education: Prominent themes in zoo mission statements. *The Journal of Environmental Education*, 38 (3): 53-60.

Patton, M. Q. (2002) Qualitative research and evaluation methods . Thousand Oakes.

Pearce, C. & MacLure, M. (2009) The wonder of method. *International Journal of Research & Method in Education*, 32 (3): 249-265.

Pedretti, E. (2002) T. Kuhn meets T. Rex: Critical conversations and new directions in science centres and science museums. Studies in Science Education. 37: 1- 42.

Phillips, M., Finkelstein, D. & Wever-Frerichs, S. (2007) School site to museum Floor: How informal science institutions work with schools. *International Journal of Science Education*, 29 (12): 1489-1507.

Piaget, J. (1964) Part I: Cognitive development in children: Piaget development and learning. *Journal of research in science teaching*, 2 (3): 176-186.

Piersol, L. (2013) Our hearts leap up: Awakening wonder within the classroom. In: *Wonder-Full Education*. Routledge: 11-29.

Plummer, J. D. & Small, K. J. (2013) Informal Science Educators' Pedagogical Choices and Goals for Learners: The Case of Planetarium Professionals. *Astronomy Education Review*, 12 (1): 1-16.

Popper, K. (2005) *The logic of scientific discovery*. Routledge.

Price, S. & Hein, G. E. (1991) More than a field trip: Science programmes for elementary school groups at museums. *International Journal of science education*, 13 (5): 505-519.

Prieur, A. & Savage, M. (2013) Emerging forms of cultural capital. *European Societies*, 15 (2): 246-267.

Rahm, J. & Ash, D. (2008) Learning environments at the margin: Case studies of disenfranchised youth doing science in an aquarium and an after-school program. *Learning Environments Research*, 11 (1): 49-62.

Ramey-Gassert, L., Walberg, I. & Walberg, H. (1994) Museums as science learning environments: Reexamining connections. *Sciene Education.* 78 (4): 345-363.

REC, A. (1998) A Report on the Evaluation of the National Science Foundation's Informal Science Education Program.

Rennie, L. J. (2014). Learning science outside of school. In *Handbook of research on science education, Volume II* (pp. 134-158). Routledge.

Rennie, L.J. (2013) 'The practice of science and technology communication in science museums' in *Communication and Engagement in the Informal Sector: Issues and Dilemmas, edited by JK Gilbert and S. Stocklmayer*, 197-211.

Rennie, L. J. & McClafferty, T. P. (1996) Science centres and science learning. Studies in Science Education, 27, 53-98.

Rennie, L. J. & McClafferty, T. P. (1995) Using visits to interactive science and technology centers, museums, aquaria, and zoos to promote learning in science. *Journal of Science Teacher Education*, 6 175-185.

Resnik, D. B. (2011) What is ethics in research & why is it important. *National Institute of Environmental Health Sciences*, 1 (10): 49-70.

Rix, C., & McSorley, J. (1999). An investigation into the role that school-based interactive science centres may play in the education of primary-aged children. *International Journal of Science Education*, *21*(6): 577-593.

Robson, C. (1993) *Real World Research*. Oxford, UK: Blackwell.

Roe, K., McConney, A. & Mansfield, C. (2014) Using evaluation to prove or to improve? An international, mixed method investigation into zoos' education evaluation practices. *Journal of Zoo and Aquarium Research*, 2 (4): 108-116.

Roscigno, V. J. & Ainsworth-Darnell, J. W. (1999) Race, cultural capital, and educational resources: Persistent inequalities and achievement returns. *Sociology of education*, 158-178.

Rossman, G. B. & Wilson, B. L. (1985) Numbers and words: Combining quantitative and qualitative methods in a single large-scale evaluation study. *Evaluation review*, 9 (5): 627-643.

Rumberger, R. W. & Willms, J. D. (1992) The impact of racial and ethnic segregation on the achievement gap in California high schools. *Educational Evaluation and Policy Analysis*, 14 (4): 377-396.

Salmi, H. (2003) Science centres as learning laboratories: experiences of Heureka, the Finnish Science Centre. *International Journal of Technology Management*, 25 (5): 460-476.

Sattler, S. & Bogner, F. X. (2017) Short- and long-term outreach at the zoo: cognitive learning about marine ecological and conservational issues. *Environmental Education Research*, 23 (2): 252-268.

Schauble, L., Gleason, M., Lehrer, R., Bartlett, K., Petrosino, A., Allen, A. & Street, J. (2002) Supporting science learning in museums. *Learning conversations in museums*, 425 - 452.

Schwan, S., Grajal, A. & Lewalter, D. (2014) Understanding and Engagement in Places of Science Experience: Science Museums, Science Centers, Zoos, and Aquariums. *Educational Psychologist*, 49 (2): 70-85.

Schwandt, T. A. (1994). Constructivist, interpretivist approaches to human inquiry. *Handbook of qualitative research*, *1*, 118-137.

Scribner-MacLean, M. and Kennedy, L. (2007) More than just a day away from school: Planning a great science field trip. *Science Scope*, 57.

Shephard, K. (2008). Higher education for sustainability: seeking affective learning outcomes. *International journal of sustainability in Higher Education*.

Shortland, M. (1987) No business like show business. *Nature*, 328 (6127): 213.

Silverman, D. (2000) Doing qualitative research. A practical guide. *Thousand Oaks, CA: SagePublications*.

Singal, N. & Swann, M. (2011) Children's perceptions of themselves as learner inside and outside school. *Research Papers in Education*, 26 (4): 469-484.

Sirin, S. R. (2005) Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of educational research*, 75 (3): 417-453.

Slavin, R. E. (2003) A reader's guide to scientifically based research. *Educational leadership*, 60 (5): 12-16.

Somekh, B. & Lewin, C. (2005) *Research methods in the social sciences*. Sage.

Sørensen, H., & Kofod, L. H. (2003). *School visits at science centres: It's fun, but is it learning?* Paper presented at the annual meeting of the National Association of Research in Science Teaching, Philadelphia, PA.

Spicer, J. I. & Stratford, J. (2001) Student perceptions of a virtual field trip to replace a real field trip. *Journal of Computer Assisted Learning*, 17 (4): 345-354.

Springate, I., Harland, J., Lord, P. & Wilkin, A. (2008) *The factors affecting A-level and undergraduate subject choice in physics and chemistry by ethnic group*. Slough: NFER [online]. Available: www. nfer. ac. uk/nfer/publications/AUC01.

Stocklmayer, S. M., Rennie, L. J. & Gilbert, J. K. (2010) The roles of the formal and informal sectors in the provision of effective science education. *Studies in Science Education*, 46 (1): 1-44.

Storksdieck, M. (2001). Differences in teachers' and students' museum field-trip experiences. *Visitor Studies Today.* 4 (1): 8-12

Storksdieck, M. (2006) *Field trips in environmental education.* Berlin: Berliner Wissenschaft-Verlag.

Storksdieck, M., Ellenbogen, K. & Heimlich, J. E. (2005) Changing minds? Reassessing outcomes in free-choice environmental education. *Environmental Education Research*, 11 (3): 353-369.

Stronck, D. R. (1983). The comparative effects of different museum tours on children's attitudes and learning. *Journal of Research in Science Teaching*, *20*(4): 283-290.

Sullivan, A. (2001) Cultural capital and educational attainment. *Sociology*, 35 (04): 893-912.

Sullivan, A. (2002) Bourdieu and education: how useful is Bourdieu's theory for researchers? *Netherlands Journal of Social Sciences*, 38 (2): 144-166.

Sutton, A. & Soderstrom, I. (1999) Predicting elementary and secondary school achievement with school-related and demographic factors. *The Journal of Educational Research*, 92 (6): 330-338.

Szczepanski, A., Malmer, K., Nelson, N. & Dahlgren, L. (2007) The distinctive nature and potential of outdoor education from a teachersperspective: An intervention study of teachers in school. *Didaktisk tidskrift*, 16, 89-106.

Szeman, I. & Kaposy, T. (2010) *"The forms of capital (1986)" Cultural theory: An anthology*. John Wiley & Sons.

Tal, R. T., Bamberger, Y. & Morag, O. (2005) Guided school visits to natural history museums in Israel: Teachers' roles. . *Science Education*, 89, 920-935.

Tal, T., Lavie Alon, N. & Morag, O. (2014) Exemplary practices in field trips to natural environments. *Journal of research in science teaching*, 51 (4): 430-461.

Tal, T. & Morag, O. (2009) Reflective practice as a means for preparing to teach outdoors in an ecological garden. *Journal of Science Teacher Education*, 20 (3): 245-262.

Tal, T. & Steiner, L. (2006) Patterns of teacher-museum staff relationships: School visits to the educational centre of a science museum. *Canadian Journal of Math, Science & Technology Education*, 6 (1): 25-46.

Teddlie, C. & Tashakkori, A. (2009) *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Sage.

Thompson, J. (2014) Engaging girls' sociohistorical identities in science. *Journal of the Learning Sciences*, 23 (3): 392-446.

Tindall, C. (1994) Issues of evaluation: *Qualitative methods in psychology: A research guide*. In: *Qualitative methods in psychology*. Buckingham: Open University Press: 142-159.

Tofield, S., Coll, R. K., Vyle, B. & Bolstad, R. (2003) Zoos as a Source of Free Choice Learning. *Research in Science & Technological Education*, 21 (1): 67-99.

Tran, L. U. (2007). Teaching science in museums: The pedagogy and goals of museum educators. *Science Education*, *91*(2): 278-297.

Tribe, A. (2001) *Captive wildlife tourism in Australia*. CRC for Sustainable Tourism Gold Coast, Australia.

Tribe, A. & Booth, R. (2003) Assessing the role of zoos in wildlife conservation. *Human Dimensions of Wildlife*, 8 (1): 65-74.

Tunnicliffe, S. D., Lucas, A. M. & Osborne, J. (1997) School visits to zoos and museums: a missed educational opportunity? *International Journal of Science Education*, 19 (9): 1039-1056.

Turley, S. K. (2001) Children and the demand for recreational experiences: The case of zoos. *Leisure Studies*, 20 (1): 1-18.

Tzanakis, M. (2011) Bourdieu's social reproduction thesis and the role of cultural capital in educational attainment: A critical review of key empirical studies. *Educate~*, 11 (1): 76-90.

Van de Werfhorst, H. G. (2010) Cultural capital: strengths, weaknesses and two advancements. *British Journal of Sociology of Education*, 31 (2): 157-169.

Visscher, N. C., Snider, R. & Steop, G. V. (2009) Comparative analysis of knowledge gain between interpretive and fact-only presentations at an animal training session: an exploratory study. *Zoo Biology*, 28 (5): 488-495.

Waite, S. (2009) Outdoor learning for children aged 2–11: Perceived barriers, potential solutions. Fourth International Outdoor Edcuation Research Conference. Victoria, Australia.

Walton, R. (2000). Heidegger in the hands-on science and technology centre: Philosophical reflections on learning in informal settings. *Journal of Technology Education*, 12, 49–60.

WAZA (2005) *Building a future for Wildlife - The World Zoo and Aquarium Conservation Strategy.* [online] Available from: http://www.waza.org/files/webcontent/1.public_site/5.conservation/conservation_strategies/building_a_future_for_wildlife/wzacs-en.pdf (Accessed March 2018)

Weiler, B. & Smith, L. (2009) Does more interpretation lead to greater outcomes? An assessment of the impacts of multiple layers of interpretation in a zoo context. *Journal of Sustainable Tourism*, 17 (1): 91-105.

Weßnigk, S. & Euler, M. (2011) The potential of an out-of-school laboratory to improve the image of physics and chemistry. Science Education research for evidence-based teaching and coherence in learning, Lyon, France.

Wharton, J., Khalil, K., Fyfe, C. and Young, A. (2019) Effective Practices for Fostering Empathy Towards Marine Life. In *Exemplary Practices in Marine Science Education* (pp. 157-168). Springer, Cham.

Wheaton, M. & Ash, D. (2008) Exploring middle school girls' ideas about science at a bilingual marine science camp. *Journal of Museum Education*, 33 (2): 131-141.

Whitesell, E. R. (2016) A day at the museum: The impact of field trips on middle school science achievement. *Journal of Research in Science Teaching*, 53 (7): 1036-1054.

Willis, P. (2017) *Learning to labour: How working class kids get working class jobs*. Routledge.

Witz, K. G. (1996) Science with values and values for science education. *Journal of Curriculum Studies*, 28 (5): 597-612.

Wolcott, H. F. (1994). *Transforming qualitative data: Description, analysis, and interpretation*. Sage.

Woods-McConney, A., Oliver, M., Maor, D., Schibeci, R. & McConney, A. (2011) Science engagement in Australia and New Zealand: A comparative, secondary analysis. In: European Science Education Research Association (ESERA) 2011 Biannual Conference, 5 - 9 September 2011, Centre de Congres, Lyon, France.

Wunschmann, S., Wust-Ackermann, P., Randler, C., Vollmer, C. & Itzek-Greulich, H. (2017) Learning Achievement and Motivation in an Out-of-School Setting-Visiting Amphibians and Reptiles in a Zoo Is More Effective than a Lesson at School. *Research in Science Education*, 47 (3): 497-518.

Yatani, K., Onuma, M., Sugimoto, M., & Kusunoki, F. (2004). Musex: A system for supporting children's collaborative learning in a museum with PDAs. *Systems and Computers in Japan*, *35*(14): 54-63.

Young, I. M. (2000) Inclusion and Democracy (New York. *Sarah Meyer/Teresa Peintinger*, 196.

Zeyer, A. & Dillon, J. (2019) The role of empathy for learning in complex Science| Environment| Health contexts. *International Journal of Science Education*, 41 (3): 297-315.

Zimmerman, B. J. (1990) Self-regulated learning and academic achievement: An overview. *Educational psychologist*, 25 (1): 3-17.

Appendix 1 – Interview Schedules

Teacher Interview Questions- Pre-visit

1. Why are you taking your students to the NMA?
2. Who is usually responsible for deciding on the location of your class trips?
    a. Did you/this person decide on booking your trip to the NMA (NMA)?
    b. If they did not personally decide on the trip, ask if they are pleased about the decision to take children to NMA
3. What kind of school trips have you taken students on in the past?
    a. If not specified, clarify if they have taken a class to the NMA and/or another aquarium before?
4. Please tell me about trips you know of that this class has been on before with you or other teachers?
5. How do you feel about taking students on school trips and why?
6. What kind of learning, if any, do you believe occurs during school trips?
    a. what makes you think this
7. How do you view school trips, as stand-alone events or linked into class lessons?
    a. Is this the case for your NMA trip?
    b. If yes ask for more detail about how this trip fits in with their classwork
8. Please tell me about any preparation for trips you normally do with students.
    a. If they do pre-activities, ask for specific information on these activities including if they are curriculum linked?
    b. And what about follow up, post-trip activities?
9. Do you think many of the children in your class will have been to an aquarium before?
    a. What makes you think that?
10. Is there any kind of special preparation you would do with children who haven't been to an aquarium before?
11. Do pupils have to pay for this trip?
12. Is pupil premium helping to subsidise the cost for any of the children?
13. Do you think there are any children missing the trip for financial or cultural reasons?

14. What are your expectations for the trip?

    i. *(prompts if required- in terms of the aquarium/tour content? – structure of tour? – level of formality)*

15. Are you taking an aquarium staff member guided tour of the aquarium?

    a. Why did you choose that particular kind of tour?

16. If on an explorer tour go to Q.13 If on an interactive tour skip to Q.14

17. How much, if any, interaction with aquarium staff do you expect to have during your self-exploration of the aquarium?

    a. Ask them to explain their answer (e.g. what types of interaction)

    b. How much interaction would you like with aquarium staff during your visit?

        i. - What kinds of interaction would you like to have with aquarium staff?

18. Skip to Question 15.

19. What role do you expect the aquarium staff members to play on your upcoming tour?

20. What do you imagine your role will be during the aquarium visit?

    i. (*Prompts if required around: - disciplining, crowd control, explaining content)*

        – *What do you think you will be doing there*

21. Tell me about your teaching approach during a school trip?

    a. What, if anything, do you feel chances about the way you teach when you are on a trip?

    b. What about the way you interact with students?

        i. *(Prompts if required around: - teaching style, attitude)*

22. Have you received any training in the area of running school trips?

23. ***If yes*** - *ask for more detail about it*

    a. How useful did you find the training you received useful?

    b. Would you have liked more training in this area?

    c. ***If yes to more training,*** What kind of training do you think would have been most useful to you?

24. ***If no*** - Would you have liked some training in this area?

    a. ***If yes* to training**, What kind of training do you think would have been most useful to you?

25. What did you think as school trips as a child?

a. Do any of your trips as a child particularly stand out for you?

26. Overall, what – if anything, do you think is valuable about school trips?

Teacher Interview Questions- Post-visit

1. How was your trip to the NMA?

   aiming to collect the teachers immediate, first thought reactions to the trip

   a) Did you enjoy the trip? – Why?

   b) Do you think your students enjoyed it? – How do you know this?

   c) Did the trip meet your expectations? – In what ways?

2. In the previous interview we talked about your teaching approach and how you interact with students during school trips. How well do you think your trip to the NMA reflected your previous experiences in this respect?

3. With the benefit of hindsight, are there any pre-trip activities you would like to have undertaken with your class?

   a. ***If yes,*** What would you have liked to do?

   b. Why?

Interactive tour questions

4. What did you think of the content of the tour?

   a) How did the content of the tour compare to any expectations you might have had?

   b) Please tell me about any subjects areas you think were missed out, or any that were covered in too much detail?

5. How do you think your aquarium experience may have been affected by having a staff member lead you around the aquarium?

6. How do you think that having an aquarium staff member with you on your tour of the aquarium may have affected the role you played during the trip?

7. Having experienced a guided tour once, would you now feel adequately prepared to lead your own tour of the aquarium?

   If yes, would your preference still be to have a guided tour on any future visits though?

Explorer Tour questions

8. With the benefit of hindsight, how do you now feel about your decision to opt for a self-led explorer tour?

a) Why do you feel this way?

b) Would you still elect for this same type of tour in future?

9. Please tell me about any interactions you had with aquarium staff whilst touring the aquarium?

   a) How many people did you speak to?

   b) Did you approach them or did they approach you?

   c) Was the nature of the conversation aquarium contents based / instructions based /other?

   d) How helpful did you find these interactions?

   If no staff interactions mentioned,

   a) What kind of interactions, if any, would you have liked to have with aquarium staff during your trip?

   b) What do you think prevented you from having more interaction with aquarium staff.

Remaining questions for all tours

10. What other resources, if any, did you use whilst your class was touring the aquarium?

    a) Maps?

    b) Leaflets?

    c) Tank labels / signage?

11. In the previous interview we talked about the role you thought you might play during the trip? How would you say your trip to NMA compared to these predictions?

    a) What role did you actually play?

12. At the beginning of the tour they asked the children if they had been to the NMA before. How do you think individual children's experiences of the trip may have varied depending on this factor?

13. How do you think individual children's experiences of the trip may have varied depending on whether they had been to the aquarium before or not?

14. What behavioral differences, if any, did you notice between children you had been before and those who hadn't?
    a. Did this have any influence on how you worked with the children?
15. What kind of learning, if any, do you think took place during the trip?

If no learning is indicated skip to question 18.

16. What indicated to you that no learning was taking place?
    - What, if anything, do you think could have been done differently to foster learning during the trip?
17. Do you think all the children learned equally?
    a. ***If no,*** What factors do you believe influenced the learning that took place?
    b. Do you think there is anything that you could have done to make the learning experience more equitable?
    - What about anything the aquarium could have done differently to make the learning experience more equitable?
18. What if any behavioral differences did you notice between children who had been to an aquarium before and those who hadn't?
    a. ***If yes,*** what were they?
    b. ***If yes,*** did this have any influence on how you worked with the children?

19. Would you recommend a trip to the NMA to other schools/teachers?
    - If yes, what kind of trip would you recommend they took- staff led or self led?
21. Is there anything else you would like to say about your trip to the SA?

Appendix 2 – NMA Session Content Form (School E)

NATIONAL MARINE AQUARIUM

Interactive Tours 2017

School Name:

Date of Visit: Lead Teacher:

Listed below are topics which we can include within a tour of the Aquarium. Any one of the topics below can be covered in enough detail to fill a 2 hour tour. Therefore, it is advisable to only select a few topics to ensure your pupils have enough time to observe the exhibits.

Primary "Our Magical Seas"		Secondary "Ocean Adventure"	
Adaptations	✓	Adaptations	
Body Form and Function - movement		Animal Health, breeding and rearing	
Camouflage, Patterns and Colour		Body Form and Function	
Classification		Classification	
Climate Change		Climate Change	
Colonisation and Succession		Colonisation and Succession	
Conservation		Conservation	
Dentition		Coral Conservation and Threats	
Feeding Techniques		Customer Care	
Food Chains/Webs		Dentition	
Habitats	✓	Exclusion Zones and sea management	
Nutrition		Exhibit Design	
Ocean Myths		Extinction	
Ocean Productivity and marine plants		Feeding Techniques	
Pollution		Fish Farming	
Renewable Energy		Fishing and fisheries management	
Senses		Food Chains/Webs, Trophic Levels	
Species Identification		Habitats	
Sustainability		Marketing	
Australia/Great Barrier Reef		Nutrition	
Life Cycles		Ocean Productivity	
Evolution		Pollution and Bioaccumulation	
		Renewable Energy	
		Recruitment and job roles in the Aquarium	
		Senses	
		Species Identification	
		Sustainability	
		Science/careers/skills in the Aquarium industry	
		Aquarium as a Business	
		Underwater Technology	
		Water quality and chemistry	

If you have a particular topic (or any specific learning outcomes) that you would like us to incorporate into your session but it is not currently listed, please feel free to note the subject areas in the box provided. Alternatively, we are more than happy for you to send a copy of the curriculum with the areas you would like covered clearly marked.

Additional Topics you would like covered:

Appendix 3 – Pre and post student questionnaires

Pre-Visit Survey – KS2 students

My full name is : _____ I am a: Boy / Girl I am _____ years old

In the box below please draw a shark and all the other plants and animals that share its habitat (where it lives).
Please label what you have drawn including the shark's body parts.

Please tell me about what you have drawn _____

1. **Have you been to an aquarium before today?**
   (please circle the right one)

No, never	**Once before**
More than once	**I can't remember**

If you can remember, write down the number of times you have been to an aquarium before today

_____

2. **Have you been to a zoo before?**
   (please circle the right one)

No, never	**Once before**
More than once	**I can't remember**

If you can remember, write down the number of times you have been to a zoo before

_____

3. **Have you been to a museum before?**
   (please circle the right one)

No, never	**Once before**
More than once	**I can't remember**

If you can remember, write down the number of times you have been to a museum before

_____

4. **What do you think the sea will be like in the future?**

_____

_____

5. **How do you feel about your trip to the aquarium?**
   (please circle the face that best shows how you feel)

6. **What emotion does that face show?**

_____

7. What do you think you will be doing at the aquarium?

_____

_____

8. What are you most looking forward to about your trip to the aquarium?

_____

_____

9. Is there anything about your trip you are <u>not</u> looking forward to?

_____

_____

10. How do think people should behave in an aquarium?

_____

_____

11. Do you think these sentences are true or false?
(Put T for true or F for false or tick the other box if you are not sure)

	T or F	**Not sure**
People are meant to be quiet in an aquarium		
Aquariums are for learning		
There is no reading to do in an aquarium		
People spend a lot of time listening at an aquarium		
You can ask questions at an aquarium		
Aquariums are just for fun		

12. List as many species (kinds) of shark as you can below.

_____

_____

_____

_____

13. What comes to mind when you think about sharks?

_____

14. How do you feel about sharks?

_____

15. What threats might there be to sharks in the sea?

_____

16. Is it a good thing that we have aquariums?

Yes	No
Not sure	

17. Why do you think this?

_____

_____

18. What do you think people can do to help save sea animals from extinction?

_____

_____

19. Do you think YOU could do anything to help save sea animals from extinction?

Yes	No
Not sure	

20. If you answered yes to Q.19, what do you think YOU could do to help save them?

_____

_____

Post-Visit Survey – KS2 students

My full name is : _____

In the box below please draw a shark and all the other plants and animals that share its habitat (where it lives).
Please label what you have drawn including the shark's body parts.

Please tell me about what you have drawn _____

1. What do you think the sea will be like in the future?

_____

_____

2. How do you feel about your trip to the aquarium?
(please circle the face that best shows how you feel)

3. What emotion does that face show?

_____

4. What was the best part of your trip to the aquarium?

_____

_____

5. What was the worst part of your trip to the aquarium?

_____

_____

6. How do think people should behave in an aquarium?

_____

_____

7. Do you think these sentences are true or false?
(Put T for true or F for false or tick the other box if you are not sure)

	T or F	**Not sure**
People are meant to be quiet in an aquarium		
Aquariums are for learning		
There is no reading to do in an aquarium		
People spend a lot of time listening at an aquarium		
You can ask questions at an aquarium		
Aquariums are just for fun		

8. List as many species (kinds) of shark as you can below.

_____

_____

_____

_____

9. What comes to mind when you think about sharks?

_____

10. How do you feel about sharks?

_____

11. What threats might there be to sharks in the sea?

_____

12. Is it a good thing that we have aquariums?

Yes	No
Not sure	

13. Why do you think this?

_____

_____

14. What do you think people can do to help save sea animals from extinction?

_____

_____

Please turn page over for final 2 questions

Appendix 4 – Instructions for teachers when delivering surveys

PRE-VISIT SURVEY INSTRUCTIONS

Our class is taking part in some research into what children think about school trips and how much they learn from them.

To do this we are going to answer some questions and do a drawing both before and after our visit to the aquarium.

You will have 5 minutes to do the drawing on the front page.

After that 5 minutes is up, I will ask you to stop doing the drawing and start answering the questions on the other pages.

You will have 10 minutes to answer as many of those questions as you can.

Please do not turn over and start answering the questions until I have told you the first 5 minutes is up.

The researcher is interested in all of your individual ideas so please do not copy your neighbour's answers or drawings. This is not a test, there is no right or wrong answers- it's all about what YOU think.

If you don't understand any of the questions or the words that have been used then please ask.

You may start drawing now.

POST-VISIT SURVEY INSTRUCTIONS

We are now going to do the after trip survey. It's very similar to the survey we did before our visit but don't worry, that is on purpose!

Like last time you will have 5 minutes to do the drawing on the front page.

After that 5 minutes is up, I will ask you to stop doing the drawing and start answering the questions on the other pages.

You will have 10 minutes to answer as many of those questions as you can.

Please do not turn over and start answering the questions until I have told you the first 5 minutes is up.

Like before, the researcher is interested in all of your individual ideas so please do not copy your neighbour's answers or drawings. This is not a test, there is no right or wrong answers- it's all about what YOU think.

If you don't understand any of the questions or the words that have been used then please ask.

You may start drawing now.

- Please give them a 1 minute warning that they need to finish the drawing.
- Please give them a 2 minute warning for the questions.

Appendix 5 – School and parent consent forms

WARWICK
THE UNIVERSITY OF WARWICK

PARTICIPATING SCHOOL CONSENT FORM

Title of Project: Investigating social and cultural factors within children's non-formal learning experiences in an aquarium

Name of researcher(s): Sarah-Jane Judge MSc.
Supervised by Dr. Eric Jensen and Professor Des Hewett.

Please initial box

1. I confirm that I have read and understood the participant information sheet provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that mine, and my classes, participation is voluntary and that I am free to withdraw at any time without giving any reason, without any effect on our trip to the aquarium. ☐

3. I consent to audio recording and transcription of my interviews with the researcher. ☐

4. I consent to anonymised verbatim quotations from my interviews to be used in the PhD thesis. ☐

5. I consent to handwritten notes being taken during the observation of the aquarium trip. These notes will not include the names, or any identifying features, of any of the children participating in the trip. ☐

6. I consent to anonymised verbatim quotations from the children's survey answers and reproductions of their drawings, to be used in the PhD thesis. ☐

7. I understand that all data supplied by the school, students and parents will be anonymised so that no school or individual persons could be identified in the PhD thesis and, that I have the option for students to be issued a pseudonym from the beginning of the research period so that the researcher need never know any individual children's names. ☐

WARWICK
THE UNIVERSITY OF WARWICK

8. I understand that my data will be securely stored for a minimum of 10 years, in line with the University of Warwick's Research Data Management Policy. ☐

9. I agree to take part in the above study. ☐

10. I confirm that I am giving proxy consent for my students to take part in the research (pre and post surveys and observation of their trip to the aquarium) with the understanding that parents/guardians will have the option to withdraw their children from the study at any time. ☐

Name of Participant	Date	Signature
Name of Researcher taking consent	Date	Signature

RESEARCH INFORMATION

Title of Project: Investigating social and cultural factors within children's non-formal learning experiences in an aquarium

Name of researcher(s): Sarah-Jane Judge MSc.
Supervised by Dr. Eric Jensen and Professor Des Hewett.

Dear Parent / Guardian

Your child's school has agreed, as part of their upcoming trip, to take part in a research project being undertaken by the University of Warwick and the National Marine Aquarium. This research, funded by the Economic and Social Research Council, aims to investigate children's differing experiences of a school trip with a particular focus on how prior experience of similar venues might influence the learning potential of the trip. Participation in the research is voluntary and withdrawal from the study will not prevent the child from attending the aquarium.

What will my child be asked to do?

Your child will be asked to undertake an age appropriate survey both before and after the trip. The survey is designed to record children's attitude towards, interest in and knowledge of marine environmental issue through a mix of multiple choice and open-ended questions and a fun drawing activity. Your child's trip to the aquarium will also be observed by the researcher with handwritten notes being taken about the overall experience of the class, not on individual children. We will not release information about your child to anyone. The data about your child will be stored securely and anonymously by number, not by name.

What will happen to the results of the research study?

The results of the study as a whole will be presented at academic conferences and in research journals. No names or identifying information will be contained in this information. Schools will be provided with the results of the study and will be able to share this with parents on request.

What if I have a query or a complaint?

If you have any queries about the research please contact the researcher **Sarah-Jane Judge** at [redacted] or [redacted] Alternatively, if you have any concerns about any aspect of this study please contact **Dr. Eric Jensen, Department of Sociology, University of Warwick, Coventry, CV4 7AL, email:** [redacted] For complaints please also see *www2.warwick.ac.uk/services/rss/researchgovernance/complaints_proc*

WARWICK
THE UNIVERSITY OF WARWICK

CONSENT FORM

Having read the research information above, I agree to my child taking part in the study.

Participating Child's name

_____

Parent/Guardian name

_____

Date

_____

Signature

_____

To ensure anonymity this consent form will be stored by the school.
The school will instruct the researcher as to which children can and can't take part in the study.
Participating children will be issued a code name to be used within the study.