Primary trainee teachers' talk with primary school science coordinators: Two case studies of primary trainees learning to teach science.

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Abstract

This thesis concerned the potential influence of talk on learning to teach primary science and was based on two case studies involving primary science trainee teachers and primary school science coordinators. The overall question for the thesis was: how may 'talk' with a primary school science coordinator influence a trainee learning to teach science during a placement?

This study adopted a lens that acknowledged the importance of people and contexts for learning to teach. Extant research on science coordinators' responsibilities, talk features and mentoring literature, as well as my own background as a science teacher and teacher educator informed and framed the study. A collective instrumental case study provided a methodological context for gathering qualitative data from interactions between two primary school trainee teachers and two science coordinators in primary schools. These participants were in two primary schools where the trainees were placed during the second year of a Bachelor of Education degree at a university in the Midlands, England. A participant observation strategy combined with a semi-structured interview protocol and participants' reflective diaries were employed as research instruments.

Three linguistic features of talk were analysed: topics in sequences of utterances, types of utterances spoken by the science coordinator and 'we-statements' spoken by trainees and science coordinators. Eight common topics emerged with science coordinators giving more information than instructions or questions and employing the use of 'we- statements' more than trainees. Trainees' 'I-statements' altered during the placement. Factors influencing linguistic features included science coordinators' prior experiences of ITT mentoring, school practices in teaching science, and topics of talk.

The study findings suggest three main ways in which talk may influence a trainee learning to teach science in a primary school. Firstly, talk may influence trainees 'thinking and doing' science; secondly, talk may influence trainees' perceptions about their 'achievements' and thirdly, talk may influence trainees' feelings about science teaching.

In making explicit how trainee teachers and science coordinators talk, this study helps to inform how talk may influence learning to teach primary science. From the findings, a new analogy emerged to support an understanding of 'scaffolded' learning for trainees through their zone of proximal development (ZPD) (Vygotsky, 1978): 'talk molecules'. 'Talk molecules' visualise linguistic features of talk for a particular topic such that multiple 'talk molecules' create a 'talk space' which may act as stimuli for learning. This new analogy contributes new knowledge to an understanding of how talk may influence a trainee learning to teach science.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

The following acronyms are used in the text:

A level	General Certificate of Education (Advanced level)
AfL	Assessment for Learning
BA	Bachelor of Arts Degree
EE	External Examiner
GCSE	General Certificate of Secondary Education
IT	Information Technology
ITT	Initial Teacher Training
NC	National Curriculum
NQT	Newly Qualified Teacher
Ofsted	Office for Standards in Education
PCK	Pedagogical Content Knowledge
PGCE	Post Graduate Certificate in Education
QTS	Qualified Teacher Status
TA	Teaching Assistant
UG	Under Graduate
2b	2b Placement – second placement in year 2 of UG course

CHAPTER ONE - INTRODUCTION

1.1 Introduction to the Study

Talk is 'arguably the true foundation of learning' (Alexander, 2004, p.5). This thesis is based on a study that explored how 'talk' with primary school science coordinators influenced primary teacher trainees learning to teach science during placements as part of working towards an undergraduate degree and the professional qualification that is qualified teacher status (QTS) in England. England is one of four countries in the United Kingdom (UK) and education policy is devolved to each country (British Broadcasting Company (BBC), 2016). The study was conducted between 2011 and 2017. It was located in a university that provides Initial Teacher Training (ITT) in the English Midlands and in two primary schools for children aged 4 to 11. The university and the primary schools worked in partnership together to support ITT and, during the study, I was Head of ITT at the University. Each year I provided leadership for undergraduate and postgraduate programmes for approximately 400 trainee primary school teachers in a changing landscape in England with national policy changes influencing ITT providers and school based learning.

A government driven shift towards greater schools' involvement (Taylor, 2008; Mutton, Burn and Menter, 2017) in the training of future primary teachers in England has focused ITT providers' attention on describing and understanding trainees' learning processes during placements which are seen as places of work for teachers. I chose to focus on science for this study because of concerns over science education in England and my personal interest in science: I have been a science and physics teacher and science local authority advisor.

This case study makes an original contribution to understanding how talk with a primary science coordinator, who has responsibility for leading on the quality of teaching and learning of science, may influence trainees' learning to teach science through the use of 'talk molecules' to visualise 'talk spaces'. It was conducted in the context of the assumption that learning to teach science involves an individual interacting with their environment, including people; an experience which may stimulate individuals to change or modify their knowledge

and attitudes (Vygotsky, 1978; Illeris, 2009; Barner and Baron, 2016). The study is also based on an assumption that talk may influence learning to teach and that talking with a science coordinator is a factor for primary trainees learning to teach science (Ofsted, 2002). Observations, semi-structured interviews and participant diaries were adopted to explore how two science coordinators used talk to influence two trainees learning to teach science in primary schools.

1.2 Introduction to Initial Teacher Training in England

In England, the provision of ITT programmes is situated within a nationally changing landscape for ITT although it is not new for ITT to be at the centre of English government policy. Korthagen, Loughran and Russell (2006) report on concerns over the 'reality shock' (p.1021) faced by teachers in their first year of teaching after ITT courses. Hobson, Ashby, Malderez and Tomlinson (2009) identify criticisms of the relevance of University led ITT courses and Taylor (2008) and Furlong (2005) point to the opening up of school based ITT providers to address these criticisms. A national review of postgraduate ITT provision (Department for Education (DfE), 2015a) has led to new standards for class teachers who support trainees as mentors during school based placements and new ITT Content Criteria for all ITT providers (DfE, 2016a; DfE, 2016b). Alongside changes in the provision of ITT through University and school based providers, a new primary school National Curriculum was introduced in England in September 2014 (DfE, 2013). This study was therefore timely given the changes in ITT policy so consequently makes relevant suggestions for ITT providers, policy makers and schools to consider.

The quality of the training in all ITT providers, and its outcomes, are assessed by a national regulator, the Office for Standards in Education (Ofsted). Ofsted was first introduced in England in 1992 following the Education Reform Act 1988 (Her Majesty's Stationery Office (HMSO), 1988) and the Education (Schools) Act 1992 (HMSO, 1992). Without agreement from Ofsted that the ITT provider is at least a 'good' provider of ITT then the right to train primary teachers can be removed. This has significant implications and pressures therefore for my role as Head of ITT to ensure that that the provision in the undergraduate and postgraduate ITT programmes is compliant and of the highest quality.

All trainee teachers in England are assessed against national Teachers' Standards (DfE, 2011) (Appendix 1) and since September 2012 in England, all trainee teachers work towards the same Teachers' Standards as qualified teachers. In England overall, fewer primary trainees complete their ITT via the undergraduate training route than those who do so as postgraduates (McNamara, Murray and Phillips, 2017) but at the university where this study was located, the opposite is the case.

1.3 School Placements within ITT

National ITT criteria in England state how may days a trainee must be in school as part of their ITT programme: currently 120 days, over a three year undergraduate programme (DfE, 2016c). Each ITT provider may decide how the days are distributed, as individual days or blocks of time, to form school placements with partnership schools.

During this research project, the study University had approximately 250 partnership schools whose Headteachers had signed an ITT agreement and each block placement, varying from 2 to 7 weeks duration, had identified sets of aims and tasks for trainees. Within the study University, placement modules were used to construct the undergraduate programme alongside academic modules (Appendix 2). Placements provide potentially valuable opportunities for trainees to develop and enhance their personal learning through teaching children and talking to experienced teachers in schools (Nilsson and van Driel, 2008a). Maclellan (1994) considers schools and their classrooms the best places for trainees to 'synchronise the multiple facets of teaching: planning, delivery, classroom management, assessment and evaluation' (p.172) and Fox, Wilson and Deaney (2010) add that a placement offers a means for trainees to experience and learn about professional practice in real situations that may include talk at the place of work of a teacher.

Teacher trainees may see their school placements as 'the real world' (Maclellan, 1994, p.171) where they can become familiar with the norms of a school, including its relationships and structures. Nevertheless, this situation presents a paradox: the trainee's purpose whilst in school is to learn about being a teacher as well the norms of the particular school, including the relationships and structures, so the concept of a 'normal workplace'

for a trainee might not be the same for a teacher who is employed in a school where the placement takes place.

At the same time, placements offer opportunities for those with subject responsibility, referred to as coordinators, to improve the quality of future teaching of that subject, in particular science (Ofsted, 2001). However, Ofsted (2003) has suggested that ITT providers make little planned use of science coordinators such that trainees spend little time with them (Ofsted, 2008). This study has not identified extant studies on use of science coordinators in ITT, however Roden (2003) points to the positive influence of the confidence and experience of science coordinators on teachers in their first year of teaching, Newly Qualified Teachers (NQTs), teaching science in 36 primary schools in Kent, England. In the study University the undergraduate programme included directed tasks (Appendix 3) for all trainees to talk to and observe the subject coordinator of their specialism during the study placement.

1.4 Science Curriculum in Primary Schools in England

In England, the primary National Curriculum (NC) referred to in this study as NC is divided into Key Stage One for children aged 5 to 7 and Key Stage Two for children aged 7 to 11. The original NC was introduced in 1989 (DES, 1989). Science has been one of three 'core subjects' of the NC taught in English primary schools alongside mathematics and English since 1989 (Wellcome Trust, 2014) and it is a requirement that all children study science in England from the age of 5 to 16.

The study of science in the NC is constructed around the acquisition of 'procedural and conceptual knowledge' (Newton and Newton, 1998, p.152). Traianou (2006) also considers science consists of these two aspects of knowledge; 'conceptual understanding of a small number of broad scientific principles (the Big Ideas of Science) along with procedural understanding characteristic of a proper scientific orientation' (p.832). According to the Wellcome Trust (2014) primary science 'should develop pupils' understanding of the world, nurture their curiosity and teach essential skills, including enquiry, observation, prediction, analysis, reasoning and explanations' (p.4). The NC (DfE, 2013) implemented from

September 2014 included a new strand entitled 'working scientifically' with a focus on different types of science enquiry (Appendix 4) and associated procedures, such as measuring and recording. It was a requirement that this strand was embedded within the content of biology, chemistry and physics outlined in the programme of study for each Key Stage (DfE, 2013). The development of these skills and knowledge are considered to be at the forefront of developing a scientifically literate public (Harlen and Qualtar, 2014) that can promote economic growth in the United Kingdom (UK) (HMSO, 2006; Ofsted, 2013).

Changes in the NC content in England have been accompanied by changes in assessment of childrens' learning (DfE, 2015b). Teachers in primary schools in England are required to report on standards that primary children reach at the age of 7 and 11 in science. The data for this study were collected during a period of consultation on 'no assessment levels' and therefore examining talk in relation to trainees' learning about assessment of children's learning in science may also be important so extant literature relevant to assessment of children's learning in science is considered in Chapters Two and Three.

There remains concern over the amount of science taught in primary schools in England and the value placed on the teaching of science (Ofsted, 2002; Rice, 2005; Hanrahan, 2005; Maddern, 2011; Ofsted, 2013; Wellcome Trust, 2014; Ofsted, 2016). Science is usually taught in the afternoon (Ofsted, 2013), however a recent survey of 260 primary teachers by the Confederation of British Industries (CBI) and Brunel University (CBI, 2015) reported that 36% of schools do not provide the minimum recommended two hours of science per week in Key Stage Two and 7.5% provided one hour a week. In 33 schools of 234 inspected in May 2016, Ofsted reported there were no separate science lessons (Ofsted, 2016). Hence some trainees' experiences in placements may differ and therefore examining talk about science is important to this study. Extant literature relevant to this point is considered in Chapters Two and Three.

1.5 The Researcher's Positionality in this Study

My positionality as a researcher is considered relevant in terms of considering how my reflexivity about my own 'socio –political position and interests' contribute to the principles

of educational research including doing research to improve the education of children (Griffiths, 1998, p.96). My research is influenced by five aspects: personal interest in science, prior professional identities and experiences, my MA dissertation, my present role as Head of ITT and my ontological perspective. As a child I valued learning about science; I enjoyed thinking, asking questions and carrying out investigations about my environment. At 16, I changed schools in order to study A- levels in mathematics, physics and English Literature since my existing girls' only grammar school would not offer an arts/sciences combination.

At 18, I applied to train to be a primary school teacher but was advised because of my A-levels to become a secondary school physics teacher and therefore I then spent 25 enjoyable years teaching children aged 11 to 18 science and physics in five schools. During this time, I supported primary schools to develop their science curriculum and was given promotions to acknowledge my work with primary school science and when I moved into Local Authority science advisory work, I had the privilege of working with teachers of science in all phases of education in state mainstream from early years to sixth form, science specialist colleges and special educational settings. These roles and experiences helped to develop my identities as a teacher, advisor and leader and were supported through my talk with others.

I moved into Higher Education as the Programme Leader for a postgraduate secondary science ITT course in a different Midlands University from the study University. Establishing a new identity as a teacher educator involved completing my MA in Education Studies. My dissertation focused on analysing the talk between a trainee secondary science teacher and a science technician and ignited an interest in understanding how trainees learn to teach through an examination of their talk with others.

My present 'institutional position' (Ravitch and Riggan, 2012, p.10) is the fourth influence on this study. As the Head of ITT, I am responsible for ensuring the quality and outcomes of training for all trainees and therefore this study offers personal and institutional understandings that are original and timely with potential to influence trainees' learning.

The fifth influence on this study is my ontological perspective on the natural world and its links to learning to teach science. During my physics degree there was an emphasis on learning accepted scientific representations and conducting empirical studies of the natural world using tools to measure accurately and reliably. My experience as a scientist had encultured me to adopt an ontological perspective aligned with a positivist approach; this is discussed further in Chapter Four. However, as a physics teacher, my focus was on enabling children to enter a scientific way of knowing the natural world through talking and supporting their cognitive challenge of everyday representations for particular natural phenomena. I recognised that individuals including myself need to make sense of new ways of viewing the world. Therefore, my experience as a teacher had encultured me to adopt an ontological perspective aligned more with a subjectivist approach. Holding these two ontological perspectives has influenced this study of the social world because of their seemingly opposing views on reality. However, whilst there has been an ongoing cognitive tension between these two perspectives, it has contributed to a depth of understanding that 'representations are constructed, communicated and validated within everyday culture' (Driver, Asoko, Leach, Mortimer and Scott, 1994, p.11). I have shifted during this study more strongly towards a view of realities from a subjectivist perspective.

1.6 The Rationale for the Study

Against the backdrop of changes to ITT in England and my own positionality as a science teacher, teacher educator and Head of ITT, this study was conducted to examine an aspect of practice within ITT programmes that has received limited prior attention: talk with science coordinators to support primary trainees learning to teach science. A range of literature has analysed the talk between classroom teachers who are designated as mentors (for example, Sempowicz and Hudson, 2011) although little of this literature focuses specifically on science (for example, Jarvis, McKeon, Coates and Vause, 2001; Hudson, 2005; Nilsson and van Driel, 2010). However, to date a review of the literature has not identified any study which has examined how teacher trainees talk with those with responsibility for science in primary schools - science coordinators - during a placement.

This thesis proposes that paying attention to 'talk', with reference to 'talk molecules', can help to provide an understanding of how learning to teach occurs. In particular, one learning expectation of all trainee teachers in England is the ability to 'develop effective professional relationships with colleagues, knowing how and when to draw on advice and specialist support' (DfE, 2011, p.13). This study contributes original knowledge to understandings of what and how advice and specialist support for learning to teach science may be given by experienced teachers with responsibility for primary science - science coordinators - to trainees. In other words, this study yields new insights into how talk of experienced teachers with a responsibility in science may influence teacher trainees learning to teach science in primary schools.

The main research question was:

> How may 'talk' with a primary school science coordinator influence a primary teacher trainee learning to teach science?

This question focused on identifying ways that talk may make a difference to trainees' learning to teach science, for example by influencing changes in their knowledge, attitudes and incentives. Literature relating to these points is considered in Chapter Two and Three. Two subsidiary research questions were used to enable the main research question to be addressed. Firstly:

> 1. What are linguistic features and patterns in 'talk' between a primary school science coordinator and trainee during a teaching practice?

This question focused on identifying linguistic features and patterns of 'talk' spoken by a science coordinator and trainee in terms of the words and utterances they spoke individually and how these were used in interactions to provide sequences of talk. Literature relating to these points is considered in Chapter Three.

The second subsidiary research question asked:

> 2. What factors, including the setting, participants, purpose and topic influence linguistic features and patterns of talk between a science coordinator and trainee during a teaching practice?

This second question considered factors that may influence linguistic choices. For example: the different topics of talk; the prior experiences of science coordinators in ITT; the approach to planning science in the school and the purpose in giving information about school practices. Literature relating to these points is considered in Chapters Two and Three.

1.7 Overview of the Thesis

This thesis comprises ten chapters. Chapter Two and Chapter Three cover two distinct areas for the literature review that have relevance to understanding how talk may influence learning to teach science. Chapter Two reviews the literature relating to the debates on the knowledge a trainee teacher needs to learn science, referred to as 'knowledge for teaching' and who may support this learning, a class teacher and a science coordinator, during a placement. The chapter also considers inequalities in mentoring for science and trainees learning to teach science.

Chapter Three focuses on talk and social factors which may influence linguistic choices. Three linguistic features of talk are considered: topics of talk in sequences of utterances identified in sequences of 'turns' which were coded as relating to the same topic, types of utterances spoken by science coordinators in terms of 'giving information, 'giving instruction' and 'asking questions' and 'we-statements' spoken by both participants. In addition, 'I-statements' of each trainee are analysed in relation to topic. The study considers theories of talk before drawing on a social-linguistic framework to describe social factors - setting, participants, purpose, topic - which may influence linguistic choices. Chapter Three concludes with a discussion on the theoretical framework for the study and an initial conceptual framework.

Chapter Four presents the case study research design and methods, explaining how data were collected and detailing the instruments used in the research. As the study's theoretical framework included a social-linguistic interpretation of learning to teach, data were collected from the participants talking to each other as well as diaries and interviews.

Chapter Five introduces the two cases and discusses how these were selected. It also includes an overview of the data collection process.

Chapter Six and Seven consider the research data gathered in Case One and Case Two respectively. In each chapter, findings related to research question 1 are presented in relation to topic during 'sequences of turns' during two meetings, types of utterances spoken by each science coordinator during two meetings and 'we-statements 'spoken by each participant in meetings and interviews. 'I- statements' for each trainee are also presented for two interviews.

Chapter Eight discusses the findings in relation to each subsidiary research question and brings out similarities and differences in science coordinators' and trainees' talk. As the chapter reveals the two science coordinators talk with the trainees differed, as did their influence on the trainees learning to teach science. The Chapter concludes with a discussion on how science coordinators may influence trainees in three ways.

Chapter Nine discusses 'talk molecules' which may act as an analogy to describe 'talk spaces' and the influence of talk on learning to teach science. The Chapter concludes with a presentation of a conceptual framework developed from the study.

Chapter Ten concludes the thesis by considering the study findings in relation to the main research question and contribution to new understandings of talk through the use of 'talk molecules'. It suggests how this research adds to an understanding of factors influencing the learning of trainees as they interact with science coordinators during placements. The chapter ends by identifying limitations in this study and considering areas for further research and personal learning.

1.8 Summary of Chapter One

Chapter One has identified the focus of the study and the structure of the thesis. Talk is considered an important tool in acting as stimuli from an interaction between a trainee and science coordinator during a placement to influence a trainee learning to teach science. Learning to teach science includes a trainee learning 'knowledge for teaching' and through an examination of talk, in terms of its specific linguistic features and factors which may influence these, provides data to examine how, using analogies of 'talk-space' and 'talk-molecules', talk may influence trainees' learning to teach science.

The next two chapters explore the extant literature as a basis for the present study. Chapter Two provides a literature review of learning to teach science and Chapter Three provides a literature review of talk. At the end of Chapter Three, I consider a gap in the extant literature and the theoretical framework for the study and initial conceptual framework.

CHAPTER TWO – LITERATURE REVIEW: LEARNING TO TEACH SCIENCE

2.1 Introduction

The next two chapters review extant literature in two key areas - to set the present study in the context of the field of education, specifically learning to teach science and talk for learning. Chapter Three is concerned with 'talk', whilst this chapter addresses literature about learning to be a primary school teacher, in particular learning to teach science. There are eight sections. Following this section, the second section describes the initial systematic literature review process using initial key words of talk, primary, science and mentoring based on my professional knowledge of mentoring and the focus of the study. Section three considers what a trainee needs to learn to teach science situated within debates on learning. Section four considers theoretical frameworks to analyse 'why' and 'how' the 'what' is learnt. Section five discusses who supports trainees during a placement and how mentors may influence trainees and inequalities in mentoring for science. Section six considers trainees who are learning to teach before concluding with section seven reviewing information on science coordinators in primary schools.

2.2 Literature review process

The process of identifying literature to review for this study comprised four main stages. As it was an exploratory study the reviewed literature provided a tool at the end of the data collection process 'to compare and contrast the findings of the qualitative study' (Creswell, 2014, p.29). A systematic review of literature was considered problematic (Bryman, 2012) in that knowledge was accumulated during the study which led to continual review of literature; however, the study incorporated an initial systematic review processes to guide the work. This included the use of key words such as 'primary' and 'science' as criteria to decide if extant studies would be used in the review.

The first review stage occurred during February – July 2011 in preparation for the writing of the PhD proposal. During this time I revisited the literature from an earlier study I had

conducted which had focused on talk between science technicians in secondary schools and training teachers. This stage focused on three papers related to primary science and provided useful background information: Murphy, Beggs, Carlisle and Greenwood (2004), Kenny (2010) and Bradbury (2010).

During the second stage of literature review to support the PhD proposal I inserted the key words 'mentors', 'science', 'talk' and 'primary' into my University's library journal search engine, resulting in four key papers that included analysis of talk between mentors (Butterfield, Williams and Marr, 1999; Williams and Watson, 2004; Chalies, Ria, Bertone, Trohel and Duran, 2004; Sempowicz and Hudson, 2011). These articles reported empirical studies focused on the talk between mentors and trainee teachers although none referred specifically to primary science. One further paper was identified that concerned the analysis of talk when leaders mentored others (Holmes, 2005).

The third stage of the literature review started on August 2nd 2012 after the PhD proposal had been accepted. A search with no time limiters applied was undertaken by inserting the following keywords into ProQuest, Intered, SAGE, Elsevier, Web of Science and Zetoc databases: 'teacher', 'mentoring' and 'conversational analysis'. This process led to 603 results but when these were analysed using the keyword 'mentoring' only, the list reduced to five: Jarvis *et al*., 2001; Hudson and Skamp, 2002; Hudson, 2005; Hudson, 2007; Hudson, Usak, Savran-Gencer, 2009.

On August 24th 2012 the same search was run providing three additional papers for review: Strong and Baron (2004); Hennissen, Crasborn, Brouwer, Korthagen and Bergen (2011) and Crasborn, Hennissen, Brouwer, Korthagen and Bergen (2011). There are limitations in using databases because of the implications of which keywords authors choose to use on their papers and some papers do not include keywords. For these reasons, it was possible that relevant studies had not been identified, so I changed the keywords and searched the same databases as above using the two keywords: 'primary science' and 'mentoring'. This elicited 4214 studies. When these studies were searched using the category of 'primary science' only, the list reduced to 22 with one repeated entry. Of these 21 studies, five had previously

been identified and two new studies were identified (Hudson, 2004; Nilsson and van Driel, 2010) as they were empirical studies on the talk between mentors and trainees with specific reference to primary science. This process resulted in the identification of 15 papers for analysis which was important to this study as they provided my initial understanding of debates which surround learning to teach science. The literature review continued throughout the study. Post data collection literature maps were created (Creswell, 2014, p.39) (Appendix 5) to support the analysis process and seek additional literature to support the understanding of the emerging findings using new key words, for example 'motivation'. The remainder of this chapter and the chapter that follows it are based on the literature that emerged during the initial literature search, data collection period and review process.

The following two sections review extant literature concerning science, trainee teachers and mentors to consider what trainee teachers need to learn to teach science and who may support their learning during placements as part of ITT.

2.3 What do trainees need to learn to teach science?

As already mentioned in the introduction, there are debates on the relevance of trainee's learning within placements in terms of what and how they learn to teach science. Debates on what and how to learn to teach are situated within debates on theories of learning (Illeris, 2009; Aubrey and Riley, 2016) which have predominantly been the province of psychology (Palmer, 2005). Learning may be considered as an individual's acquisition of knowledge or change or growth in knowledge (Peressini, Borko, Romagnano, Knuth and Willis, 2004), so that a trainee viewed as the learner - the subject - gains knowledge in terms of the 'content' they need to know. However, Illeris (2009) considers that learning 'content' is not characterised by just knowledge or skills or understanding or attitudes but also the learning of a broader set of personal qualities such as self –confidence and responsibility.

Teaching requires 'a distinct and wide ranging body of knowledge… concerned with preparation for an altruistic vocation' (Taylor, 2008, p.68). Debates on what to learn to teach identify three main aspects: subject knowledge, pedagogical content knowledge and context (Shulman, 1987; Gess-Newsome and Lederman, 1999; Bishop and Denley, 2007;

Nilsson, 2008a). However, in England, what trainees need to learn is not a matter of choice; it is set out in the statutory documentation. The national ITT Content Criteria for England (DfE, 2016b) lists essential content, aligned to the Teachers' Standards (DfE, 2011), to be taught by ITT providers to trainees in England. This document includes subject knowledge, pedagogical knowledge, behaviour management as well as knowledge about legal and professional duties of a teacher in England.

2.3.1 Learning to teach – subject knowledge

Learning to teach science in primary schools has become the focus of particular debates on subject knowledge (Traianou, 2006). Studies suggest the greater the subject knowledge held by a teacher, the better they will be at supporting children to learn the subject (Nilsson and van Driel, 2008b; Harlen and Qualtar, 2014). If teachers do not understand the subject themselves then they may not be able to explain conceptual knowledge to the children:

> 'if a teacher does not explicitly understand principles underlying physical phenomena then they cannot explain it to their pupils' (Nilsson and van Driel, 2008b, p.1).

In addition, the way trainee teachers view science subject knowledge may also affect the learning opportunities they provide to their pupils (Tsai, 2000; Kinchen, 2004). Although this is not a universally held belief; Waters-Adams (2006) suggests there is no direct link between teachers' understanding of the nature of science and their teaching practices.

2.3.2 Learning to teach – pedagogical content knowledge

Shulman (1987) considers teachers need to learn about pedagogical content knowledge (PCK) to combine subject knowledge and pedagogy. Whereas pedagogy includes general elements about classroom organisation, lesson planning and procedures (Bishop and Denley, 2007), PCK concerns how teachers can make a specific subject accessible to the learners. Poulson (2001) argues that for primary teachers, PCK is more important than subject knowledge given the wide range of subjects which are taught. Traianou (2006) adds that it is unrealistic to expect primary teachers, especially those with no science

qualifications, to acquire adequate understanding of all science concepts in the science National Curriculum.

Appleton (2002) considers that teachers can manage the teaching of science in primary schools by developing a set of science PCK activities that work. Trainees might learn a 'professional repertoire and range of analogies, explanations and metaphors' to successfully support pupils in understanding science (Parker, 2004, p.835). These activities may have fairly predictable outcomes in providing science knowledge because they have been taught before and the teacher feels comfortable in teaching them (Appleton, 2003). However, Zeidler (2002) comments that teachers need to have the skills to select and translate essential content into learning activities which recognise and highlight the application of the content to the lives of the pupils.

2.3.3 Learning to teach – context knowledge

There are debates on context knowledge in terms of other aspects which teachers need to learn to provide context to their teaching (Korthagen, 1993; Davis, Petish and Smithey, 2006; Nilsson, 2008a). These include knowledge about the curriculum, for example national requirements and educational contexts, educational goals, values and purposes including the history and philosophy of education (Shulman, 1987; Davis *et al*. 2006). Dewey (1997) and Mishra and Koehler (2006) consider that teachers also need knowledge about children and theories of child development in order to teach them.

2.3.4 Learning to teach - practical work in science

Learning to teach science also involves learning to engage with practical work which aims to improve an understanding of content through practical experience and specific procedural skills such as measurement and observation (Holman, 2016). Practical work is a 'hands –on' experience which prompts thinking about the world (Score, 2008; Holman, 2016) and may be categorised as core activities which develop practical skills and directly related activities which includes designing and planning investigations and analysing data using Information Technology (IT). Jarvis *et al*.'s (2001) survey of 26 primary trainees and 64 mentors in England reported differences in the levels of confidence of trainees and mentors in teaching

practical science. Whilst 35% of trainees felt more confident in teaching 'scientific enquiry' than life processes, materials or physical processes, 39% of mentors felt less confident in teaching 'scientific enquiry' than the other three attainment target focus areas (DfE, 2013).

2.3.5 Learning to teach - personal qualities for teaching

Debates on what trainees teachers should learn also include views about the development of the trainee in terms of their personal qualities such as values and resilience (Illeris, 2009). Taylor (2008) writes that trainees should learn about values and attitudes towards children, the school and the community because teaching is 'underlined by a sense of equality and social justice' (p.68). Edwards and Protheroe (2004) consider trainees should view learning to teach as a way for them to grow their capacity to make decisions during teaching and by reflecting on learning develop resilience so that they do not get 'bogged down' with the process of learning (Ghaye, 2011, p.77). Others have focused on learners learning to take responsibility for their own learning (for example, Al-Weher, 2004) or learning to take risks in their teaching (Guskey, 2002).

2.4 Theoretical frameworks to consider 'how' and 'why' the 'what' is learnt

Debates on 'what' is needed to be learnt to teach science are furthered by considering 'how' and 'why' the 'what' is learnt. Engeström (2009) considers any theory of learning needs to identity how the learner learns and why the learner makes the effort to learn as well as the content or outcome of learning. Illeris (2009) proposes in his 'comprehensive theory of learning' that there is an interplay between what is learnt, the 'content' and drivers or 'incentives' from an individual's different levels of motivation or goals, to learn 'content' as they interact with an environment. Learning viewed from the perspective of a socially mediated individual as the basis of analysis (Vygotsky, 1978; Illeris, 2009) considers the interaction of an individual and an environment as the stimulation for the acquisition of 'what' and 'why'.

Wenger (2009) places the focus of 'why' learners learn 'content' in terms of a learner engaging and contributing to the practices of their community such that an individual teacher may be motivated to learn 'content' so that they can participate in valued practices

in a given situation as a collective subject. Engeström (2009) also focuses on the collective subject rather than an individual subject but in terms of task orientated practices or 'activities' that go beyond a given situation. Where activities are viewed as the unit of analysis rather than the individual person then the activity can be considered to move though a zone of proximal development (ZPD) influenced by broader systemic and motivational contexts (Eraut, 2007; Sannino, Daniels and Gutierrez, 2009). However, when viewed from 'social constructivism' or 'sociocultural' perspective, an individual is considered to move through their (ZPD) guided by a more experienced and knowledgeable other (Vygotsky, 1978; Mercer, 1995; Bruner, 2006; Remington Smith, 2007) using talk to transform experiences which may be sensory or social into knowledge mediated through talk (Keenan, 2002).

In the next section, I consider how a trainee may be guided by a more knowledgeable other during a placement by considering the role of a mentor.

2.5 Mentors supporting and assessing trainees during a placement?

Circular 14/93 (DfE, 1993) provided a framework to reform ITT in the UK for primary trainees and to establish the 'right' for equal partnerships between university departments and schools (Bailey and Robson, 2002), requiring 'experienced practitioners' within schools to act as instructors for trainee teachers (Smethem and Youens, 2006; Rice, 2007). The term 'mentor' did not appear in this Circular and there was no explicit guidance on what skills the experienced teacher needed to mentor a trainee. Fletcher (2000) credits Kenneth Baker - then Secretary of State for Education - with 'effectively creat[ing] a new workforce – the school mentors' (p.6). ITT school mentors in England are positioned as the 'assessor' of trainees and loan their class to the trainee during a placement (Jones, 2001) which has led to debates on whether the assessment and support function of mentors should be separated because of the negative impact on the development of a relationship between the mentor and trainee (Le Maistre, Boudreau and Pare, 2006; Hobson *et al*., 2009).

Recently in England, ITT school mentoring has been accorded greater significance in that the Ofsted framework for the inspection of ITT providers requires examination of mentor

training provision (Ofsted, 2014) and Mentor Standards in England (DfE, 2016a) have been introduced. ITT Mentors are regarded as key people who can help trainees to learn to teach and to develop longer term goals for professional development (Jayne, 1995; Wang, 2001; Rice, 2007; Bradbury, 2010).

Central to mentoring is a view that trainees learn to teach through engagement with more experienced practitioners as the latter will enable the trainee to do more than they could do on their own (Vygotsky, 1978). The experienced teacher can be an active variable in trainees learning to teach (Wang, 2001). In recent years, there has been a growth of literature on the role of ITT mentors (for example, Maynard and Furlong, 1993; Maclellan, 1994; Williams and Soares, 2002), the process of mentoring ITT students (Jones, 2001; Koballa, Bradbury, Glynn and Deaton, 2008; Nilsson and van Driel, 2008a), the qualities of ITT mentors (McIntyre and Hagger, 1993; Caires, Almeida and Vieira, 2012), ITT mentor expectations of teacher trainees (Hayes, 1999a), and self-efficacy of ITT mentors (Hall, Smith, Draper, Bullough and Sudweeks, 2005) to enable ITT mentors to address the needs of trainees (Young, Bullough, Draper, Smith and Erickson, 2005; Caires *et al*., 2012).

2.5.1 Ways ITT Mentors may influence trainees who are learning to teach

The influence of ITT mentors within teacher education has been described in terms of their role in developing cognitive processes of a trainee, the socialisation of the trainee into the school and the ways they supervise and develop relationships with trainees (Bullough and Draper, 2004; Caires *et al*., 2012). In the context of ITT, mentoring includes a focus on collaboration: the ITT mentor works with a trainee to solve problems and reflect on their practice (Harrison, Lawson and Wortley, 2005; Bradbury and Koballa, 2008). Bell (2001) refers to ITT mentors as 'critical friends' who may 'collaborate, set common goals, hold conversations for a range of purpose, make time to critically reflect during and after teaching and think … action and outcome, through formulating and asking questions' (Edwards and Collison, 1996, p.36). As critical friends, mentors may help trainees to develop expertise (Nilsson and van Driel, 2008a). Crasborn *et al*.'s (2011) study classifies mentors as 'imperators' if they give 'opinion and advice' compared to 'advisor' mentors who give 'direct advice' (p.322). Similarly, classifications are offered by Young *et al*. (2011) to distinguish

between mentors who adopt a more responsive approach to trainee's needs or those who take a more direct approach to giving advice.

ITT mentors may influence trainees' learning by providing information which may stimulate cognitive changes in terms of learning content related to a range of 'knowledge for teaching' as considered in section 2.3. Mentors may give trainees information to help them plan lessons (McIntyre and Hagger, 1993: Edwards and Protheroe, 2004; Sempowicz and Hudson, 2011). However, Davies and Rogers' (2000) study of 92 first year trainees using surveys, lesson plan analysis and interviews found that planning a science and design and technology lesson was also influenced by trainee's beliefs about science and technology and prior experiences of learning these subjects as well as the school context. Mentors may influence trainees learning by talking about ways of assessing children's learning (Wang, 2001; Jarvis *et al*., 2001; Hudson, 2004) however, variations have been found in mentors' level of confidence in talking about assessment, which will be discussed further in Chapter Three section 3.4.1.

ITT mentors may also influence trainees by giving information in the form of oral feedback after observing lessons (Ofsted, 2002; Hudson, 2005; Sim, 2006) which may give 'advice constructively and critically' (Jones, 2001, p.80). Feedback may identify errors and offer steps for improvement (Eraut, 2007; Hattie and Timperley, 2007). However, the stimuli from feedback may trigger different responses from different trainees as will be discussed in section 2.5 such that feedback may not influence a trainee to change their practices (McNally, Cope, Inglis and Stronach, 1997).

ITT mentors may influence a trainee learning to teach by providing affective support as part of the giving of personal support for a trainee to engage in the mental effort to construct and reconstruct knowledge (Palmer, 2005; Young *et al.,* 2005). Koballa *et al*. (2008) found mentors provided support focused on 'emotional, pedagogical and administrative concerns' (p.396-7). According to a view of learning where there is an interplay between 'content' and 'incentives ' or 'cognitive' and 'motivation' (Illeris, 2009), then mentors may influence learning by being there for trainees; McNally *et al*. (1997) found trainees appreciate

teachers who were 'on tap' and 'always there when you needed them' (p.492). Mentors who listen and offer advice may also influence a trainee in learning 'how to cope with stresses associated with teaching' (McNally, 1997, p.397). The affective aspects of learning are critical to the formation of and development of a teacher's attitudes, views and practices (Flores, 2001; Bradbury and Koballa, 2008).

A further way ITT mentors may influence their trainees' learning concerns how they encourage trainees to reflect on and evaluate their own teaching (Hudson, 2005; Sim, 2006; Nilsson, 2008a; Ghaye, 2011; Sempowicz and Hudson, 2011). However, according to a survey of primary trainees, ITT mentors do not always assist trainees with reflective practice (Hudson, 2005; Hudson *et al.*, 2009). Without criticality, knowledge and skills, trainees' learning may be incomplete or incorrect, or may simply reinforce traditional beliefs and methods and undermine innovation (Bennett and Carre, 1993; Maclellan, 1994).

There are other ways in which ITT mentors may influence trainees learning to teach science including 'thinking out aloud' and 'observations of teaching'. Carroll (2005) and Feiman-Nemser (2001) report observations of ITT mentors 'thinking out aloud' in order to reveal their thinking whilst teaching otherwise this may remain invisible to the trainee. Mentors may organise opportunities for trainees to observe other teachers (Carroll, 2005; Cremin and Arthur, 2014) although modelling is not perceived to be one of the dominant aspects of mentoring (Jones, 2001). Observation of teaching does not necessarily lead to deeper understanding of teaching (Meijer, Zanting and Verloop, 2002) and the opportunities for trainees to talk to ITT mentors about their learning from their observation is variable (Ofsted, 2002; Hudson, 2005).

ITT mentors may also need to recognise the developmental level of their trainee (Maynard and Furlong, 1993; Harrison *et al*., 2005; Bradbury, 2010; Crasborn *et al*., 2011) as well as the duration of their mentoring (Young *et al*., 2005; Hobson *et al*., 2009) in order to continue to influence trainee's learning by offering the 'right level of challenge' (Eraut, 2007, p.417). Berliner (1992) proposes a five stage model of teacher development through which trainees move: novice, advanced beginner, competent, proficient and expert with

accompanying differences for the type of support offered by a mentor. Bradbury and Koballa (2008) also explore trainees' development stages by using the notion of 'border crossing' as a theoretical framework, whilst Nilsson (2008b) discusses the 'stops' of the journey that trainees make from learner to teacher. However, Fox *et al*. (2010) considers that models which suggest mentors should view the development of trainee to teacher as linear as limited given the diversity of workplace practices.

Challenging and supporting trainee's development to teach science may be viewed as 'scaffolding'. Wood and Middleton's (1975) important study on mothers and children led to the concept of 'scaffolding' which has been become associated with a zone of proximal development (Vygotsky, 1978) whereby an expert guides a learner through learning beyond what they could achieve on their own. Scaffolding learning can involve giving generic encouragement, direct instructions and feedback and explicit modelling to gradually guide the learner to develop their knowledge and skills while making connections with existing mental schemes (Tharp and Gallimore, 1988; Palmer, 2005). However, mentors may give too much or too little help and feedback which is discouraging rather than instructive (Schneider, 2008).

2.5.2 Inequalities in mentoring influencing trainees' learning to teach science

Inequitable mentoring can occur in individual schools during placement (Ferrier-Kerr, 2004; Hudson, 2005) which may be due to the variability of value placed on ITT mentoring in schools, a lack of training in mentoring and the quality of the mentors' science knowledge. Mentors may not work with all trainees in the same way (Young *et al*., 2005) which may lead to trainees leaving teacher education (Hobson *et al*., 2009).

One issue with mentors influencing trainees' learning to teach is the variable value that schools place on placements and ITT mentoring by schools. Schools' involvement in training teachers may be seen as an additional burden rather than an opportunity to influence the quality of future teaching (Furlong, 2005) and ITT mentors may experience inconsistencies in how their role is supported because of the variations in agreements between ITT providers and schools (Rice, 2007). In addition, trainees may experience variability in the ways of

working with their ITT mentors because of mentors varying experiences of mentoring during their training (Coates, Vause, Jarvis and McKeon, 1998; Nilsson and Driel, 2008a).

The quality of training for ITT mentors, in general, is variable, with some ITT mentors having no training or only senior people in a school may have training which is then cascaded to class teachers (Edwards and Protheroe, 2004). Training for science mentoring is inconsistent (Jarvis *et al*., 2001; Ofsted, 2002; Ofsted, 2009) although class teachers who have specific training in science mentoring seem to be more confident in raising issues with trainees, to expect more science specific learning outcomes and to place greater emphasis on pedagogical knowledge (Jarvis *et al*., 2001). However, Carroll (2005) considers that all ITT mentors need to be willing to talk about science teaching in order to create a shared language to solve problems and to interpret critical incidents at a deeper level (Nilsson and van Driel, 2008a; Hudson *et al*., 2009).

A third issue concerns the variability in the quality of science knowledge which may be learnt through mentoring. Primary teachers lack expertise and confidence in science subject knowledge (Ofsted, 2013; CBI, 2015) and that this weakness is a significant barrier to the provision of quality science learning experiences for trainee teachers (0fsted, 2011, para.118). There is a possibility that 'trainees may not be provided with adequate pedagogical knowledge in the school setting to develop successful science practices' (Hudson *et al*., 2009, p.69). In addition, it cannot be assumed that an ITT mentor can provide support for a trainee in terms of developing their subject knowledge as well as their general pedagogy (Thornton, 1998; Bradbury, 2010) or that they will focus on a trainee's learning rather than the pupils' performance and the pace at which pupils need to move through the curriculum (Edwards and Protheroe, 2004). However, in England, teachers' science subject knowledge was judged as good or outstanding in 75% of primary schools visited during school inspections (Ofsted, 2013) with good practice observed in schools using extra-curricular visits, mostly linked to environmental awareness (Ofsted, 2009).

The sections on mentoring and inequalities in mentoring have identified debates on how a trainee may be supported in their learning during a placement by a class teacher, a mentor, who may provide support in particular ways during interactions with the trainee.

In the next section I consider the trainee, who, as a learner brings their own 'internal factors' (Illeris, 2009) to interactions with those who may support them in their learning.

2.6 Trainees who are learning to teach

A trainee in England enters ITT with at least eighteen years of life experiences and usually thirteen years of schooling which may or may not have included science. These experiences can shape a trainee's beliefs about learning (Brownlee, Purdie and Boulton-Lewis, 2001; Griffin, 2003; Smith, 2005), their dispositions to learning (Raths, 2001; Hagger, Burn, Mutton and Brindley, 2008) and their preparation to be a teacher (Fensham and Northfield, 1993; Bradbury and Koballa, 2007). The result of trainees rarely being asked about their implicit views of teaching and learning can lead to a clash between them and their mentors (Eraut, 1994) which alongside different personal characteristics and individual biographies can significantly affect the relationships that are formed during ITT placements (Bullough and Draper, 2004).

A trainee's disposition to learn to teach may be considered in relation to their intentionality, their frame of reference, their response to feedback, their attitude to context and their aspirations (Hagger *et al*., 2008, p.167). Hagger *et al*.'s study (2008) found that trainees may be more or less proactive in trying things out in the classroom. Illeris (2009) adds that learners may have different 'incentives' in terms of their interest in learning particular 'content'. In addition, a trainee may also vary in their dispositions and perceptions about the expertise of their mentors (Hsu, 2005; Remington Smith, 2007; Hagger *et al*., 2008). Koballa *et al*. (2008) found that when mentors and trainees considered each other to be sources of expertise even though their kinds of knowledge are different, they can act as 'collaborative partners' (p.399) in sharing the workload for trainees learning to teach science which blurs the distinction between novice and expert. Remington Smith (2007) also advocates that expertise should be seen as arising from 'the joint exploration of teaching ideas' (p.101).

However, Caires *et al*.'s (2012) study of secondary trainees found that satisfaction with mentors may differ between subjects: secondary school trainee art teachers reported greater satisfaction with their mentors than secondary school trainee science teachers.

In addition, a trainee's level of confidence about different aspects of science subject knowledge may influence their learning to teach science (Shallcross, Spink, Stephenson and Warwick, 2002; Nilsson, 2008b). Trainees' levels of confidence in terms of subject knowledge and pedagogic knowledge are related to their experiences of teaching different topics, some of which are more likely to be taught by trainees than others (Shallcross *et al*., 2002). For example, trainees are ten times more likely to have taught 'Forces' than 'Earth and Beyond' (DfEE, 1999) leading to higher levels of confidence in their subject knowledge and pedagogic knowledge concerning 'Forces' (Shallcross *et al*., 2002, p.1298). A survey of 26 primary trainees also identifies variations in confidence in teaching different subjects; 27% feel confident in teaching life processes compared to 15% feeling confident in teaching physical processes (Jarvis *et al*., 2001). A trainee may also be influenced in how they learn to teach science according to the availability of resources (Appleton and Kindt, 1999).

A trainee's perception of how they view the school as a workplace, the quality of the socialisation process into the school and the expectations they identify for their relationship with their mentor may also influence their learning (Flores, 2001; Koch, 2006; Bradbury and Koballa, 2007; Caires *et al*., 2012). A trainee may not ask their mentor for help because they do not perceive the relationship to be supportive or cannot find the time to talk to them (Hardy, 1996). Trainees may then seek help from any experienced teachers they perceive to be friendly and caring, independent of whether the teachers are formally recognised as their mentors (Eraut, 2007). Hsu's (2005) study of 935 requests for assistance made by 40 students in Taiwan during one of their teaching practices found that only half of the help sought was provided by the mentor, the other half was provided by other teachers and staff in the same school (p.313). Fox *et al*. (2010) also found some trainees are more proactive in finding and using support from a range of teachers in a school and Mutton, Burn and Hagger (2010) found that trainees valued opportunities to access and learn from teachers other than their appointed ITT mentor, especially towards the end of their course. These findings

are important to this study because of the potential implications for school-based ITT, during placements, which influences trainees' learning to teach science.

In the next section, literature concerning the role of another more knowledgeable other teacher in a primary school, a science coordinator, will be considered.

2.7 The role of science coordinators in primary schools

The idea of a continuum of accessing professional support from a range of teachers during placements may be helpful to trainees given the complexity of learning to teach (Hardy, 1996; Bradbury, 2010). Smethem and Youens' (2006) study on 'mentoring departments' considers how all staff in a school may mentor trainees, including 'heads of year, teaching assistants, Special Educational Needs Coordinators, careers staff, librarians and technicians' (p.8). However, Ofsted (2003, 2008) found that ITT makes little use of science coordinators in schools: 'frequently it is little more than a brief interview about the scheme of work and its resources' (Ofsted, 2002, para.25). In this section, I discuss literature that addresses the role and responsibility of a science coordinator.

For a long time, teachers in primary schools in England have held responsibilities for teaching the whole curriculum while also taking an active role in leading on their subject (Ofsted, 2002; Hammersley-Fletcher, 2004). Titles given to staff who have subject responsibilities have changed over time, reflecting historical values and demands in education. For example, the primary teachers responsible for curriculum areas have been referred to as 'consultant teachers' (CACE, 1967), curriculum co-ordinators (Department for Education and Science (DES), 1975), occupants of posts carrying special responsibility (DES, 1978), subject managers (Ofsted, 1994; Hammersley-Fletcher, 2004) and 'subject coordinator(s) who provide(s) 'effective, sustained leadership' (Ofsted, 2011, p.8). Schools were advised to have at their disposal at least one teacher 'with the capacity, knowledge and insight to make science education for primary pupils a reality' (DES, 1989) and more recently to 'delegate the management of particular subjects to individual members of staff' (Ofsted, 1994, para. 37). In 1998, the Department for Education and Employment (DfEE) (DfEE, 1998) Circular 4/98 introduced a requirement that all primary ITT courses must

prepare trainees to teach at least one specialist subject. This focus on subject knowledge and 'advanced study of subject pedagogy' (Ofsted, 2001, para 2) shifted a focus to subject knowledge in a specialist subject to at least level 3 (Advanced Level) (UNESCO, 2011), pedagogical content knowledge and introduced subject leadership.

Changes in subject coordinator's responsibilities reflect changes within the primary curriculum on the focus of teaching subjects (Farmery, 2004). The Plowden Report (CACE), 1967) identifies subject coordinators as those who could offer advice and support to their colleagues as specialists in a subject. However, this was a small, informal role (Smith, 2002) and there was no recommendation for these subject coordinators to teach their specialist subject to all children in a school. By the time of the Primary Survey (DES, 1978), a subject specialist could be asked to give advice and guidance to other teachers who are a 'little unsure' (para 8.42) and in science where 'expertise is short' a subject specialist could take 'either the whole class or classes other than their own' (para 8.42). Policy focus on a subject based curriculum intensified in England by the time the National Curriculum was introduced (DES, 1989), leading to the developing concept of subject based curriculum and the role of a coordinator who provides leadership for a subject becoming common currency (Farmery, 2004; Burton and Brundrett, 2005).

Historically many science subject coordinators were assigned to the post because of their interest in science, experience or school need (Thornton, 1998; Qualtar, 1999). Subject coordinators need an understanding of what constitutes good teaching and learning practices in their subject; however being approachable is often considered more important than being a 'bank of knowledge that other staff cannot share' (Farmery, 2004, p.41). This is the case even if a teacher's lack of training as a science 'specialist' means that there is 'a limit to the training they are able to provide to other teachers in their school' (Ofsted, 2011, para 69; Williams and Soares, 2002). A recent survey considers 3% of the English primary teachers' workforce is considered as a science 'specialist' (Royal Society, 2010) who was defined as a teacher with specialist subject knowledge who teaches a subject full time (DES), 1992). However, Burton and Brundett (2005) consider a specialist as someone with

expertise, knowledge or a flair for a subject gained from undertaking further study in the subject (Ofsted, 2001; Taylor, Yates, Meyer and Kinsella, 2011).

A subject coordinator might offer assistance through team teaching with colleagues and observing lessons (Thornton, 1998), discussion (Cross and Byrne, 1995), actively listening (Harrison, 1995; Bowe, 1995; Hammersley-Fletcher and Brundrett, 2005), suggesting 'innovative approaches to learning' (Farmery, 2004, p.32), keeping staff up to date with developments in the subject (Ofsted, 2011) and providing advice on key vocabulary (Ofsted, 2011). Science coordinators make good reference books available (Cross and Byrne, 1995, 77) and look after resources (Bowe, 1995; Ofsted 2008), although the role of subject leadership goes beyond 'simply coordinating activities and resources' (Farmey, 2004, p.21). However, as indicated above, there is limited use of the expertise of science coordinators in ITT (Ofsted, 2002). As professional practices of a trainee teacher may be changed by a conversation with other teachers (Bubb, 2005; Ofsted, 2008) then an exploration of how science coordinators may influence trainees' learning through talk in face to face verbal interactions will offer original insight into the field of learning to teach science.

2.8 Summary of Chapter Two

This chapter has considered what trainees need to learn to teach, in particular what trainees need to learn to teach science, and how they may be supported through mentoring by a class teacher. The chapter has discussed issues regarding inequalities in mentoring and factors which may influence trainees learning to teach science including their disposition to accessing specialist support. The chapter has considered the responsibilities of a specialist teacher in a primary school, a science coordinator, and how science coordinators may support trainees in learning how to teach science. It has also been noted that there appears to be a gap in the literature on understanding how a science coordinator, as a more knowledge other in a school, may influence a trainee learning to teach science during a placement.

The next chapter reviews literature examining talk in terms of linguistic patterns and features and how different factors may affect these linguistic patterns and features. It also considers research on talk related to learning to teach science.

CHAPTER THREE – LITERATURE REVIEW: TALK

3.1 Introduction

The focus of the eight sections of this chapter is a literature review on verbal communication, in particular talk, which is argued to be an essential element within theories of learning which consider learning involving interactions between a learner and their environment (Alexander, 2004). This chapter is the second of the two literature reviews for this thesis concerning how trainees learn to teach science by focusing on the nature and features of talk in verbal face to face interactions during a placement and how these may be influenced by social and physical contexts. The second section of this second review considers the literature concerning human communication and talk as a form of verbal communication in interactions. Section three reviews literature about contexts of talk and theoretical perspectives on talk. Section four considers frameworks to describe and analyse the influence of social context on talk in terms of topic and purpose of talk with particular reference to types of utterances and 'we-statements'. Section five describes the extant literature on 'I-statements' before moving on to section six to identify gaps in the literature and discuss the theoretical framework for the study. Section seven considers an initial conceptual framework for the study.

3.2 Communication between people

There are continuing debates over what is human communication (Heath and Bryant, 2000). Goffman (1967) argues that is 'a class of events which occurs during co-presence and by virtue of co-presence' of people (p.1) and involves two or more people sending and receiving messages (Martin, 2001; Long, 2005). This is important to this study in linking debates in Chapter Two on what and how trainees learn to teach science in relation to messages given and received by trainees talking with a science coordinator alongside other messages they may receive from multiple other sources during a placement.

People influence one another by their actions and statements (Heath and Bryant, 2000). However, there may be no intentionality in messages and whilst early models about human

communication reflected simple transmission models of messages being sent from sender to receiver (McQuail and Windahl, 1993) these models have shifted 'to a more complex interactionist or social constructionist model' (Corden, 2000; Jones and Stubbe, 2004, p.203). These shifts are considered to have been influenced by the development of radio technology in the 1950s which led to the introduction of terms such as 'feedback' and 'noise' for describing the functioning of radio systems which also influenced understandings about human communication including acknowledging factors about the participant's personal dispositions including 'perceptions of themselves, their roles, attitudes and values (which) create a disposition in receiving communication' (McQuail and Windahl, 1993, p.47). Factors which may influence communication during an interaction of messages being sent and received may be important to this study which is concerned with talk between a trainee and science coordinator.

Saville–Troike (2003) states that human communication is made up of verbal and non-verbal components. Verbal communication is considered the spoken word or talk (Cameron, 2001) whilst non -verbal cues communicate without words. Cues include facial expressions, gestures and eye contact (Hayes, 1999b; Sage, 2006), postural movements (Cameron, 2001), eye gaze (Tannen, 1983) and proximity between communicators (Mast, 2007). Knapp and Hall (2005) summarise three areas of non – verbal communication: the communication environment in terms of the physical and spatial signals, the physical appearance of the participants in terms of dress code and thirdly the body movements and position of the participants in terms of gestures, posture, facial expressions, eye movements and vocal behaviours. Rosenfeld and Hancks (1980) found when speakers gazed away from listeners at the end of their utterances, the listeners were likely to reciprocally avert gaze. More recently, Cassell, Nakano, Bickmore, Sidner and Rich (2001) have suggested that posture shifts may signal the start or end of a person talking.

Non-verbal cues can differ in different cultures (Cameron, 2001; Paltridge, 2012). Tannen (1983) considers that cross cultural communication occurs between people from different countries but also across regions, class and gender. Sage (2000) considers that effective communicators understand the conventions that determine how to communicate and

recognise the influence of cultural differences in the conventions of talk (Lambirth, 2006). Eye gaze can differ in the same way as people may speak different languages (Cameron, 2001) however misunderstanding can occur in cross talk between different cultures if one person looks away or down when another expects them to use eye contact to show attentiveness (Callender, 1997). Mathias (2012) describes Germans as being more direct than Americans and suggests they consider eye contact an important part of being direct and to the point. Proxemic studies suggest that people stand and sit at different distances apart from each other (for example Hans and Hans, 2014) and Germans and the English tend to have a larger personal space than Americans (Hall and Reed Hall, 1990).

Verbal communication may be described using different words to reflect different types of talk; for example, conversation (Trudgill, 2000; Cameron, 2001) or debate (Gee, 2014). McNally *et al*. (1997) refers to informal conversations compared to formal encounters.

The next section considers the context of talk for a trainee teacher given the importance of context of talk identified in Chapter Two in terms of social and physical contexts leading to variations in the development of relationships and the influences of these on trainees' learning (She and Fisher, 1999; Wang, 2001).

3.3 Context of talk

Context is a complex concept and can be explored at different levels (Holmes and Stubbe, 2003; Paltridge, 2012). According to Schegloff (1992), there are two types of context. The first type is the intrinsic or 'linguistic' context which refers to information that can be found in the text, written or speech, which surrounds the language being analysed at a particular point (Mercer, 2000). Talk has particular features (Mercer, 1995; Hayes, 1998; Slembrouck, 2003) which may be analysed by examining speech acts as a unit of analysis. Speech act theory, with its tradition in analytical philosophy, provides a way to analyse the individual actions of the utterances of the speaker and listener and a means to 'differentiate between the linguistic meaning of an utterance and its status as an action' (Nofsinger, 1991, p.33). Each utterance depends on the context of the 'action' that took place in the previous utterance, for example a question utterance is usually followed by response utterance

(Drew and Heritage, 1992). Sequences of utterances which occur during talk as speakers take turns to talk can last for a 'word, phrase, clause or full sentence' (Nofsinger, 1991, p.81). Gee (2014) refers to a 'stanza' in terms of a group of lines, in a text, which refer to one event or theme; when the event changes there is a new stanza.

The second type of context is 'extrinsic' context which refers to information about the setting, the situation and the participants (Miles and Huberman, 1994; Farmery, 2004); 'where the person is physically, who else is involved, what the recent history of contact is as well as the relevant aspects of the social system in which the person appears – a classroom, a school' (p.102). Holmes (2000) refers to participants and setting as 'social factors' which may influence linguistic features and she adds topic and purpose of talk as two other 'extrinsic' factors. These factors are discussed further in the next section.

By placing intrinsic and extrinsic context as two binary ends of a spectrum, theoretical approaches to analysing talk may be considered. Starting at one end of the spectrum focusing on intrinsic context only, linguistic studies focus on an analysis of words, sounds of words and sequential structural patterns of exchanges with no reference to its physical or social context (see, for example, Chomsky, 1998). Also towards this end of the spectrum, conversational analysis studies consider context is made within ordinary talk at the moment of talk and rely on fine grain analysis of the sequences and order in talk to identify distinctive features in talk with 'little attention to social setting, identities of participants, personal attributes' (see, for example Sacks, Schegloff and Jefferson, 1974; Atkinson and Drew, 1979; Goodwin, 2002; Strong and Baron, 2004, p.49; Viiri and Saari, 2006; Radford, Blatchford and Webster, 2011). Moving along the spectrum, pragmatics studies the principles that underlie how words are interpreted to give meaning in speech acts and used in universal social interactions such as promises or warnings (for example, Austin, 1996; Goffman, 1967; Keenan, 2002; Dalton-Puffer and Nikula, 2006). Alternatively, sociolinguistic studies assume an 'intrinsic and causal relationship between language and social contexts in which it is produced' (for example, Hutchby and Wooffitt, 1998, p.5; Holmes, 2001). Finally, ethnographic studies analyse speech within the context of a particular community (for example, Hymes, 1974; McGregor, 2000; Saville - Troike, 2003) and Critical Discourse studies

(for example, Fairclough, 1999; Rogers, 2011) reflect context in relation to variance of power, ideologies and social issues.

This study draws on sociolinguistics as it provides a method of looking at the specific features of talking itself as well as relating verbal behaviour to social processes (Gumperez, 1982; Saville – Troike, 2003; Erikson, 2004) to recognise the influence of social context on learning. The strength in adopting a sociolinguistic approach rather than conversational analysis is that the study will examine sequences of utterances and frequency counts of particular linguistic features, but it will also consider the intention of talk (Holmes, 2001).

3.4 Frameworks to describe and analyse influence of social context on talk

Previous studies (for example, Hymes, 1974; Halliday, 1979; Holmes, 2001) have developed frameworks to describe and analyse talk between participants which consider the influence of social context on linguistic features of talk. That is important to this study because of the potential to support understanding of how social contexts may influence participant trainee's learning to teach science through an analysis of talk.

Social context may be examined by considering different factors. Holmes (2001) refers to four social factors - setting, participants, function and topic - whilst Halliday (1979) uses three factors: field, mode and tenor. Hymes (1974) uses the acronym SPEAKING to refer to eight factors of setting/scene, participants, ends, acts, key, instrumental, norms and genre to consider influences of social and physical context on linguistic features. Holmes (2001) adopts the term 'setting' to describe the influence of the physical setting of where participants talk whereas Hymes (1974) uses the terms 'setting' and 'scene' to differentiate between the influence of time, place and concrete physical circumstances in which speech takes place and the abstract psychological or cultural features of a setting. The lack of time to talk is considered a key factor in hindering the development of effective verbal communication (Hardy, 1996; Wang, 2001; Farmery, 2004). However, Thompson (2003) reports that it is more important to find the 'right time' rather than the lack of time to ensure participants are free to listen and Eraut (2007) identifies learners need to identify the 'right' person to ask.

Consideration of social context includes the influence of participants (Halliday, 1979; Holmes and Stubbe, 2003). Goffman (1967) considers participants as actors who bring their own thoughts, personal values, expectations and verbal skills in a moment of interaction (Coleman, 1966; Hayes, 1998; Thompson, 2003). The participants in a verbal interaction may be described in terms of how they fulfil certain societal roles and if they act as the sender or receiver of messages (Hymes, 1974). The social context may also be influenced by how each participant views their own role during an interaction (Jones, 2001; Kinchen, 2004) and how comfortable participants feel in listening, asking questions and accepting appropriate responses (Farmery, 2004). That possibility is important to this study based in a place of work for teachers where a science coordinator and trainee teacher has different roles.

The influence of the relationship between the participants on linguistic features may be described with reference to a social distance scale (Holmes, 2000). Brooks (1996) considers that interpersonal relationships may be promoted by participants' frequently meeting face to face which in turn may support successful learning (Wubbels and Levy, 1993). Wang's (2001) study on the frequency, duration and location of talk between trainees and their mentors in China, UK and USA finds that fewer, shorter and more interrupted talk offers different opportunities for trainees to learn from their mentor.

The influence of the relationship between participants on linguistic features may also be described with reference to power (Holmes, 2001). Power may be described as 'the ability to impose one's will on others' which is 'expressed through discourse' (Paltridge, 2012, p.244). According to Follett (1924) though, 'true power is 'power with' another, not 'power over' another' (cited in Phelps, Parayitam and Olsen, 2007, p.7). 'Power with' others involves creating an alliance between those with apparent formal power, and those with less or no formal power (Bacal, 2018). In contrast, Foucault (1980) considers that power is everywhere and exists in the multiple and complex relations between all individuals (cited in Paechter, 2001). Power is not something held by individuals. He also adds that power is not necessarily negative or repressive, and that power 'produces things, it induces pleasure, forms knowledge' (Rabinow, 1991, p. 61). This pleasure is considered an 'important factor in

the successful operation of power relations' (Paechter, 2001, p.10) which may align with Mclelland's (1999) identification that people have a need for power.

Participants with greater power - or assumed greater power - will talk more (Duck, 1986), interrupt or give orders (Saville-Troike, 2003) and may position the other participant as 'powerful or powerless, confident or apologetic, dominant or submissive, definitive or tentative, authorized or unauthorized' in terms of their right to speak (van Langenhove and Harre, 1999, p.17; Bullough and Draper, 2004). Jones (2001) found the power differential between a mentor and trainee that occurred when the mentor assessed the trainee whilst they worked in their class placed the trainee in a position of 'dependency and inferiority' (p.85) and interfered with 'the development of a trusting and honest relationship' (p.91). The focus on the participants and the relationship between participants through an analysis of talk is important to this study because of the potential influence of relationships on the trainee learning to teach science.

The influence of knowledge on linguistic features may also be considered; one participant may have more knowledge or different levels of knowledge due to different expertise (Drew and Heritage, 1992). Participants may use this knowledge to interpret verbal interactions through 'knowledge frames' (Labov, 1972). Foucault (1972) proposes that verbal interactions may be described by considering discourses which 'systematically form the objects of which they speak' (p.49). Discourses are 'group of statements that belong to a single system of formation' for example 'clinical discourse, economic discourse' (Foucault, 2002, p.121). However, the conventions of discourses can be controlled by those with knowledge; for example, 'look rather than read, verify rather than comment' (Foucault, 1972, p.218). Possession of knowledge gives one power and power is function of knowledge (Routledge, n.d). The nexus between knowledge and power in Foucault's (1972) thinking is that power defines the discourses which actively shape what can be known and what is not allowed. Cameron (2001) also adds that knowledge is surrounded by a 'network of concepts and beliefs that set an agenda' to control and define what and how to talk about knowledge (p.16). A focus on the participants' knowledge through an analysis of talk is important to this

study because of the potential influence of knowledge on the trainee learning to teach science.

In the next two sections I consider the 'topic' of talk with reference to what is being spoken and 'purpose' of talk which links to 'outcomes' with particular reference to two linguistic features; 'types of utterances' and 'we-statements'.

3.4.1 Describing and analysing the 'topic' of talk

Describing and analysing the 'what is being talked about', is a common aspect when considering the influence of social context on talk. Holmes (2001) refers to 'topic' and Halliday (1979) uses the term 'field' to describe the subject matter of the communication and its influence on linguistic features of talk. Hymes (1974) uses the descriptor 'acts' to refer to the actual form and content of what is said, the precise words, how they are used and the relationship of what is said to the actual topic at hand. This is important to the study in providing an understanding what of trainees talk about in relation to developing 'knowledge for learning' and influences on these topics.

The 'topic' of talk may be useful to describe and analyse when accounting for different linguistic features (Holmes, 2001). It may be argued that to support an understanding of what is going on in a particular situation, the 'topic' needs to be identified in terms of an activity type which is recognised as distinct within a particular institution, for example; writing a lesson plan or observing a lesson in a school (Fairclough, 1989). Edwards and Protheroe (2004) use 'activity theory' (Engeström, 2009) to consider how mentors, as the subject, influenced trainees, as the object, in improving pupil progress through the use of artefacts including lesson plans. Connecting individual acts with actions which are located within a more general activity offers a framework to examine the influence of relationships on individual acts.

An activity type is 'likely to constrain the set of possible topics' of talk but not predict them (Fairclough, 1989, p.147). Topics may shift from one subject to another gradually or abruptly (Hudson, 1981, p.133) although usually there is a link with what has been talked about

before (Crow, 1983) even though specific words and the content of talk may be altered due to the time when talk takes place (Williams and Watson, 2004). Skeleton overviews can provide a model to visualise how topics are attended to in a linear, one after another, or spiral structure, returning to previous topics (Talbot, Atkinson and Atkinson, 2003; Holmes and Stubbe, 2003). However, participants may have different views on what is talked about (Wardhaugh, 2002) and participants 'must recognise when it is appropriate to raise particular topics and when it is not' (Duck, 1986, p.57).

Topics of talk between trainees and mentors have been identified and analysed (for example, Jarvis *et al*., 2001; Wang, 2001; Edwards and Protheroe, 2004; Hudson, 2005; Bradbury and Koballa, 2007). Jarvis *et al*.'s (2001) survey of primary mentors' confidence identifies that 32% of 69 UK ITT mentors felt confident in talking to trainees about topics coded as 'science knowledge and understanding' with variations in their confidence in teaching different subjects: 45% felt confident in teaching physical sciences compared to 59% in teaching materials. Hudson's (2005) survey of 331 final year primary trainees in Australia reports that 35% discussed topics coded as science knowledge with their mentors and 41% of trainees felt their mentor assisted with their learning about teaching strategies in science.

Assessment of children's learning is a topic talked about by trainees and mentors to varying degrees. Butterfield *et al*.'s (1999) study of nine mentors talking to secondary PGCE trainees in England found talk about assessment varied between 3% and 14% with no reference to National Curriculum Attainment Targets or Levels. Jarvis *et al*.'s (2001) survey of 69 primary mentors finds that only a quarter, 25%, felt confident in talking about assessment of science and similarly Hudson (2005) survey of 331 primary trainees' reports that 31% talked to their mentor about assessment. In addition, Edwards and Protheroe's (2004) analysis of talk between mentors and trainees after lesson observation in primary literacy and numeracy lessons identifies that talk about assessment featured least as a topic of talk.

Mentors and trainees may also talk about children. Wang (2001) comparative case studies of pairs of primary and secondary trainees and their mentors in US, UK and China finds that

the time the pairs spent talking about children with UK and China was less than 5% but in US was slightly higher at 7.9%. Mutton *et al*.'s (2010) analysis of 25 PGCE trainees' talk in post lesson observations meetings found that trainees felt they lacked knowledge about children and in particular the relationships between children in the class. Additionally, Edwards and Protheroe's (2004) analysis of talk finds that the frequency of talk about children differed after mentors' observing primary literacy and numeracy lessons. However, two surveys set up to explore mentoring for primary science do not include any references to mentors talking about children (Jarvis *et al*., 2001; Hudson, 2005). This is important to the study in understanding the degree that trainees talk about children in order to inform their science teaching.

3.4.2 Describing and analysing the 'purpose' of talk

Considering the 'purpose' of talk is a common aspect in describing and analysing its influence on the features of talk (Halliday, 1979; Holmes, 2001). This is important to this study because it will add insight to understanding the influence of the perceived purpose of talk and its influence on linguistic features and learning to teach science. Halliday (1979) proposes that the purpose of talk may be viewed by considering roles played through talk in terms of questioner, informer and responder. Hymes (1974) uses 'ends' to refer to the purpose of talk in terms of conventionally recognised and expected outcomes of an exchange as well as the personal goals that participants may seek to accomplish on particular occasions.

Two purposes of talk may be perceived as gaining information and developing relationships (Holmes, 2001) and signified by clearly demarcated types of utterances or 'genre' (Hymes, 1974). McQuail and Windahl (1993) and Holmes and Stubbe (2003) consider talk as a vehicle for creating and maintaining social interaction. However, Holmes (2001) refers to one purpose of talk as means to provide referential content in terms of giving information.

Analysing linguistic features provides a means to discuss the purpose of talk and in the next section I define and consider two features in particular; utterances and 'we-statements'.

3.4.2.1 Utterances - referentials, directives and questions

Utterances are not the same as sentences (Renfrew, 2014) since they have linguistic meaning (Austin, 1996). Utterances are classified as a speech act (Searle, 1996) to describe actions that can be performed by speech such as convey information, cause others to behave in certain ways and elicit information (Halliday, 1979; Liberman, 2016). This is important point in this study that examines how talk may influence learning.

Utterances which convey information are termed 'referential' (Holmes, 2001). The literature provides a number of different types of referentials. For example, Vine (2004) refers to 'advice' utterances in her study of four women and their work place colleagues and Blom, Verdaasdonk, Stassen, Stassen, Wieringa and Dankelman (2007) use 'explaining' to classify talk which aims to 'transfer knowledge' (p.1562) from a trained to a trainee surgeon. Scott (1998) uses the term 'authoritative discourse' to describe the 'information transmitting voice' of a teacher to children which often involves instructional questions and factual statements.

A second type of utterance has the purpose to promote action in the listener. Patterns of speech acts that get people to do something are called 'directives' (Searle, 1996; Holmes, Stubbe and Vine, 1999; Vine, 2004) although Blom *et al*.'s (2007) study of surgeons talking to trainee surgeons uses the term 'commands'. The strength of an instruction may be seen in how it is given and a direct or indirect instruction may reflect the length of time people have been working together (Holmes *et al*., 1999; Vine, 2004). The relative strength of a directive utterance may be observed by the use of a suggestion or advice (Hauge, Wanzek and Godellas, 2001; Crasborn *et al*., 2011) or the use of a 'hedge' such as 'haven't you?' to reduce the imposition on the person to whom the directive is addressed and indicate signs of subordination (Brown and Levison, 1987; Remington Smith, 2007). In addition, the inclusion of the person's name may suggest the speaker knows the other person well and is making the directive more gently (Trudgill, 2000). The instruction may also be influenced by the urgency of what is being asked for (Holmes *et al*., 1999; Vine, 2004). Crasborn *et al*.'s (2011) study found variations in mentoring talk coded as' initiator, imperator, encourager and advisor' (p.327) reflecting different strengths in the uses of directives by mentors.

Young *et al.* (2005) also identify variations in 18 mentors' responses which are classified into three groups such that 'directive' mentors give strong recommendations rather than suggestions or possibilities to trainees.

People with less power in an asymmetrical relationship are not likely to give orders to those with more power: decreasing amounts of power would be reflected in a spectrum of orders moving from a 'demand [to a] request, suggestion, hint, and entreaty' (Saville-Troike, 2003, p.258). Broady (2006) suggests there are two registers for directives; ones that request action and predominately focused on regulating teaching activities and those that request information and focus on facilitating the acquisition of knowledge. However, Koballa *et al*. (2008) found that when science mentoring is conceived as an 'apprenticeship' with a view that the 'mentor knows best' (p. 398) then stronger directives from the mentor to trainee also occur alongside suggestions (p. 398). Directives might be softened by the use of 'we' rather than 'you' within the instruction (Holmes *et al*., 1999; Vine, 2004) or by the inclusion of a modal verb for example 'you could have' rather than 'you need to' (Vine, 2004). Williams and Watson (2004) found that these increased in frequency when mentors delayed giving feedback after a lesson observation. The role of asymmetrical relationships is important to this study because of the differences between trainees and science coordinators in terms of different experiences in teaching science.

A third type of utterance, a question, has a purpose to elicit information (Halliday, 1979; Myhill and Dunkin, 2005) or check understanding and support conceptual change as participants question and negotiate a shared understanding of meaning or fill a gap in knowledge (Blosser, 1973; Roth, 1996; Blom *et al*., 2007). Questioning is considered a 'significant part of teaching and science talk' (Chin, 2006, p.1334) and an 'integral part of learning' (She and Fisher, 1999, p.710; Kim, 2015). However, Myhill and Dunkin (2005) find that questions asked by primary teachers to children are mostly fact finding. Questions may be made to appear more obvious to the listener by using verb-subject switching; for example using Wh- questions such as what, why, where, when and how questions (Nordquist, 2017a) or the addition of tag questions (Coates, 1996). Tag questions, such as

'doesn't it?', may also act as 'softening tags' to reduce the impact of directives and build relationships (Tottie and Hoffman, 2006).

3.4.2.2 'We-statements'

A purpose of talk may be viewed as building and maintaining relationships so the analysis of 'we-statements' may act as a linguistic indicator of a relationship which has developed over time to create a 'we' (Gergen, 2009). When participants use 'we – statements' it indicates a time investment and verbal commitment to a relationship (Gergen, 2009). The use of 'we-statements' foster the 'cooperative, mutually facilitating aspects of the relationship' (Burr, 1990, p.268) although they may also be used to 'covertly control or used to speak for others, when someone does not have the power to speak for themselves' (Burr, 1990, p.272). 'We-statements' have been used to consider the development of relationships between trainees and mentors during placement (Ticknor and Cavendish, 2015).

In the next section, I consider a linguistic feature which may reflect an individual's perception on their learning, 'I-statement'. Trainee teachers are learners and one approach which may be used to provide an insight into the perception of a learner about themselves and their learning is the analysis of 'I-statements'

3.5 Learning and 'I-statements'

'I-statement' analysis is an approach which focuses on how individuals speak or write in the first person to describe their actions, achievements and goals (Burr, 1990; Ushioda, 2008). They are an utterance where the participant uses the word 'I' to refer to themselves (Gee, 2014). 'I-statements' have been analysed to consider reflective writing (Ushioda, 2008; Wei and Hsu, 2013; McWhirr and Gordon, 2015), the development of teenage identity (Gee, 2014) and the identity of trainee teachers (Ticknor, 2010, Ticknor and Cavendish, 2015). 'I-statements' have been categorised into affective, cognitive, state and action, ability and constraints and achievement (Gee, Allen and Clinton, 2001; Wei and Hsu, 2013) such that the examples below provide a framework for analysis.

Type of 'I-statement'	Examples of 'I-statements'
Cognitive statements	I thought, I know, I think, I don't know, I suppose
State and action statements	I talked, (I was talking, I will be talking), I changed, I was excited, I am worried
Ability and Constraints	I don't want, I couldn't get over, I struggled
Achievement about activities, desires or efforts	I learnt, I could, I need to, I improved
Affect/desire statements	I want to, I like, I love

Table 3.1 Types of 'I-statements'

This section concludes the literature review and in the next section, I consider gaps in the literature and the theoretical framework for the study.

3.6 Theoretical framework for the study

A gap in the literature is an understanding of how an experienced teacher other than a mentor, may support a primary trainee's learning to teach science during a placement through talk. This study addresses that gap by analysing features of talk between a science coordinator and trainee and factors which may influence them. Learning may be understood by considering psychological, biological and social conditions which are involved in the learning process (Illeris, 2009) and positions taken by researchers emphasis the role and interaction of each condition (Palmer, 2005; Illeris, 2009; Aubrey and Riley, 2016). This study is situated within a theoretical framework of learning that focuses on processes whereby an individual acquires knowledge and skills that lead to observable lasting changes in behaviours of the individual.

During this study, different theoretical frameworks have been considered as the data emerged and was analysed. Three particular theoretical frameworks were considered: social activity, community of practices and social constructivist because they recognise an

interrelationship between cognition, context and practice. However, a social activity framework was not used because this study focused on an individual's development rather than the development of historically located activities (Engeström, 2009; Cole and Gajdamashko, 2009). A community of practice framework was not considered appropriate for this study given the focus was not on individuals developing social relationships to participate in the placement (Wenger, 2009).

The social constructivist theory of learning is seen as a dominant framework of learning in science (Jenkins, 2000; Palmer, 2005). Social constructivism has been used to guide how to teach science in the school classroom (Tsai, 2000; Kearney, 2004: Reigosa and Jimenez-Aleixandre, 2007). It is also influencing theories in teacher education (Noel, 2000; Liang and Gabel, 2005; Beck and Kosnick, 2006; Taylor, 2008; Ellis and McNicholl, 2015) and has been used to guide the writing of training programmes for trainee science teachers (Al-Weher, 2004; Liang and Gabel, 2005), and qualified science teachers (Kroll, 2004; Ekborg, 2005; Galili and Lehavi, 2006). This framework is not favoured by all (Irzik, 2000; Guile and Young, 2001; Palmer, 2005) and it is suggested that the dominant emphasize has narrowed the professional and research agenda relating to school science teaching (Jenkins, 2000) and the pedagogical approach is at odds with scientists and their understanding of science knowledge (Kragh, 1998).

However, an underpinning concept in the social constructivist paradigm concerns learners being supported by an experienced other in their development through a zone of proximal development (ZPD) to achieve a level of achievement beyond that possible on their own (Vygotsky, 1978). This is considered pertinent to this study. When learners interact with their social and physical environment (Mercer, 1995; Wenger, 2009) it may act stimulus to provide an experience or activity to initiate the learning process (Illeris, 2009). Collaboration with an experienced other, through talk, may support a learner to transform the experience or activity into learning (Vygotsky, 1978; Tharp and Gallimore, 1988; Keenan, 2002); 'intellectual development occurs when speech and practical activity converge' (Vygotsky, 1978, p.24). However, not all experiences lead to learning; some may never enter consciousness or feature in talk (Illeris, 2009) and a focus on experiences for cognitive

development in the ZPD ignores the development of the affective domain which may empower learners with confidence to learn (Yung and Tao, 2004; Palmer, 2005) as well as their social development (Guile and Young, 2001).

Whilst social constructivism is the dominant theoretical underpinning for this study, it also draws on sociolinguistics as a method of looking at the specific features of talking itself as well as relating verbal behaviour to social processes to recognise the influence of social context on learning (Gumperez, 1982; Saville-Troike, 2003; Erikson, 2004). The strength in adopting a sociolinguistic approach rather than conversational analysis is that sociolinguistics allows for the examination of sequences of utterances, speech acts and frequency counts of particular linguistic features and for consideration of the intention of talk (Holmes, 2001). The study may be viewed as a descriptive analysis of talk (Gee, 2014) rather than a critical one which examined the use of talk in relation to 'social and cultural issues such as race, politics, gender and identity' (Paltridge, 2012, p.186). It aimed to identify and understand linguistic features of talk and how these may influence learning to teach science in teacher education.

The study's theoretical framework is also influenced by speech acts (for example, Searle, 1996) and comprehensive theory of learning (Illeris, 2009). These theoretical perspectives provide important underpinnings for the study because they offer an insight into the different types of utterances spoken by the experienced other to the learner and the influence of what is learnt and the incentives for learning and the interaction of these with an environment which may provide a stimulus for learning.

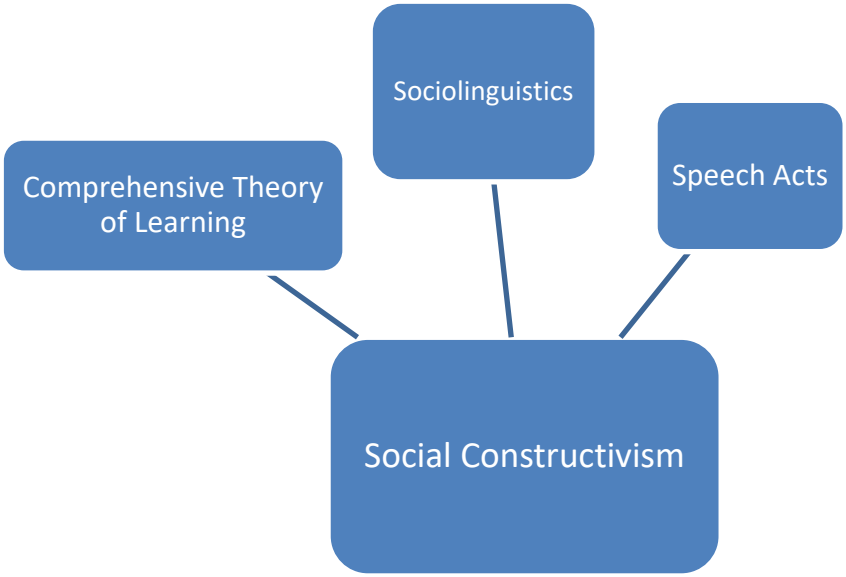

Figure 3.1 Theoretical frameworks for the study

3.7 Initial Conceptual Framework for the study

The development of an accompanying conceptual framework for this study was iterative. The figure overleaf reflects an initial conceptual framework based on the literature review and reflection on my professional experiences. It identifies four initial factors which may influence trainees' learning 'knowledge for teaching' science. Firstly, ITT expectations and Teachers' Standards, secondly, context in terms of the school, science NC topic taught, resources available, meeting times, thirdly a trainee's disposition to learn and confidence in science and fourthly talk with a science coordinator in terms of providing a stimulus or for transforming an experience or activity into learning.

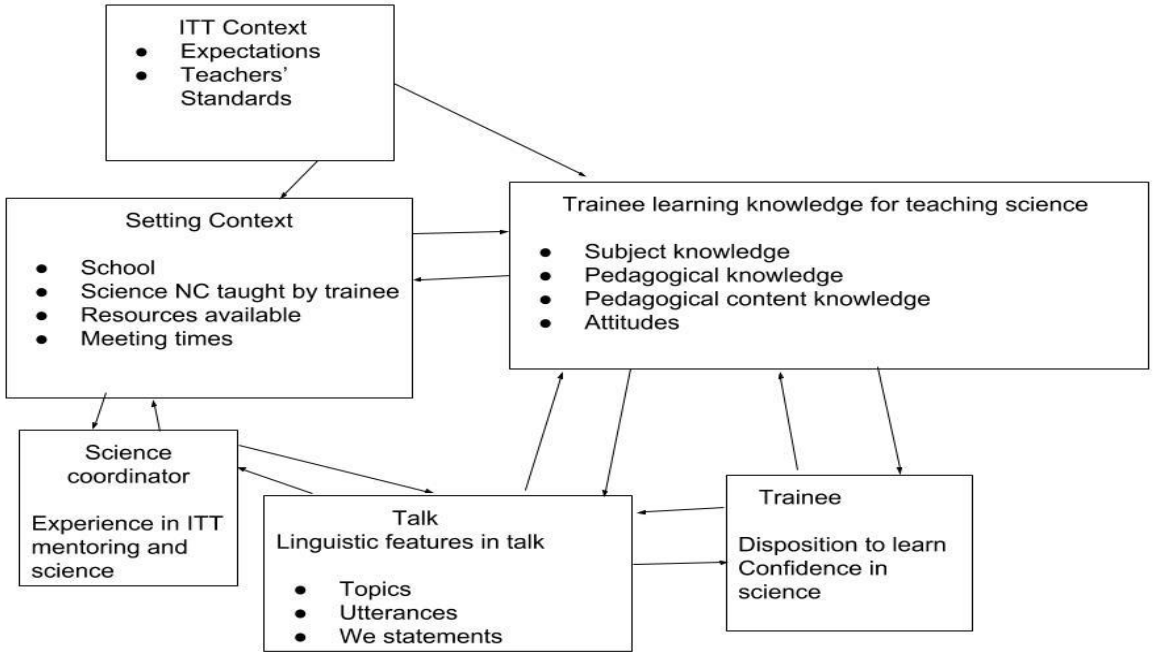

Figure 3.2 Initial Conceptual Framework

It was considered appropriate for a qualitative study to develop a conceptual framework post data collection and analysis. The conceptual framework is discussed in Chapter Nine.

3.7 Summary of Chapter Three

Extant studies into talk are varied, focusing on the structure and content of the words and phrases as well as relationships between the words and the social world. Talk is not the same in all contexts; it is complex and subject to various interpretations. Studies identify that talk is essential in building relationships as well as supporting the constructing of knowledge. This chapter has provided an overview of talk and features of talk as a means of understanding how talk may influence trainees' learning to teach science and identified gaps in the literature that this study addressed.

The next chapter will consider the methodology and methods that were adopted for collecting data in the present study.

CHAPTER FOUR - METHODOLOGY

4.1 Introduction

This chapter provides information on how data were collected for the study and justifies decisions taken in this regard. The chapter comprises thirteen sections. The first section considers the paradigm selected for the study and how this provided a means to consider how beliefs about reality positioned the study. I discuss two opposing beliefs on reality - objectivism and subjectivism - and how this study of talk aligns with the ontological belief that is subjectivism which in turn is congruent with my epistemological stance. In the third section, I consider the type of data that were collected and how they responded to two research questions:

1. What are linguistic features and patterns in 'talk' between a primary school science coordinator and trainee during a teaching practice?
2. What factors, including the setting, participants, purpose and topic influence linguistic features and patterns of talk between a science coordinator and trainee during a teaching practice?

The fourth and fifth sections consider the chosen methodological approach, an instrumental case study (Stake, 1995; Bassey, 1999). I look initially at the key features of case study and I focus on how case study addresses the question stem in each of the research questions. The sixth section considers the issue of collecting data on talk. The seventh section within this chapter considers how the use of participant observations, semi- structured interviews and reflective diaries enabled the triangulation of qualitative and quantitative data to substantiate interpretations. Sections eight, nine and ten discuss trustworthiness, phases for data collection and the decisions on ways to analyse data. The eleventh section considers how participants were selected and who they were before the final section on ethical considerations which are detailed further in Appendix 6.

The aim of this study was to examine how 'talk' with a primary school science coordinator may influence a primary teacher trainee learning to teach science. In the study, talk

between a science coordinator and trainee teacher was not considered to be predetermined or a mechanistic response to an environment during a placement. Participants were afforded opportunities to make their own decisions about talk and talking although asymmetrical differences in status, knowledge, experience and expectations may have affected their decisions which may or may not have been made consciously. Embarking on a study of human interaction provided a stimulus to reflect on my own beliefs about reality and knowledge.

4.2 Choosing a paradigm

There is a close link between a researcher's beliefs about the world and human behaviours and a chosen framework for a study (Creswell, 2014). Different philosophical beliefs and 'worldviews' lead to different views about realities and knowledge that affect the planning of a research study and its approaches (Grix, 2004; Creswell, 2014, p.6). Bryman (2012) suggests that connections between research strategies and 'ontological and epistemological commitments are not deterministic' (p.618) but it was through an explicit and conscious consideration of my beliefs about reality and knowledge that I selected a paradigm appropriate to my study (Opie, 2004; Cohen, Manion and Morrison, 2007; Lincoln, Lynham and Guba, 2011). A paradigm is a set of fundamental assumptions and beliefs: 'a network of coherent ideas about the nature of the world' (Bassey, 1999, p.42). Most research paradigms tend to align with one of two overarching paradigm categories: 'objectivist and the subjectivist' (Raddon, 2010).

In the next two sections, I use the terms objectivism and subjectivism to consider key features which may distinguish paradigms and then summarise the paradigm in which the study is situated.

4.2.1 Objectivism

The objectivist - or positivist - paradigm reflects a view that reality has an independent existence of its own, external to an individual (Cohen and Manion, 1989; Lincoln *et al*., 2011). An objectivist perspective assumes reality does not depend on any observer seeing it, there is only one reality, it is present irrespective of being observed and even if it is

observed then everyone would experience the same reality. Within the natural sciences objectivity is a key expectation and characteristic of empirical science research (Raddon, 2010; Creswell, 2014). The methodology associated with positivism includes 'chiefly quantitative methods and verification of hypotheses' (Lincoln *et al*., 2011, p. 100). Hypotheses can be tested by gathering data that consider the presence or not of phenomena and the links between causes and effects.

Positivists believe there are 'facts' on human behaviour which can be gathered and are independent of how they are interpreted (Raddon, 2010). A social science researcher working within a positivist framework would collect data which can be used to generalise behaviours and, if appropriate sampling has occurred and variables have been constructed, to produce causal findings based on mathematical patterns and probabilities (Creswell, 2009; Lincoln *et al*., 2011). Within this paradigm, human behaviour would be perceived as the product of the environment and any changes to this would be measurable when a circumstance is changed. Therefore, talk between a science subject coordinator and trainee teacher could be considered a predetermined or a mechanistic response.

There can be advantages to working in a positivist paradigm. It depersonalises and restricts the knowledge of talk by concentrating only on selected observed and measured behaviours of humans at one point in time. Identifying and measuring concepts or indicators (Bryman, 2012) may then act as dependent and independent variables to explain a certain aspect of the social world. Yet, in educational research isolating variables can be difficult (Scotland, 2012).

4.2.2 Subjectivism

An alternative view on reality and knowledge is the subjectivist or non-positivist paradigm (Opie, 2004), sometimes termed interpretivism (Cohen *et al*., 2007; Denscombe, 2010), or the 'naturalist paradigm' (Lincoln and Guba, 1985; Basit, 2010). In this paradigm, realities are regarded as being represented and located within individuals, 'socially and experientially based and dependent for form and content on the persons who hold them' (Guba, 1990, p.27). Multiple realities exist in the minds of humans as they make sense of their

engagements with the world and these may be 'formed through interaction with others' (Creswell, 2014, p.8) such that realities are the 'institutions, structures, practices and conventions that people reproduce and transform' (Miles, Huberman and Saldana, 2014, p.7). Interpretivism focuses on in-depth analysis and interpretation of multiple realities, contributed by people in different situations, and leading to multiple meanings rather than general statements: 'individuals develop subjective meanings of their experiences' (Bassey, 1999; Creswell, 2014, p.8). In addition, interpretivist researchers uncover social phenomena by taking an insider perspective such that the experiences and values of the researcher and participants influence the collection and analysis of data (Wahyuni, 2012).

Knowledge about realities is elicited and understood through interactions between the researcher and participants (Guba and Lincoln, 1994); 'the researcher must understand the social context in which the data are produced to accurately reflect what the data actually mean to the study' (Lincoln *et al*., 2011, p.113). Knowledge and understanding of the world are constructed by a person and persons based on historical and social perspectives and enabled by the employment of the 'tools' of language, numbers and symbols (Vygotsky, 1978; Creswell, 2014; Aubrey and Riley, 2016). Cognitive development in an individual is considered to result 'from processes which occur first between people and then occur within the individual' (Keenan, 2002, p.133). In addition, in this paradigm, the voice of the researcher is mixed with the participants alongside a reflection on the self as a researcher to 'recognise their own backgrounds shape their interpretation' (Creswell, 2014, p.8) as the world does not exist independently of their knowledge of it (Grix, 2004).

An advantage of research conducted within an interpretivist paradigm concerns the 'rich evidence and credible and justifiable accounts which can be made use of by someone in another situation if the research process and findings can be replicated' (Cohen *et al*., 2007, p.133-149). The disadvantage of this paradigm lies in its very nature of considering knowledge as being constructed subjectively. Those who align with the positivism may argue that this bring into question the validity in terms of one accurate truth from the standpoint of researcher, participants and readers (Creswell and Miller, 2000). The belief that knowledge is socially constructed limits the development of generalisable laws which

can be verified (Lincoln *et al*., 2011): 'knowledge produced by the interpretive paradigm has limited transferability as it is usually fragmented and not unified into a coherent body' (Scotland, 2012, p.2).

This study was eventually positioned within an interpretivist paradigm. This paradigm was chosen because of my beliefs that multiple perspectives of reality are held by people that may be 'shaped by social, political, cultural, economic, ethnic, and gender values' (Scotland, 2012, p.13). However, this decision was personally challenging, because of my prior experiences as a science teacher which emphasised my positivist perceptions about reality and measurements of variables which could generate equations to represent links between causes and their effects. I addressed this challenge by working with numbers as well as words as discussed in the next section.

4.3 Considering the data to be collected

There are two types of data: quantitative and qualitative (Denscombe, 2010; Miles *et al*., 2014). Quantitative data is often associated with the collection of numerical data which are manipulated for statistical purposes. In contrast, qualitative data are often associated with the collection of words which 'may be more unwieldy than numbers, [but] they render more meaning than numbers alone' (Miles and Huberman, 1994, p.56). This study was concerned with capturing and discerning features and patterns of talk, which included numbers and words, so both types of data were collected.

The study was strengthened by having both types of data which contributed to a richer description and provided data which were triangulated not only from different methods but also from different types; it makes 'a more coherent, rational and rigorous whole' (Gorand and Taylor, 2004, p.4). Research Question One focused on identifying linguistic features and patterns and therefore it was answered by gathering both types of data. Firstly data, which were enumerated, for example counting how many times the word 'we' was used by each participant or how many questions the science coordinator asked the trainee. The use of quantitative data in terms of data on the relative prevalence of particular words (Bryman. 2012) supported the identification of patterns (Denscombe, 2010). For example, the types

of utterances made by the science coordinator were classified and analysed in relation to topics. In Research Question Two, the focus on identifying factors which may influence linguistic features and patterns was supported by gathering qualitative data to support interpretations on how factors influenced linguistic features.

The next section reports the steps I took to decide on a methodology, 'a plan of action designed to achieve a specific goal' (Denscombe, 2010, p.3).

4.4 Deciding on a methodology

Firstly, an action research strategy (Lincoln *et al*., 2011) was not considered suitable because this study did have as its main aim to improve practice (Coleman and Lumby, 2005); it was not focused on 'bringing immediate improvement to an ongoing programme' (Johnson, 1984, p.35). Secondly, a survey strategy (Creswell, 2014) would have required data collection on talk by questionnaire or by structured interview whilst it happened between trainee and science coordinator. A survey would have reduced the contact time with the participants and travel time to get to them, although using an internet survey it might have been possible to reduce the turnaround time and still gather a similar quality of data to the traditional postal ones (Denscombe, 2010, p.14). However, whilst a survey may have allowed for systematic collection of information on what was remembered from talk that had already occurred; surveys 'do not give the opportunity to explore a topic in depth' (Johnson, 1984, p.18), so a survey strategy was not considered suitable for this study.

Thirdly a quasi-experimental approach was considered (Lankshear and Knobel, 2004). For such an approach, researchers attempt to control conditions and then observe and measure changes in human behaviour, going on to establish if findings can be replicated in other similar conditions (Cohen and Manion, 1994). However, ethical issues in using control groups of trainees and science coordinators, identifying samples and attempting to consider or control the effect of factors outweighed any potential benefits in improving replication and cancelled out the potential for credibility.

Ethnography may have provided richer data by capturing 'the concrete reality of particular events' (Denscombe, 2010, p.85). However, given my busy day job, I did not have the time to spend in the settings to ensure that I could 'share in the lives of the people rather than be detached from them and to study the mundane of their everyday life' (Denscombe, 2010, p.80).

An alternative methodology was case study, which was more suitable for this study for the reasons set out below.

4.5 Suitability of case study

Case study was a suitable methodology for this project because it was concerned with the influence of talk between two people, bounded by the time and place of an ITT placement. Yin (1994) defines a case study as 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident… [and] relies on multiple sources of evidence' (p.13). The study of talk during an ITT placement was a 'bounded system' (Stake, 1995). In addition, the project fulfilled Denscombe's (2010) description of case study as 'an in-depth account of events, relationships, experiences or processes occurring' in a given setting at a particular time (p.52). Bryman (2012) considers case study 'entails the detailed and intensive analysis of a single case' (p.66), for example a case about an individual, an event or focus of interest in its own right. The two cases in this study are the talk between each science coordinator and a trainee learning to teach science in a time bounded placement.

Case study was considered suitable as it recognised the researcher's lack of control over factors which may affect the particular phenomenon under study - talk - and which could not be separated from the context (Stake, 1995). Case studies may be used to 'understand the complex relationship between factors as they operate within a particular social setting' (Denscombe 2010, p.5). Choosing a case study enabled contextual conditions to be studied in respect of the two cases. The talk during placement was the bounded system of interest

and the working parts that were of particular interest were the trainees and science coordinators who engaged in talk.

The nature of the case study adopted for this project was instrumental and collective. An instrumental case study is carried out when a research question may be understood by studying a particular case (Bassey, 1999). As this study was about seeking answers to questions that arise from a conceptual review of theories and to try and understand the theoretical framework within a specific setting, it was an instrumental case study (Stake, 1995; Bassey, 1999).

The use of two cases, forming a collective case study (Stake, 1995), provided data to analyse linguistic features and patterns and factors influencing these in each case and across the two cases which may address issues of generalisability given that a case study is 'not a sample of one' (Bryman, 2012, p.70) and there are no typical cases to represent talk between a science coordinator and trainee. Using two cases does not suggest generalisations will be made or that the two cases are representative of all trainee or school coordinators experiences, however two cases were selected to support understanding (Stake, 1995) because of their relevance to the questions being asked (Bryman, 2012). Any attributes of causality between talk and influencing learning to teach primary science and factors in the cases and linguistic features were explored cautiously.

Finally, case study was considered suitable as it provided 'relatability' (Bassey, 1981, p.85) and 'commonsensical' (Flyvbjerg, 2011, p.313) to future readers. However, the small scale of this study means that readers - and participants - will 'judge for themselves if the outcomes are of value and relevant to other instances' (Denscombe, 2010, p.61).

4.6 Issues of collecting data on talk

There are methodological problems in finding out how people talk. Firstly, in terms of locating potential participants, trainees and science coordinators, I capitalised on my knowledge and access to information about placements. It was advantageous to be familiar as a teacher, ITT tutor and Head of ITT with placements, which formed some of my 'insider

knowledge' to support gaining access to participants (Denscombe, 2010, p.211). I addressed this issue by locating two cases in schools which are in partnership with my institution but they were selected according to a set of questions (as described in Chapter Five) rather my familiarity with the schools.

Secondly there was limited time available because I was in full time employment for the study's duration. I had to match 'seeking free time' (Johnson, 1984, p.11) from the participants with time available from my job to carry out fieldwork. A trainee teacher is on placement in a partnership school for a fixed time and the placement times guided the time frame of the study (Ball, 1980; Johnson, 1984). The study had to be flexible in order to deal with situations that occurred in each school and for the participants. The two sites were chosen because they were geographically close to the University to help with the difficulties of time constraints and to minimise travel (Denscombe, 2010). I planned manageable times for data collection and analysis which were amended on a regular basis to reflect the time participants could be available (Simpson and Tuson, 1995; Bryman, 2012).

The third issue was that I needed to acquire good data through good quality audio recording (Pride and Holmes, 1976). I acknowledged that participants may change their vocabulary or pay more attention to how they spoke during data collection (Bell, 2005; Labov, 2006), reflecting their responses to a perceived formality of the situation or the expertise of the researcher (Hudson 1981). I addressed this by considering how I talked in terms of my own responses to the axioms posed by Labov (2006) and accommodated my own speech to maintain a flow of conversation but also to listen and exchange views (Holmes, 2001). As the participants had agreed to be interviewed it was not unreasonable to consider that they would be responsive to answer my questions although I recognised that aspects of my personal identity, including my 'sex, age and ethnic origins' may have had a bearing on the amount and nature of information they provided (Denscombe, 2010, p.178).

Using my eyes and ears, I also used personal interpretation of non-verbal cues to identify the confidence and completeness of participants' responses. These acted as indicators that allowed me to identify any need for additional probing. The intention was to be sensitive

and attentive to the participants in order to get the highest quality data out of the interview (Denscombe, 2010). Non- verbal cues were not investigated systematically by video recording the interviews and meetings as it was considered that this detailed information was not relevant to the research question (Cameron, 2001). However, field notes were used to identify when non-verbal cues were obvious and appeared to match or not match the spoken word. For example, hand gestures which were used to reinforce verbal information in an easy visual form (Hans and Hans, 2014), eye gaze being diverted and body movements which suggested participants were not at ease. In addition, my eyes and ears acted as a video recorder and provided mini clips stored in my memory, with recognised limitations to accuracy and detail, to recall non-verbal cues.

At the end of the interviews and meetings after switching off both digital audio tape recorders I sometimes encountered an ethical issue in that participants continued to discuss points that were relevant to the study, but they were not included as I had not requested permission for them be included.

The sections that follow will now consider the range of methods used to collect data which enabled the two instrumental research questions to be addressed. The next section - Section 4.7 - summarises how three methods - participant observations, semi structured interviews and a participant written diary - were used to collect data following a pilot study to 'try out' the methods (Baker, 1994; Creswell, 2014) and support the development of my research skills in conducting interviews (Dewalt and Dewalt, 2002).

4.7 Data Collection Methods

Adopting a case study approach did not 'imply any particular form of data collection' (Yin, 1993, p.32) given that 'any tool for data – gathering provides only one picture of the social world' (Simpson and Tuson, 1995, p.17). The advantage of the case study approach is in the opportunity to use a range of methods to explore the complexity of talk. Collecting data from different methods improved the 'trustworthiness' of the study as it gave the opportunity to triangulate findings (Pole and Morrison, 2003; Cohen *et al*., 2007; Bryman, 2012).

4.7.1 Participant observation of meetings

Observation was selected as a research instrument because it is a tool which gathers data that is 'strong on reality' (Cohen *et al*., 2007, p.405). Observations capture 'explicit evidence through the eyes of the observer either directly or through a camera lens' (Moyles, 2002, p.173). I was present with the participants during two meetings in each case although an ethnographic approach of unstructured observation with no leading research question was not adopted because 'it would [have been] impossible to achieve the degree of immersion necessary' (Opie, 2004, p.73).

The observations aimed to gather data that can be used to discuss the interpretation and significance of the social factors governing linguistic choices in the meeting (Pride and Holmes, 1976; Holmes, 2000). These meetings were part of the normal practices expected within the ITT programmes, for example discussions before or after lesson observations or meetings to respond to directed tasks set by the University. The dates and times of the observed meetings were agreed at the time of gaining consent from the participants to participate in the study and amended and confirmed throughout the time of the placement.

I adopted an overt but unobtrusive researcher role during the meetings (Simpson and Tuson, 1995; Brown, 2004) and did not fully participate in the meetings (Johnson, 1984; Denscombe, 2010). However, by sitting at the same table with the participants because of the physical location for the observations chosen by the science coordinators it offered the opportunity to interact with the participants. I recognised that my presence may have been seen as intrusive (Creswell, 2014) and that I needed to be aware of my own roles as an observer and participant (Dewalt and Dewalt. 2002). A highly structured pre-ordinate observation schedule (for example Bales, 1950) was not considered to be appropriate nor feasible for an interpretivist study because I did not know what factors may be recorded 'in terms of incidence, presence and frequency' (Cohen *et al*., 2007, p.398).

With the informed, written consent of participants, the meetings were audio tape recorded for the data collection. I was able to use audio tapes from each meeting to 'replay it again and again' to inform my transcript writing (Croll, 1986, p.52). I wrote descriptive notes soon

after my visits to the schools including descriptions of physical settings and behaviours of the participants (Brown, 2004; Denscombe, 2010) as they addressed possible memory loss about events (Wragg, 2005).

Observational studies are not without criticism. They can be 'subjective, biased and lacking in the precise quantifiable measures that are the hallmark of survey research' (Cohen *et al*., 2007, p.407). I may have missed an event during a meeting by looking away or not concentrating or by only recording particular behaviours (Simpson and Tuson, 1995; Cohen *et al*., 2007). However, there are advantages because during observations 'intimate and informal relationships' in a natural environment may develop which would not occur through the use of a survey (Cohen and Manion, 1994).

As I was not present when all talk took place, interviews were used to add further data through construction of a historical record of the verbal interactions (Creswell, 2014).

4.7.2 Semi-structured interviews

Semi- structured interviews were adopted because they contributed to understanding the lived experiences of the participants as they talked to each other and the meanings they made of those experiences (Seidman, 2006). Use of semi structured interviews ensured that the data collection remained focused on the study aim but also enabled participants to use their own words and develop their own thoughts which a structured interview with pre – determined questions, presented in a set order and offering 'limited option responses' would not (Denscombe, 2010, p.174). A semi structured interview enabled particular issues as they arose to be probed by the use of prompts and 'dumb questions' (Stake, 1995, p.66). A totally unstructured interview was not considered appropriate (Dunscombe, 2010) because I needed to gain a set of responses to questions which were fairly easy to record, summarise and analyse (Bell, 2005). In addition, a semi-structured interview enabled the collection of 'sufficient data to support claims and interpretations' (Denscombe, 2010, p.366) of participants' feelings (Wragg, 1994; Cohen *et al*., 2007) and 'motives' which a questionnaire cannot do (Bell, 2005, p.157).

The interviews with each participant were held at the start and end of the placement and constructed to be open and informal to gain the most from the participant's time and not lead to fatigue, an ethical consideration (British Educational Research Association (BERA), 2011); they aimed to build an open, trusting dialogue (Wragg, 2005; Cohen *et al*., 2007). I arranged the timing and order of the interviews at times when they were convenient to the participants and to recognise potential power imbalances between the participants (Creswell, 2014). I arranged to arrive at the schools when the trainees or science coordinators were available to be interviewed, so the order of interviews was determined by their teaching commitments. The interviews did not exceed the length of time the participants had offered (Bell, 2005) and to ensure there was minimum disruption to the setting, the venue was chosen by the participants (Creswell, 2014). The physical surroundings were noted as these had the potential to affect the nature of talk (Peel, 1988). For the first few minutes, the participants were asked to confirm and expand on personal factual details to allow a comfortable dialogue to be established and provide an atmosphere conducive to 'open and undistorted communication' (Holstein and Gubrium, 1997, p.116).

Initial structured questions were preformulated for the first and second interviews with each participant (Appendix 7) based on my expertise as a teacher and teacher educator, reference to the literature and pilot study findings. It was important to maintain a balance between a degree of standardisation and the spontaneity of responses whilst ensuring they did not follow a line of enquiry that had not been agreed. I mentally rehearsed the questions to ensure their order and purpose supported the research focus and then adapted them during the interview to allow equivalent information to be gathered from participants in each school on their expectations, perceptions and stimulated recall of their talk with each other as well to gather personal data. The questions were shown to the participants at the start of the interview so they could query the 'meaning and implications of any statements' (Bell, 2005, p.156-157). The sharing of questions was also viewed as a means to share decisions with the participants on the order of the questions (Bryman, 2012).

Each interview was audio tape recorded using two digital tape recorders in case one did not work. Recording minimised any tendency to unconsciously select data so it helped to preserve the participants' voices during analysis and interpretation. Hand written notes were taken during the interview and made visible to the participants. These were read back to the participant at the end of the interviews to secure verification and to support 'trustworthiness' of the study in relation to its credibility by using 'respondent validation' (Bryman, 2012, p.391).

Particular issues presented when I collected data on talk through interviews. It was time consuming and potentially subject to bias because a science coordinator or trainee may have given a 'right answer', in that they were trying to please me as Head of ITT or provide statements which were then not seen or perceived to be seen during observations of meetings. I could not always be sure that I framed questions appropriately, meaning interview responses may not always have been full and open. Face-to-face video conferencing could have been used without the loss of non-verbal clues and would have led to a reduction in travel costs. However, being in the schools helped me to understand their context; additionally, these contexts with which the participants were familiar so more likely to have felt more at ease and arguably more likely to make authentic responses (Wragg, 2003).

4.7.3 Reflective diaries

Diaries are an 'attractive way of gathering information about the way individuals spend their time' (Bell, 2005, p.173) and a tool for 'recording things which have already happened' (Denscombe, 2010, p.117). A diary represents a way of capturing participant's memories of previous events in terms of 'estimates of frequency and/or amount of time spent in different forms of behaviours' (Bryman, 2012, p.243). McGee (1996) reports that that more positive and open professional relationships were developed between trainees and mentors when participants could write rather verbalise their memories. Fairbanks, Freedman and Kahn (2000) use of collaborative reflective journals also finds that the process enhanced collaboration between mentors and trainees.

Participants in this study were provided with a diary template and verbal guidance on its completion (Appendix 7) (Denscombe, 2010; Bryman, 2012) however they were also encouraged to record using their own templates. Diaries were recorded in an email by the trainee in Case Two and hand written by both participants in Case One. Diaries of participants' talk were used to identify participants' recall of significant words or phrases as well as allow access to evidence that was not available logistically as I was not present during all face-to-face interactions of the participants (Morrison, 2002). However, diaries can be time consuming for participants (Bryman, 2012) and one of the participants did not complete a diary; Science Coordinator 2. She had hesitated before ticking the consent form (Appendix 9) and was informed that she did not have to complete a diary which was an ethically sound affordance (BERA, 2011).

4.8 Trustworthiness of data

In a case study, the concepts of reliability and validity associated in quantitative studies are not vital (Bassey, 1999). The quantitative tradition believes research should rely on reliability and validity to ensure 'replicability and generalisability' (Wahyuni, 2012, p.77). Reliability in quantitative studies concerns the extent to which a measured finding can be repeated or is 'stable (Bryman, 2012, p.168) when an 'instrument is administered a second time' (Creswell, 2014, p.160). In qualitative studies, reliability is difficult to meet, for example in this case study, it is not possible to 'freeze' a school placement and then replicate the study.

In terms of validity in quantitative studies two concepts are used, firstly the extent to which an instrument measures what it is intended to (Bryman, 2012) also referred to as content validity (Creswell, 2014) or face validity (Bryman, 2012). In qualitative studies, the use of humans as instruments (Lincoln and Guba, 1985) can lead to difficulties in achieving this. Validity can also refer to the links between causes and effects in a study, internal validity, and the extent to which the findings in one study can be generalised to other contexts, external validity (Bryman, 2012). Validity in a case study is difficult to achieve even by reading across cases (Ticknor, 2015).

An alternative concept to reliability and validity is the concept of trustworthiness (Lincoln and Guba, 1985; Bryman, 2012). Trustworthiness consists of four criteria (Bryman, 2012; Wahyuni, 2012): dependability as an alternative to reliability and representing how the findings may apply at other times, credibility as an alternative to internal validity representing how believable are the findings, transferability as an alternative to external validity representing how the findings can apply to other contexts and confirmability as an alternative to objectivity representing the extent to which the researcher allowed their values to influence the study.

Triangulation was used to strengthen confidence in the findings by bringing in data from different sources (science coordinator and trainee) and different methods (interviews, observation of meetings and participant diaries). I constantly compared data within each case and across the two cases to inductively develop topics and patterns which are used to compare with existing literature (Creswell, 2014).

In the next section, I outline the phases for data collection.

4.9 Phases for data collection

The study had different phases for collecting data within the different stages of the study (Bassey, 1999). Initial timetables for data collection and analysis were amended throughout the study in respond to my personal workload.

The five phases have been summarised as below.

Phase One – Feb 2012- April 2014

- Identify and develop research questions
- Consider issues of talk and how these might be explored using two case studies
- Design and pilot interview questions
- Refine interview questions
- Design and pilot reflective diary

Phase Two – First Data Collection May-July 2014

- Refine diary layout and guidance
- Establish and conduct observations and interviews schedule with Case One
- Establish and collect diary with Case One

Phase Three – Second Data Collection May 2015-July 2015

- Establish and conduct observations and interviews schedule with Case Two
- Establish and collect diary with Case Two

Phase Four – Data Analysis July 2015 – July 2016

- Identify and analyse linguistic features and patterns

Phase Five – Discussion and Conclusions – August 2016 – Jan 2018

- Compose thesis

4.10 Deciding on ways to analyse talk

The analysis of talk began by listening, transcribing each interview and meeting, reading, listening again and re-reading the transcriptions. I revisited my participants talking by literally hearing them again and again by reading the transcribed words. I attempted to internalise and at times memorise their words. I recognised that the detail I chose to provide within each transcript could influence the findings. As the researcher, I was aware that I was 'filtering' the transcripts and that care would need to be taken to ensure there was no intentional bias but recognising that within an interpretivist paradigm I would influence the interpretation of data. I spent much time reflecting on my findings to consider if my own background was influencing my interpretations and also recognised that during the process of analysis findings contradicted early assumptions made about each case. The experience of transcribing and analysing data involved considerable development of me as a reflective practitioner.

4.10.1 Analysis of talk for research question one

In this section I outline the analysis for Research Question One.

1. What are linguistic features and patterns in 'talk' between a primary school science coordinator and trainee during a teaching practice?

Analysis of talk for research question one focused on the three specific linguistic features of talk between a trainee and science coordinator as identified from the literature review in Chapter Two and Chapter Three; firstly coded sequences of utterances which represent a 'topic' within talk in meetings between a science coordinator and trainee, secondly types of utterances spoken by a science coordinator to a trainee during two meetings and thirdly 'we-statements' spoken by a trainee and a science coordinator during interviews and meetings. A fourth linguistic feature was analysed, 'I-statements' spoken by a trainee in interviews to examine the potential influence of talk on their learning.

Transcripts were written to identify participants and researcher during talk using codes SC for Science Coordinator, T for Trainee and I for Researcher. Quotes used in the thesis followed the pattern of (Case Study, meeting M or interview I, speaker and lines in transcript) for example (CS2, M2, SC2, 45-6) where CS2 represent Case Study 2. In order to protect the identity of participants, pseudonyms were considered. However, as care needs to be taken when choosing pseudonyms because of the meaning or links associated with names (Allen and Wiles, 2016), I decided to use the terms of Science Coordinator and Trainee although there are particular quotes in which pseudonyms are used. The role of the participants was considered more pertinent than using a pseudonym.

The analysis of talk was iterative (Wahyuni, 2012) and each linguistic feature was analysed independently of each other and then revisited once all data had been initially coded. By reading and re-reading sequences of utterances in the participant-observer meetings, I looked for similarities in their content in terms of the words used to undertake 'content analysis' (Denscombe, 2010). I looked for coherence in sequences of utterances to identify when the focus of talk changed from one 'topic' to another. These were shown using a

skeleton overview (Craig and Tracy, 1983; Talbot *et al*., 2003). The 'topics' in sequences were revisited during the analysis of each case.

The second step was the manual coding of the two participant-observer meetings to identify the types of utterances spoken by the science coordinator to the trainee. I found the separation of utterances into three categories, 'giving instructions', 'giving information' and 'asking questions' (Liberman, 2016) a useful tool because of the distinguishing features of informing, instructing and questioning which relate to a purpose of talk in terms of carrying messages which may stimulate learning about 'knowledge for teaching'. The types of utterances were coded against the emerging topics which appeared in data from both Meeting One and Meeting Two, for example 'assessment' and 'planning' for each case as well as new topics, for example, 'External Examiner visit'.

The third step considered an examination of 'we-statements' spoken by each participant as they relate to a purpose of talk in terms of reflecting the building of relationships between participants and types of shared actions, thinking, feelings, abilities and achievements which may influence a trainee's learning. 'We-statements' are considered an indicator of a relationship between trainee and science coordinator which has taken time to generate (Gergen, 2009) and which supports successful learning (Wubbels and Levy, 1993; Koballa *et al*., 2008). 'We-statements' were coded into one of five groups labelled as 'affective', 'cognitive', 'state and action', 'ability and constraints' and 'achievement' (Gee, 2014). For example, 'cognitive' statements included 'we thought, we know, we suppose' and 'ability and constraints' statements included 'we could do', and 'we struggled'. Not all 'we-statements' were coded as 'we' because sometimes 'we' referred to a relation between a science coordinator and their school or between a science coordinator and other members of staff in their school. 'We-statements' were coded against the emerging 'topics'.

The fourth step involved coding 'I-statements' when the trainee spoke about herself, for example, 'I suppose' was coded as a 'cognitive' statement. 'I-statements' were analysed because they were considered an indicator of a trainee's perception of their knowledge, attitudes and behaviours and by tracing 'discourse changes' (LeGreco and Tracy, 2009) they

provided an insight into how talk may influence learning to teach science. 'I-tracing' was used to compare 'I-statements' in Interview One and Interview Two for each case trainee. Not all the 'I –statements' were analysed as some related to the trainee recalling what she had said or done in the classroom to and with children. 'I-statements' were coded against the emerging 'topics'.

Tables were produced to present the frequency, in the form of percentages, of different linguistic features for each case in relation to emerging topics, types of utterances, 'we-statements' and 'I-statements'. To support the identification of patterns in each case, the common emerging topics in Case One and Case Two were used to produce a 'talk molecule' for each topic. A 'talk molecule' is a visual representation of linguistic features for each topic. It is analogous to the use of a circle to visualise a molecule and considered an appropriate analogy given the focus on science teaching. In the example below for Case One, the two 'talk molecules' summarise talk coded as related to 'children'. This is discussed further in Chapter Nine.

Talk about the topic coded as 'children' by participants in Case One is visualised using three 'talk molecules:

'talk molecule' one 8C (3I, 3D, 4Q)
'talk molecule' two C3W (100SA) - referred to as 'we-talk' molecule
'talk molecule' three C10I (55C, 25SA, 20AC) – referred to 'I-talk' molecule

'Talk – molecule' one refers to types of utterances spoken by Science Coordinator 1 to Trainee 1 during two meetings related to 'children'. 'Children' was identified as one of the eight common 'topics' of talk identified in talk between science coordinator and trainee in both cases. In Case One, 8% of the talk in total for Meeting One and Meeting Two in relation to the common topics was coded as 'children'. 8C represents the percentage of talk on the 'topic' of 'children in the first 'talk molecule'. Utterances spoken by Science Coordinator 1 to Trainee 1 were coded in terms of 'giving information', 'giving instructions' and 'asking questions' in relation to the topic 'children': 3%, 3% and 4% respectively. Thus the first

molecule conveys information about the three specified types of utterances spoken by Science Coordinator 1 to Trainee 1 about 'children'.

'Talk – molecule' two refers to the presence of 'we-statements' and types of 'we-statements' spoken by both participants about 'children'. Using data from two meetings and two interviews with each participant the number of 'we-statements' uttered by both participants were enumerated and totalled for those related to 'children': 3%. All the 'we-statements' were coded as 'state and action' represented as 100SA.

The third 'I-talk' molecule relates to 'I-statements' spoken by Trainee 1 in both interviews coded as 'children': 10%. Her 'I-statements' were coded 55% were coded as 'cognitive', 25% as 'state and action' and 20% as 'ability and constraint'.

'Talk – molecules' provide a new way to visualise the content of a 'talk-space' between a trainee and science coordinator and to inform a discussion on their influence on a trainee learning to teach science. This is discussed further in Chapter Nine.

4.10.2 Analysis of talk for research question two

The second research question in the study focused on identifying potential factors which may influence linguistic features.

> 2. What factors including the setting, participants, purpose and topic influence linguistic features and patterns of talk between a science coordinator and student during a teaching practice?

Four factors were considered, as discussed in Chapter Three. One factor considered the influence of topic of talk which emerged from coded 'topics' in sequences of utterances in two meetings in each case. The second factor, related to participants, and referred to information from interviews, meetings and the personal details form relating to the participants. The second factor was based on the literature review in Chapter Two and that information included:

- the science backgrounds of the trainee and science coordinator
- the trainee's prior experiences in learning to teach science
- the science coordinator's prior experiences in ITT
- the trainee's preferred ways to learn and
- the science coordinator's perceptions on ways to work with trainees.

The third factor, the setting, concerned:

- the influence of the setting in terms of the focus on science in the school and how science was planned
- ages of children taught and
- the science National Curriculum science topic taught by the trainee in the placement.

The fourth factor, purpose of talk, was examined by considering the perceptions of the participants on why they talked and outcomes of talk. In addition, data were collected on the frequency and duration of meetings between participants.

In writing the results and discussion chapters, care was taken in choosing the words from the transcripts to represent the voices of the participants. I was aware that I was identifying and selecting the words and examples to be included in the analysis and that from data gathered in hours of interview and meetings only a small selection of their voices are directly included in the study. I provided contextualisation for quotations and attempted to ensure that those included were relevant to the research questions which made the process of choosing a deliberate act of continually reviewing the data to reduce misuse of participant voice.

4.11 Selecting Participants

As the sole researcher for this study, I could not study the entire population of science coordinators in primary schools in England and all the trainee teachers with whom they could communicate with during placements. Therefore, the scope of the study was

narrowed to focus on trainees who were training at my institution on the undergraduate (UG) programme. On the undergraduate programme, at the time of data collection, there were approximately 120 trainees, who were over 18 years old, in each year of a three year programme which included five periods of school placements.

The UG programme offered the opportunity to engage with trainees who were taking the science specialism modules as part of their training. The undergraduate trainees who take the science specialism have gained academic success already in science at level 3; this is the Advanced Level qualification within the UK education system, equivalent to ISCED Level 4 (UNESCO, 2011). The science specialism modules provided 70 credits of the 360 credits for the whole degree and the assignment grades contributed towards the degree classification. During the second year of the degree, the science specialism trainees focused on developing their knowledge and understanding of subject coordination of primary science. These trainees will potentially become future science coordinators who may then train future trainees during placements.

Whilst a probability sample may have less bias, a non-probability strategy, also known as 'purposive' (Bryman, 2012) was more suited to this study. This strategy accommodates small scale research since it allows for the fact that whilst not everyone in the population has an equal chance of being included in the sample, the cases were chosen with the research goals in mind. It was not a convenience sample in terms of cases which were simply available by chance. Whilst Creswell (2014) argues that a case study may have four or five cases (p.189) Denzin and Lincoln (2011) considers a sample size needs to be linked to the budget available to the researcher including costs for transcriptions. Additionally, the sample size needs to focus on selecting a case for the information it will offer, as well considering the time at which data can be collected during times of a day (Flyvberg, 2011; Bryman, 2012). Details about the characteristics of participants in each case study are discussed further in Chapter Five.

4.12 Ethical issues

This study was informed by the principles established in the Revised Ethical Guidelines for Educational Research (2011) issued by BERA (2011) and the University of Northampton Ethics Code and Procedure before the proposal for the PhD was approved by my University Ethics Committee. In particular, BERA (2011) guidelines eight to 31 were addressed as identified in Appendix 6, excluding 13 as the research was not conducted outside of the UK and 32 to 42 as there was no sponsor. Guidelines 43 to 51 were addressed by considering my professional responsibilities in engaging in research and joining a research community.

A key ethical issue concerned the impact of my role, as the Head of Initial Teacher Training, on the wellbeing of the participants to 'reduce intrusion and minimise risk of harm' (Denscombe, 2010, p.103). It was important that my roles as a researcher and a university lecturer were kept clear and separate. I acknowledge this was not fully possible though as I engage in lectures throughout the course where the trainee participants are present and I am responsible for discussing all trainee progress with appropriate staff and monitoring school involvement. I was aware of the power that I have as Head of Initial Teacher Training and started the study with the premise that a power imbalance existed between me and the trainees (Creswell, 2014). I was not involved in the assessment of the trainees during their placements. I did not discuss them with other colleagues who may be involved in their assessment to ensure confidentiality and anonymity . This also addressed a potential issue of adding undue pressure on the trainee.

I recognised perceived risks to schools who engaged with this research given my role as Head of Initial Teacher Training which may have related to making their practices available for study. I recognised the risks to the primary science coordinator's position in their school. Researching talk in the workplace context means acknowledging that people are very aware of the need to protect their relationships with colleagues. All participants' details are held confidentially, securely and were anonymised in reporting including the name of the institutions / organisations. The Data Protection Act (1998) was observed (National Archives, 2018).

Another risk concerned the data collected and written about children. Talking to children and about children in England is an essential aspect of teaching, learning and assessment. In preparation for each placement trainees are provided with guidance and expectations on keeping records on children based on various sources including their observations, talk with children, staff and parents/carers and marking of books. Listening to the child's voice directly and to information provided by teachers and parents/carers is an opportunity for trainees to gather information about the individual child to inform their planning, teaching and assessment. This is embedded in Teachers' Standard 5 (DfE, 2011). Trainees are required to maintain records of information about children using first names only in accordance with school-based data protection requirements. Schools are given information via the school placement booklets on the data to be collected by trainees on children. The study did not seek to access the information recorded by trainees. However, during interviews and meetings, talk about children known to both participants by the participants posed an 'unforeseen problem' (Cohen and Manion, 1994, p.362) because of the data about children's families.

The disclosure of information about children and their families could lead to embarrassment on behalf of the person who discloses it or the child and the family to whom it refers to or even lead to the 'prospect of legal action being taken against the participants on the basis of the disclosed information' (Denscombe, 2010, p.332).The data on the child's homelife and parent/carer child's right to privacy was considered in terms of the potential sensitivity of the information, the setting in which the data were collected and the dissemination of information (Diener and Crandall, 1978). I reflected on whether my judgement on participants disclosing information about children was within ethical standards in the teaching profession. Personal experience identified that teachers do share with each other information about children and their families, however to address this ethical issue, three protocols were established. Firstly, data were collected in a school setting only during interviews or meetings. I did not talk to any children in either school and no names of children were referred in field notes. Secondly, if data collected posed illegal or controversial issues concerning children and their families it would be discussed with the supervisors before talking with the Headteacher and trainee, if appropriate. Thirdly, data

chosen to be disseminated in the report would not enable a child or their family to be identified. In the report, children are anonymised by the use of X and their right to privacy was supported by being confidential about the participants.

4.13 Summary of Chapter Four

This chapter has described, explained and justified the methodology and methods that were adopted within a qualitative, interpretivist paradigm that acknowledged that multiple realities and knowledge are constructed by individuals. This strategy provided an appropriate context to gather data to examine the two research questions and to consider how talk influences learning to teach science. The two cases within the case study were examined using participant observations, semi structured interviews and participant diaries.

CHAPTER FIVE –IDENTIFYING PARTICIPANTS and SCHOOLS for BOTH CASES

5. 1 Introduction

The purposeful selection of appropriate participants and sites is a key factor in successful social sciences research (Miles and Huberman, 1994; Creswell, 2014). In the second of eleven sections in this chapter, the school placement for both cases is contextualised within the overall ITT programme structure at the study University. The third, fourth and fifth second sections report how and why schools and participants in both studies were identified. Sections six and seven describe each case in terms of school, trainee and science coordinator. The eighth and ninth sections consider the data collection timelines and provide figures to indicate key aspects of the physical setting where data were collected. The tenth section provides a summary of the talk recorded in the participants' diaries.

In the next section, the school placement for both cases is contextualised within the overall ITT programme structure.

5.2 Contextualising the placement within the overall ITT programme

Data collection for both cases in this study took place during the trainee teachers' second placement in year two: 2b Placement. There were three reasons for this. The first was practical time management. I had to incorporate collecting data into my full-time workload which included preparing for a potential ITT Ofsted inspection, for which I am responsible, during the spring term or summer term. I therefore chose to collect data during the summer term 2b Placement to ensure I had prepared for Ofsted during the spring term. The second reason was because the focus of 2b Placement was on trainees' specialist subjects and during 2b Placement, trainees were expected to plan, teach and assess within their specialism and to work with the school subject coordinator relevant to their specialism. Science specialism trainees were therefore required to talk to a science coordinator as part of the normal expectations of the placement.

The third reason related to the additional demands made on trainees who were asked to engage in this study. The expectations for trainees increase significantly in each year of the programme to enable them to demonstrate competence in line with the national Teachers' Standards (DfE, 2011) by the end of the programme. I did not focus on year one trainees, because they go through the early stages of learning to observe, plan and teach groups of children and I did not focus on year three trainees during their final placement as it would have been unethical to make an additional demand on their time when they were undergoing their final qualifying assessment.

Case One data were collected during the academic year 2013-14. The 2b Placement occurred over 20 days between Monday May 19th and Friday June 20th 2014 with the week beginning Monday May 26th taken as school holiday called 'half term'. The 2b Placement included an induction day, May 14th 2014, for trainees to become familiar with the school, mentor and class in which they had been placed. This was considered important in the ITT programme in order to build early relationships, ensure that travel arrangements for the trainee to reach the school were satisfactory and identify any early issues. Case Two data were collected during the academic year 2014-15 when the 2b Placement occurred over 20 days between Friday May 15th, 2015 and Friday June 19th, 2015 with the week beginning May 25th as 'half term'. The induction day was May 15th 2015.

Once the placement periods were identified for the study, it was important to select schools and trainees and consider steps to gain access to the research sites (Creswell, 2014).

5.3 The decisions made to select a school and trainee

In this section, I begin by describing and justifying the process by which the University organised placements and I detail the questions I used to identify a trainee and school.

The University had a Partnership Office team of six professional support staff who coordinated each placement. The organisation of matching trainees to schools was mainly determined by this team according to multiple factors such as the trainees' term time

addresses, access to a car and declared personal needs and was also supplemented by information provided by academic staff.

Three questions were addressed in order to identify a trainee for each case. The first step was to identify a trainee rather than a science coordinator because the University had a database of trainees but did not have a database on science coordinators in primary schools. The first question was: 'What is the trainee's specialism?' Each year the number who studied each specialism varied based on trainees' entry qualifications. As there were five specialisms available, approximately one fifth of trainees took science as a specialism each year. I focused on trainees who were taking science as their specialism since this is my own area of expertise.

My second question was: 'Will the trainee be undertaking 2b Placement in a primary mainstream school?' I decided to identify trainees who had completed their first school experience successfully in their first year two, 2a Placement, in accordance with University criteria, had been placed in a Key Stage One or Key Stage Two class for children aged 5-7 or 7-11 respectively and had not chosen to apply for an optional special school experience, available to all trainees who identified they may wish to work in a special school. The rationale for this decision was to ensure that additional pressures were not placed on any trainee who had failed the 2a Placement or was learning to address the needs of children in a special school for the first time.

My third question was: 'Which school has the trainee been allocated?' I needed to consider the geographical location so that travel to and from the school from the University was minimised to fit in with my work.

5.4 Identification of participants and a school for Case One

The member of staff in the University Placement Office responsible for coordinating the organisation of 2b Placement in 2014 provided a spreadsheet on May 6th 2014 identifying all trainees and their schools. I was not involved in the decisions for matching trainees to schools. Ethically, this ensured that I adhered to BERA (2011) guidelines in two specific

ways; firstly I did not wish a trainee or school to be identified before placements were organised in order to ensure voluntary consent for the participants in the study was not linked to the acceptance of a school for providing a placement and secondly that a trainee was not placed in a particular school which may not have been an appropriate for them in terms of their personal needs related to travel, for example, or age range of the class to be compliant with ITT criteria (DfE, 2016c). The implications of waiting for this process to occur meant that there was a very short time between 2b Placements being organised and then identifying a possible school and trainee. The data provided identified 16 of the 20 science specialism trainees undertaking 2b Placement and 4 were in schools considered geographically close to the University.

Case One Year 2 BA Primary	**Number of Trainees and Gender**
Number of Year 2 BA Primary trainees	21 Male, 79 Female
Number of trainees with science specialism	3 Male, 17 Female
Science specialism - Withdrawn from ITT	1 Female
Science specialism - Special School 2b Placement	2 Female
Science specialism - re-doing 2a Placement	1 Female
Science specialism - Undertaking 2b Placement	13 Female and 3 Male 16 possible schools 4 schools within 5 miles of the University

Table 5.1 - Identifying Trainee for Case One

I made a phone call to the closest school to the University to request their involvement in this study which was positively received by the school receptionist who referred the request to Science Coordinator 1. After sending details about the study via email, I phoned the school and spoke to Science Coordinator 1 on May 14th 2014, the 2b Placement Induction Day for Trainee 1, and the Head Teacher, as the main gatekeeper to the school, to thank them for agreeing verbally to engage with the study. During my first meeting to the school to organise the study I met with the Head Teacher who confirmed verbally again their consent.

As the Case One trainee (Trainee 1) was in school for her trainee induction day, Science Coordinator 1 spoke to her about the study and I emailed Trainee 1 details of the study and consent form. I rang the school the following week to provide time for Trainee 1 to read and decide if she would wish to participate in accordance with BERA (2011) guidelines and the UoN Ethical Code and Procedure. This was to ensure that whilst Science Coordinator 1 had voluntary consented Trainee 1 was not obliged to or coerced into agreeing. Trainee 1 confirmed that informed, voluntary written consent would be provided and dates for the meetings were arranged.

The following section details a similar process adopted for the second case in 2015.

5.5 Identification of participants and a school for Case Two.

The placement organisation for Case Two was coordinated by the same member of staff in the Partnership Office. She provided me with an initial spreadsheet on April 15th 2015 identifying all trainees and their schools which I had not been involved in. The data identified 11 trainees with science specialism.

Case Two Year 2 BA Primary	**Number of Trainees and Gender**
Number of year 2 BA Primary	97 Female, 19 Male
Number of trainees with science specialism	7 Female, 4 Male
Science specialism - re-doing 2a placement	1 Male 2 Female
Science specialism - trainee involved in previous cause for concern process - Ethical decision to not include due to my role as Head of ITT	1 Male
Science specialism - Special school 2b Placement	1 Male
Science specialism – Undertaking 2b placement	1 Male and 5 Female 6 possible schools 3 schools within 8 miles of the University

Table 5.2 – Identifying Trainee for Case Two

A phone call to the three schools within eight miles of the University did not lead to a response. Three of the other six schools had the same postcode, 25 miles from the

University, and after ringing the first one in alphabetical order, the school manager referred the request to the Head Teacher and Science Coordinator 2. I followed up with an email on May 7th 2015 to provide the Head Teacher with information about the study which he shared with Science Coordinator 2 and confirmed verbally his voluntary informed consent for the school to engage with the study over the phone on May 21st 2015.

The practical issue of gaining access to the Head Teacher was balanced with the ethical issue of gaining written consent. The Head was given time to read and decide and his verbal consent was congruent with the ethical code and procedure followed for the project (BERA, 2011). During the first visit on May 22nd 2015, I met with the Head Teacher to discuss the study and confirm his verbal consent. In order to ensure Science Coordinator 2 was not coerced by the Head Teacher given their power in the school, I rang the school and spoke to her separately. She verbally consented over the phone.

I arranged a face to face meeting the following day to discuss with Science Coordinator 2 and Trainee 2 the details of the study and the consent forms. Trainee 2 was initially spoken to by Science Coordinator 2 about the study, as similar to Case One; she had been in School 2 for four days already when the Head Teacher and Science Coordinator 2 provided verbal consent. Trainee 2 was sent details of the study and consent forms via email. Trainee 2 and Science Coordinator 2 provided voluntary informed written consent.

In the next two sections, the schools and participants for both cases are described. This is important because the unique context of each school environment may shape the professional knowledge and attitudes and competence of a new teacher (Bennett and Carre, 1993). The descriptions provide information to address three aspects of research question two, the findings for which are discussed in Chapter Eight.

5.6 Description of Case One – School 1, Science Coordinator 1 and Trainee 1

In this section, I present details about the setting for talk between Trainee 1 and Science Coordinator 1 in terms of School 1 with particular reference to the number of children on roll, school engagement with ITT, the time spent on science each week and ways of writing

science schemes of work. The physical settings for interviews and meetings are detailed in Section 5.9 and the time and location of talk as recorded in participants' diaries is presented in 5.10.

The setting for Case One was a primary school for children aged 4 -11 years that was larger than average in England. The school was graded 'Good'; the second highest of the four-point scale adopted by Ofsted, the national schools' regulator. The most recent Ofsted report the school had received had indicated that there was a growing school population in this school and at the time the data were collected there were 240 children on roll with an above average number of pupils who spoke English as an additional language and were eligible for free school meals. The school had engaged in ITT over several years.

Science was normally taught once a week in the afternoon although it had been placed on the "*back burner for quite a while*" *(CS1, SC1, I1, 184)* while the school had prioritised literacy and numeracy because of government testing requirements but now that many children could access those subjects; there was a focus on science although there was still a "*really old science policy*" *(CS1, SC1, I1, 835).*

> *SC1* *"so now we can move on with science and we can do more interesting and exciting things so we are focusing on, as a school, on science" (CS1, SC1, I1, 192-3).*

The school valued the 'voice of the child' inasmuch as teachers planned their lessons ensuring children contributed to the process of deciding what to learn.

> *SC1* *"The voice of the child is giving the children to ability to contribute to what they want to learn so the children wanted to learn more about space, umh, that you feed them ideas but then they also tell you what they need to learn next" (CS1, SC1, I1, 108-110).*

In the next section I discuss the participants in Case One as they are a factor which may influence linguistic features of talk. I begin by outlining characteristics of the Science Coordinator 1 in terms of her science background, role in school and prior experiences in ITT and how she expected to work with trainees by asking questions.

Science Coordinator 1 was a full-time member of staff, aged between 55-59 years old, female and white British. She had taught since 1992 and had a Bachelor of Education degree which included some science. She considered herself to be "*brave" (CS1, SC1, I1, 10)* to have chosen science as part of her teaching degree because she had not been able to study science at school because she was a girl.

> *SC1* *"I wasn't allowed to do them at school, umh, because if you were clever and you wanted to do three sciences then girls weren't allowed, you could do two in a grammar school" (CS1, SC1, I1, 5-6).*

Science Coordinator 1 was the class teacher for a year two class where children were aged six and seven years and following the 'old' England's Key Stage One National Curriculum (DfEE, 1999). The revised National Curriculum was implemented from September 2014, but only for certain year groups.

> SC1 "*because I have to assess them using the old Keystage One materials, so the rest of the school have gone onto the new curriculum and I am old*" *(CS1, M1c, SC1, 206-7).*

Science Coordinator 1 described her role in school coordinator as "*probably a coordinator" (CS1, SC1, I1, 175)* and "*facilitator*" *(CS1, SC1, I1, 244)* but not "*manager*" *(CS1, SC1, I1, 176).* She associated the term 'manager' with sorting out science related resources for staff and she did not do this.

> *SC1* *"Arh, okay that makes me think more about resourcing, we don't resource as such, I do have budget but I don't resource people" (CS1, SC1, I1, 178-9).*

Science Coordinator 1 was the mentor for Trainee 1 because Trainee 1 was assigned to her class for the placement and had attended mentor training at the University. Science Coordinator 1 engaged in weekly meetings with Trainee 1 as part of 2b Placement expectations for mentors, however, these were not recorded in the diaries written by Science Coordinator 1 or Trainee 1. Science Coordinator 1 felt that asking questions was an opportunity to 'honour' people.

SC1 *"And you honour people by the questions you ask them" (CS1, SC1, I1, 783).*

Science Coordinator 1 explained that she challenged trainees by asking questions and then leaving a 'space in their talk' to give a trainee time to think and respond.

I "So what words you have used to support? Or which words to challenge?

SC1 *The challenges are more the empty spaces*

I Empty spaces, what is that?

SC1 *When I might leave something with her. So I might say "What are you thinking about? Or what you know?" The big lesson that was being observed and then you don't say anythink. It's the hardest thing to do. It's what you do in coaching, so you have to wait and it's painful but you have to wait because that's the most challenging thing because Trainee 1 has to fill the space" (CS1, SC1, I2, 273-9).*

SC1 *"But you just leave a space that is big enough, that she's got to come in and do somethink, and the other thing is, got to ask the question and keep asking that question until I get something from you, or I see something changing and it is this gentle confrontation, this quiet push" (CS1, SC1, I2, 312- 4).*

In the next section, I outline the characteristics of the other participant in Case One - Trainee 1 - in terms of her science background, prior experiences of teaching science, how she preferred to learn and her perceived purposes in talking to Science Coordinator 1. These

aspects were chosen following the literature review on trainees learning to teach science discussed in Chapter Two.

Trainee 1 was female, white and 19 years old. She started ITT directly after completing her A- levels. A-levels are nationally awarded certificates at Level 3 International Standard Classification of Education (OCED, 2011). She achieved A- level Biology Grade C, GCSE Core Science Grade A and Additional Science Grade A. She reported three times that she "*loved teaching science, honestly I do, it's my favourite subject*" *(CS1, T1, I1, 550)* due to the influence of her aunt, a dentist.

Trainee 1 had successfully passed 2a Placement based in a mixed year three and four class teaching children aged seven and nine years old. She had taught NC science topics 'Moving and Growing' and 'Human Body' (DfEE, 1999). Trainee 1 believed that she learnt by doing this for herself; "*I am a doer and I do learn from doing my own mistakes" (CS1, T1, I2, 466)* although she did not think she was a 'listener' because she missed things. Trainee 1 expected a science coordinator to '*push her'* in order to support her learning: *"My biggest thing is to be pushed" (CS1, T1, I1, 303).* However, Trainee 1 indicated that the quantity of the push had to be just enough to cause a change which was acceptable to her; she did not want too much of a push though because it would make her "*feel out of comfort zone*" *(CS1, T1, I1, 307)* and she wanted to be pushed but not told; *"Kinda of pushing me in the right direction but not telling me" (CS1, T1, I1, 277).*

Trainee 1 identified a range of reasons or purposes for why she might speak to Science Coordinator 1 in terms of acquiring knowledge to meet placement and personal goals: assessment of science, teaching science to children of different ages and teaching the NC science topic 'forces and motion' (DfEE, 1999). For example if she "*wanted advice about a lesson*" *(CS1, T1, I1, 635),* to see "*if she had a better idea*" *(CS1, T1, I1, 638),* or if she wanted to "*incorporate IT*" *(CS1, T1, I1, 642).*

T1 *"what she's done in the past years and whether they worked well? If they didn't work well, would it work well with this class anyway? Maybe how they*

have responded to other science lessons in the past. Gradings, perhaps, because not necessarily, are they? Are they, are separated at the moment into groups that are specific for their maths and literacy abilities and not science. So I am not as familiar with those who are more capable, umh, and some of them are incredibly bright, so it is how far to pitch it as well" (CS1, T1, 644-9).

Trainee 1 identified that one purpose in talking to Science Coordinator 1 related to her acquiring knowledge about assessment of science. This was the only target set for Trainee 1 from 2a placement which according to Trainee 1 was because her mentor had a personal focus on assessment in science.

T1 *"No, there was, she* [mentor in 2a] *really liked to focus on assessment for learning in science" (CS1, T1, I1, 213).*

Another purpose of talk identified by Trainee 1 was to organise observing other teachers in the school teaching science. Trainee 1 was introduced by Science Coordinator 1 to all staff during the first week in the Thursday morning staff meeting where she asked if she could observe them teaching science although she commented, *"I didn't want to force myself upon them*" (CS1, T1, I1, 347). Trainee 1 observed two other teachers and reflected that her observation and talk with other teachers had been helpful in developing her confidence in teaching science to other age groups. The observations and talk with these two teachers do not form part of the study.

T1 *"I am, from it, seems, the next placement seems less daunting because I've seen it taught in a range of year groups and that's been quite helpful to know that it's not too scary to teach in different year groups" (CS1, T1, I2, 159-61).*

A third purpose for talking to Science Coordinator 1 concerned Trainee 1 developing knowledge and confidence to teach practical work related to 'forces and motion' (DfEE, 1999) which was the NC science topic taught during the placement. She reported in the first

interview that found it "*daunting if you have got big practical experiments" (CS1, T1, I1, 420-1).* She said it was one of the "*big things I worry about" (CS1, T1, I1, 420)* because of safety during practical science activities.

> *T1* *"How do you? umh, how you go about doing it? So that the children are not distracted? That it's safe to do so, that the children aren't inclined to do something other than what you have planned, umh, that sort of thing, so that's to me quite daunting"(CS1, T1, I1, 423-5).*

In the next section, I follow the same format to consider the setting, participants and purpose of talk in Case Two.

5.7 Description of Case Two – School 2, Science Coordinator 2 and Trainee 2

The setting for Case Two was a smaller than average rural Church of England primary school for children aged 4 -11, graded by Ofsted as 'Good' and meeting the nationally set minimum expectations for attainment and progress. The school had very few children from minority ethnic backgrounds and well below national average numbers of disabled pupils and those who have special educational needs. The school had been awarded international recognition for their work in promoting environmental awareness and national recognition for the work in helping children to grow healthily through two awards: Eco-Schools Green Flag (Eco Schools, 2018) and Healthy School status (Healthy Schools, 2018). The school had recently started working with the University in providing ITT placements since 2014-15.

Science was normally taught once a week in the afternoon although separate 'science days' were set up in agreement by Science Coordinator 2 with the individual class teachers throughout the year. Science Coordinator 2 was responsible for reviewing the science curriculum with the Head Teacher including deciding on which new published scheme of work to purchase as they moved towards implementing the changes for the 'new' NC; "*it is tremendous with the changes, it is absolutely tremendous" (CS2, SC2, I2, 542-3)* and the move to no assessment levels (DfE, 2015b); "*now is a nervy time, you know coming up to*

assessment, erh, without levels" (CS2, SC2, I1, 121-135). Science Coordinator 2 discussed this with Trainee 2.

> *SC2* *"She knows that I'm talking with our Head, you know, which scheme we're going to buy in" (CS2, SC2, I2, 1001-2).*

In the next section, I consider the participants in Case Two beginning with Science Coordinator 2 in terms of her science background, role in school and prior experiences in ITT and how she expected to work with trainees.

Science Coordinator 2 was a part time teacher, working three days a week, female and white German. She had taught in two schools prior to joining School 2 as the coordinator for science and modern foreign languages. Science Coordinator 2 had a PhD in a science discipline and came into teaching through the one year Graduate Teacher Programme (GTP) which was an ITT programme in England from 1998 to 2013 and required considerable organisation on the part of a trainee to organise their placements and University.

> *SC2* *"And it you know it, was very much, okay, you would like to do that, you go and find a school. So I had to go, I phoned around. Now, you find a university, so I found a university. Then I had to bring those two people together. It was quite hard work. And then, I was just given a dysfunctional class and my first lesson was this teacher is going away, this was on a Friday, "Here's a black plastic bag," I tell no lies, "and you can get some resources out of there". I thought, "Whoa, what am I letting myself in for?""(CS2, SC2, I1, 78-86).*

Science Coordinator 2 taught in Key Stage 2 (KS2) classes only where children were following the 'old' NC Key Stage Two (DfEE, 1999), teaching mainly science and modern foreign languages whilst other KS2 teachers used school allocated time to plan their lessons using published schemes of work. She did not have her own class. Her focus when teaching science was 'science skills' including data analysis which could be used in other subjects.

SC2 *"I'm trying to teach science skills outside of the science lesson. It might be just putting two units on the board, lots of different data and say, "Right. Put that in a table. So try and put it in a table"" (CS2, SC2, I1, 520-2).*

Science Coordinator 2 described her role in school as '*science coordinator'* although she was not aware of other terms such as manager or leader; "*Oh, I don't even know what the difference is" (CS2, SC2, I1, 121-135).* She considered that her role included organising the resources for each unit, which were kept in a cupboard so that "*teachers are not scrambling around looking for them*" (CS2, SC2, I1, 143-4), offering ideas on resources, and knowing what staff are doing.

SC2 *"I do from everything from the resource audit to making sure that my science file is in good order. I need to know what people are doing" (CS2, SC2, I1, 121-135).*

SC2 *"Yeah, erh, and I might give them web links. Like the other day, I know Mandy* [Mentor to Trainee 1] *is doing forces so I sent her, "Oh, look, I found this. I thought this is a really good worksheet*.""(CS2*, SC2, I1, 596-608).*

Science Coordinator 2 had not been involved in ITT before and therefore had no experience of mentoring. She reported that "*I would hope that I'm accessible at all times "*(CS2, SC2, I1, 1212-3) and that working with a trainee would be a 'partnership'.

SC2 *"Because that is, what would I like to say is, just, I have more experience than you have, but you have experience I don't have. You are young, you are in an environment where you're given new things all the time, that I'm in the rut of day-to-day, that I have to work hard to get on board, so I see it more of a partnership" (CS2, SC2, I2, 1236-40).*

In the next section, I consider the characteristics of the other participant in Case Two - Trainee 2 - in terms of her science background, prior experiences of teaching science, how she preferred to learn and how she expected to work with Science Coordinator 2.

Trainee 2 was female, white and 19 years old. She started ITT directly after studying A Levels and achieved A Level Biology Grade B and GCSE Physics, Chemistry and Biology examinations with grades A, A* and A respectively (UNESCO, 2011). She reported that she 'loved teaching science'; "*Just do, it's my favourite" (CS2, T2, I1, 298-306)* and that all children can enjoy science.

T2 *"Yes, I just think, yeah. Also, I think every child has the capacity to enjoy it as well in some way or another. It might be Biology. It might be Chemistry or Physics. But everybody has a chance to succeed because it's so broad" (CS2, T2, I1, 298-306).*

Trainee 2 had successfully passed 2a Placement based in a year one class; teaching children aged five and six years old. She had taught NC science topics 'Plants' (DfEE, 1999). Trainee 2 said that she believed that she learnt 'visually' by reading, looking at power points, colour pens and observing experiments rather than doing them.

T2 *"uhm, I'm very much, uhm, very visual.*
I How you…? Yes.
T2 *visual, I love my highlighters and my colour coordination and all that.*
I Oh, yes.
T2 *umh, and I learn well by tests as well" (CS2, T2, I1, 414-8).*
..
T2 *"Yeah, and then I learn quite well by reading as well" (CS2, T2, I1, 444).*
..
T2 *But sometimes, I'm better off just looking at the PowerPoint and looking at my notes. Sometimes, I am like that, yeah" (CS2, T2, I1, 450-4).*
..

T2 *"I'm not much of a kinetic learner. I'm not like that at all. Sometimes, like in our science lecturers will have to go do an experiment and things like that and sometimes, I'm better off watching. I'm thinking…because if you're doing it, you're not thinking about as a teacher if that makes sense" (CS2, T2, I1, 458-61)*.

Trainee 2 identified that talking to Science Coordinator 2 would not be same as talking to her mentor, who was not part of this study. Talk with Science Coordinator 2 would not include talking about targets for the placement or placement expectations.

T2 *"Well, it's not going to be the same as the way I talk with* [mentor] *because that's more targets and things like that because…*

I *Yes*

T2 *…I don't have that sort of relationship with* [Science Coordinator 2]" *(CS2, T2, I1, 651-4).*

T2 *"Well, you go in and you know you have your targets on your head for from 2a.*

I Yes

T2 *and you go tell your mentor your targets for subject knowledge or standards.*

I Yes

T2 *and booklet, what you need to do for the booklet.*

I Yes

T2 *Then that's goes to mentor…and then gives it goes back. And she'll observe me.*

I Yeah, that's true because it is….

T2 *and then set targets again" (CS2, T2, I1, 662-71).*

Trainee 2 felt that Science Coordinator 2 had more subject knowledge than other science coordinators, although she had not provided her with pedagogical knowledge.

T2 *"I think she'd be able to answer which is, you wouldn't have somebody as an expertise in other schools, I think she's got the expertise that science coordinators need*

I Yeah.

T2 *but I think in other schools, I'll probably get the more like the pedagogical expertise" (CS2, T2, I2, 522-5).*

Two purposes of talking to Science Coordinator 2 were identified by Trainee 2. The first purpose concerned responding to the University task to ask a science coordinator questions given to all science specialism trainees. She arranged to meet her on the Monday of the first week to discuss the questions.

T2 *"Well, I did tell her in advance I need to speak to her me, right. So I just went through the tasks in my folders.*

I Exactly, yeah

T2 *The folder, all that. And then* [Science Coordinator 2] *showed me like loads of good like resource banks and stuff like that and good resources like STEM* [Science, Technology, Engineering and Mathematics] *and things like that and like progression sheets" (CS2, T2, I1, 110-5).*

The second purpose focused on organising to observe the teaching of science. Trainee 2 organised to observe Science Coordinator 2 teach two lessons on 'electrical resistance' during a science day which had been arranged before the placement for the year 6 class in which Trainee 2 was based. During one of the observed lessons, she heard Science Coordinator 2 explaining to children the concept of 'electrical resistance' through the use of an analogy.

T2 *"About, you know resistance. So, like, she's saying like about electrons going down the motorway and they all go into one and they all start getting like angry. So that's what called, like. So yeah, like you're going down…I'm explaining it really badly.*

I No, no, no, I get you. Yes, go on.

T2 *So all the electrons are like cars going down the motorway and there are in three lanes but they go into one lane. And then all the drivers are getting angry with each other and that causes resistance. So it's harder for the electrons to get through" (CS2, T2, I1, 146-154).*

However, Trainee 2's talk with Science Coordinator 2 did not support her observing teaching of science across the school. Trainee 2 felt it had been hard to organise this.

T2 *"So, so, for timetabling, it is a lot easier for me to just stick to that because obviously I am teaching quite a lot on this placement, so it's quite hard to go in and observe across the school. It is. It has been quite hard, but yeah, I have been happy with science I have seen anyway" (CS2, M2, T2, 212-4).*

Trainee 2 planned and taught one science lesson related to the NC topic 'electricity' (DfEE, 1999) in the final week of the placement referred to as the 'Circuits' lesson. However, she was ill during this lesson and unable to walk around the class to correct children's misconceptions.

T2 *"Yeah, and if I was in that, if I was more active in that session, if I could have been, I would have been going round and correcting those misconceptions as I went but unfortunately because I was that, I, yeah" (CS2,T2, I2, 170- 2).*

Trainee 2 also felt that her University tutor would not be "*impressed that I've only come back with one lesson which is annoying" (CS2, T2, I2, 645-5).* Science Coordinator 2 talked to Trainee 2 about her illness after the lesson and suggested this may have been related to nerves; *"you know part of what you were feeling could be nerves" (CS2, SC2, I2, 400).*

5.8 Data collection timelines for both cases

In this section, the fieldwork timelines for the three research instruments are set out. Data were collected for each case over four-week periods, using the three research instruments outlined in Chapter Four. The first research instrument - one to one semi-structured interviews with each trainee and their respective science coordinator during the first and final week of the trainees' 2b Placement was audio recorded. The second research instrument comprised the audio recorded participant–observer meetings which took place in the third or fourth week of 2b Placement. The third research instrument was the diaries from participants written throughout the duration of the placement. Table 5.3 sets out the dates and times for the interviews and meetings for Case One.

Week in the school placement	**Data source**	**Date / 2014**	**Time started**	**Length / minutes**	**Location**
Week One	Trainee 1 Interview One	May 23rd	13.24	44	Science room
	Science Coordinator 1 Interview One	May 23rd	15.20	56	Science room
Week Three	Meeting One	June 10th	07.45	30	Classroom
	Meeting Two	June 12th	12.30	101	Classroom
Week Four	Trainee 1 Interview Two	June 19th	13.30	39	Science room
	Science Coordinator 1 Interview Two	June 19th	14.41	66	Science room

Table 5.3– Timelines for Case One

Table 5.4 overleaf identifies the dates and times for the interviews and meetings for the second case.

Week in the school placement	Data source	Date / 2015	Time started	Length / minutes	Location
Week One	Trainee 2 Interview One	May 22nd	10.41	36	Classroom
	Science Coordinator 2 Interview One	May 22nd	9.22	69	Staffroom
Week Three	Meeting One	June 11th	13.31	24	Staffroom
Week Four	Meeting Two	June 16th	15.30	17	Staffroom
Week Four	Trainee 2 Interview Two	June 18th	14.20	31	Staffroom
	Science Coordinator 2 Interview Two	June 18th	15.26	65	Staffroom and Corridor

Table 5.4– Timelines for Case Two

5.9 Physical location for interviews and meetings

In this section, the physical location for each case is described and a set of figures for each indicates the physical location of talk which may influence talk between me and the participants and between the participants (Peel, 1988).

5.9.1 Case One: physical location for interviews and meetings

The first meeting for Case One took place in the classroom around a table located at one end of the room near to an open space leading on the corridor as shown in Figure 5.1. The classroom was approximately 80 square metres with seats for 30 children. The letter T1 represents the seating position of Trainee 1, S1 represents Science Coordinator 1 and I represents myself. There were two interruptions, firstly by a member of office staff and secondly by the class teaching assistant. The audio recording was stopped each time in line with ethical expectations (BERA, 2011).

All interviews and the second meeting took place in the school's science room shown in Figure 5.1 overleaf. This was a small room adjoining the classroom. It consisted of a table, four chairs and cupboards and shelving containing science equipment. The door was closed during the meetings and interviews.

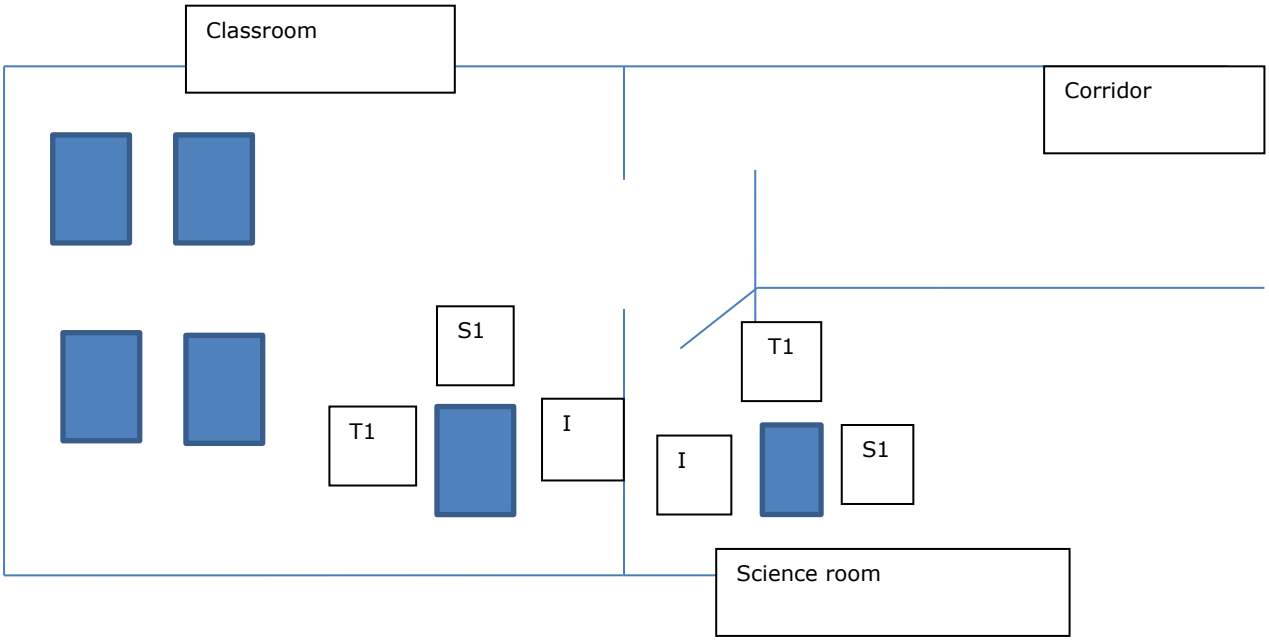

Figure 5.1 – Seating arrangements for Case One

5.9.2 Case Two: physical location for interviews and meetings

In Case Two, the first interview with Trainee 2 took place in the classroom of the class with whom Trainee 2 was placed for the experience as shown in Figure 5.2. The class room was approximately 70 metres squared with seating for 30 children. The positions are represented by T2 for Trainee 2 and I for myself.

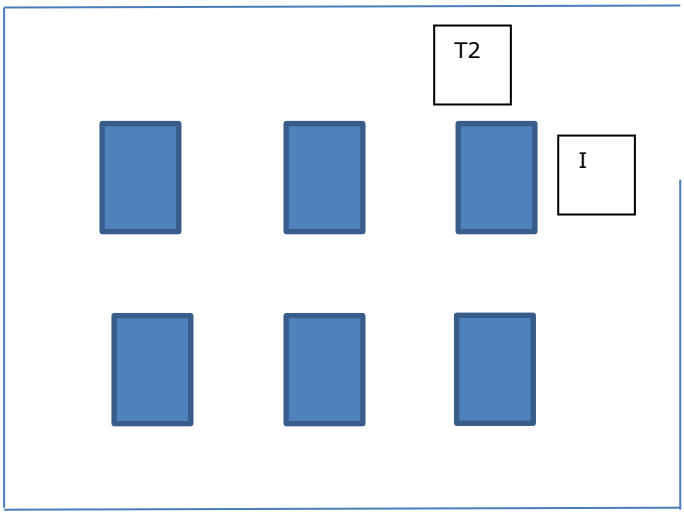

Figure 5.2 – Seating arrangements for Case Two - classroom

The second interview with Trainee 2 took place in the school staffroom at the table near to the sink and kitchen area as indicated in Figure 5.3 with myself sitting in the place labelled as I and Trainee 2 sitting at T2.

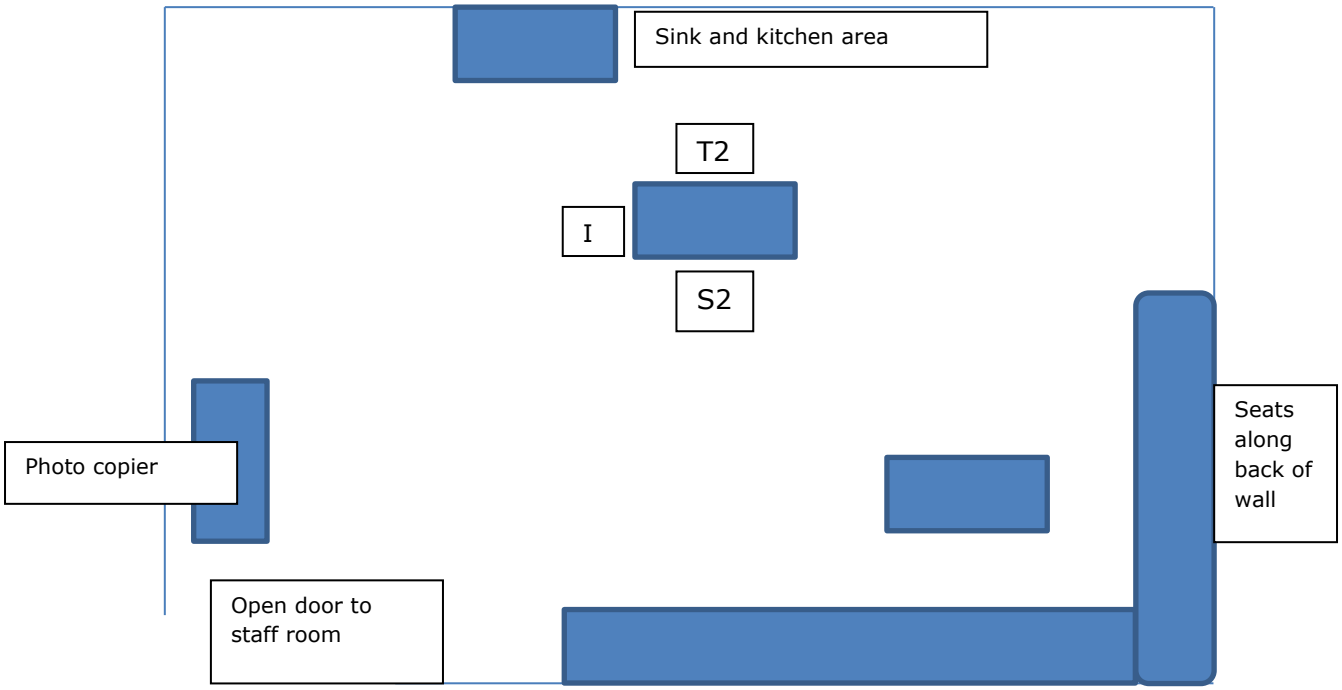

Figure 5.3 – Seating arrangements for Case Two - staffroom

The first and second interview with Science Coordinator 2 took place in the staffroom on the seats along the back of wall in the staffroom, as indicated on Figure 5.3. I was physically uncomfortable as I choose to sit at an angle to face Science Coordinator 2 in order for data collection to not be affected by a lack of face to face interaction. During Interview One, there were three interruptions by children requesting to enter the staffroom which had a permanently open door in order to retrieve documents from the photocopier. The interview was paused although the tape recorders were not stopped which was considered within ethical practices. Interview Two with Science Coordinator 2 started in the staffroom before moving into a corridor as the staffroom had been booked for an after-school meeting. The change in location provided a quieter place to collect data as the level of noise and interruptions were reduced as there were neither children nor staff in the area.

The first participant observer meeting took place in the staffroom on Thursday June 11th 2015. I arrived at 1.20pm as the meeting was booked to begin at 1.30pm and was informed by the office staff that Science Coordinator 2 had left the school as she was ill. Trainee 2 arrived unaware of this situation but offered to talk to me as she was not teaching immediately after lunch. We sat in the staffroom where five other teachers were having lunch and sitting at the table: myself at I and Trainee 2 at T. These moments of talking to Trainee 2 were not recorded because of the presence of the other staff (BERA, 2011). Science Coordinator 2 suddenly arrived in the staffroom saying that she had gone home and then remembered about the meeting. Once the staffroom was empty Meeting One was audio taped with Science Coordinator 2 positioned at S2. Science Coordinator 2 did not appear well and my field notes recorded there was little eye contact between the participants with Trainee 2 appearing distracted and looking at her watch and tapping her pen on the table.

> *Trainee 2 was distracted – looked at her watch – she did appear to find the meeting not worth doing – no purpose, she tapped her pen on the table, and then she went to the toilet near the end – so she may have been uncomfortable.*
>
> *Not sure that Science Coordinator 2 was on full cylinders – she looked away at one point – when asking question to Trainee 2 (Field notes, June 11th 2015, 3.23pm)*

Meeting Two took place in the same place in the staffroom on June 16th 2015; Science Coordinator 2 had returned to work on this day after a period of illness.

5.10 Summary of talk recorded in the participants' diaries

In this section, the data on the day, time, length and location of participant talk is reported from the participants' diaries to enable triangulation by method with the interviews and meetings to enhance trustworthiness of the analysis (Miles *et al*., 2014). The time spent writing a diary entry by the participants was not captured in the diary. I begin by discussing Case One and then Case Two.

5.10.1 Case One: summary of talk recorded in the participants' diaries

According to Science Coordinator 1, she and Trainee 1 wrote their diaries at the end of a day "*because that's the time when we can" (CS1, M1, SC1, 77).* The diaries were completed as a separate task but at the same time.

> *SC1* *"We tend to say we need to do our diaries, yes, so we sit down at the same time and we write them separately" (CS1, M1, SC1, 200-1).*

The diaries from each participant contained entries for 15 talks over the four-week 2b Placement on 10 different days: these are presented in Appendix 11. There were two talks which lasted 2 hours and 3 hours over a lunch time and during a morning respectively. The three talks which lasted between 15 and 30 minutes took place in the afternoon. The 5 and 10 minutes talks took place at different times of the day and the 2 to 5 or 'few minutes' talks were not linked to a time of day.

Duration of talk	Time within the day and frequency
3 hours	Morning 1
2 hours	Lunch time 1
15, 20 and 30 minutes	Afternoon 3
5 and 10 minutes	Morning 3, Lunch 1, Afternoon 5
2- 5 minutes, few minutes	Ongoing during a day

Table 5.5– Diary Summary for Case One

The frequency of 'talks' in different locations are indicated by the number in brackets: classroom (10), science room (3), staff room and classroom (1) and hall and classroom (1). Science Coordinator 1 reported that most of the talks took place "*in the classroom or the little room*" *(CS1, M1, SC1, 167)* where the little room referred to the science room next to the classroom. Trainee 1 added another location; *"Yeah, sometimes we've got a couple in the staffroom, haven't we? A couple of times" (CS1, T1, M1, 169-70).*

The talks were given different titles: "*chat over lunch" (CS1, M1, SC1, 87-8),* talking *"on the hoof" (CS1, M1, SC1, 92) "lots of odd conversations"* (*CS1, M1, SC1, 100) and "snippets" (CS1,*

T1, M1, 179). Science Coordinator 1 reported "*we* [Trainee 1 and herself] *hadn't actually had like a formal meeting" (CS1, M1, SC1, 106-7).*

5.10.2 Case Two: summary of talk recorded in the participants' diaries

In Case Two, Science Coordinator 2 and Trainee 2 did not meet together to complete their diaries. Neither participant kept an on-going diary throughout the school experience. Trainee 2 emailed a diary after 2b Placement ended and listed three 'talks' with Science Coordinator 2 which were recalled as being each 10 minutes each. Trainee 2 described her talk with Science Coordinator 2 in the first interview as "*just in conversation, not nothing formal" (CS2, T2, I1, 269).*

Science Coordinator 2 reported in Interview One that she had met with Trainee 2 in the first week of her 2b Placement and they had talked about diagnostic testing, the science resource cupboard and assessment of the children in the class. In Meeting Two, Science Coordinator 2 identified that meeting after school to talk with Trainee 2 would be 'difficult' because of her other commitments including leading extracurricular clubs.

SC2 *"I've got running straight after school so it will be probably difficult to talk to but I am in that class on Thursday so*
T2 *Okay dokay*
SC2 *so if you want to talk about it*
T2 *Then we'll speak anyways, yeah*
SC2 *and then we will speak anyway" (CS2, SC2, 227-232).*

5.11 Summary of Chapter Five

This chapter has contextualised the school placement in respect of the school placements and has explained the process of selecting participants for each case providing information about each participant. The chapter has described features of the physical settings where data were collected and the timelines for data collection in respect of each case. Information from the participants' diaries revealed where they talked and for how long and these data triangulated with data from the other two sources. The study benefited from the

gathering of different types of data derived from the different data collection methods. When combined, these diverse types of data provided more ways to understand the influence of talk by 'seeing or hearing multiple instances of it from different sources by using different methods' and to improve the trustworthiness (Miles *et al*., 2014, p.300).

CHAPTER SIX – PRESENTATION OF CASE ONE FINDINGS

6.1 Introduction

This chapter presents the data from Case Study One. For this chapter and the chapter that follows, data were analysed according to content analysis (Bryman, 2012) whereby through coding many topics were reduced to fewer categories. Content analysis was applied inductively and I used my professional experience and knowledge as well as topics from the literature when making coding decisions. I also used Gee's model (2014) as part of the analysis process of 'we' and 'I-statements'. Participants were not involved in the analysis of the data.

This chapter is structured in nine sections. Following this introductory section, the second section provides a summary of linguistic features that emerged from this study's empirical data in respect of talk between Trainee 1 and Science Coordinator 1 to address Research Question One:

1. What are linguistic features and patterns in 'talk' between a primary school science coordinator and trainee during a teaching practice?

The third and fourth sections in this chapter provide findings on topics in sequences of utterances which are coded into topic of talk with a particular focus on 'planning' and 'feedback and judgement about Trainee 1' which will inform the discussion in Chapter Eight on Trainee 1's learning 'content'. In the fifth section of this chapter, I consider the types of utterances spoken by Science Coordinator 1 in Meetings One and Two in terms of 'giving information', 'giving instructions' and 'asking questions'. In Chapter Eight of this thesis, findings presented in this fifth section inform discussion for Research Question Two on linguistic features and the influence of setting, purpose and topic. The sixth section of this chapter presents findings about 'we-statements' spoken by Trainee 1 and Science Coordinator 1 and considers these statements in terms of the emerging topics to inform the discussion in Research Question Two about factors influencing linguistic features. Findings for 'I-statements' spoken by Trainee 1 in Interview One and Two are presented in the

seventh and eighth sections of this chapter; these findings are used as a basis for considering the potential influence of talk with Science Coordinator 1 on trainees' learning to teach science.

The next section considers the linguistic features that emerged in Case One; topic of talk in sequences of utterances, types of utterances spoken by Science Coordinator 1, 'we-statements' spoken by both participants and 'I-statements' spoken by Trainee 1.

6.2 Linguistic Features in Case One

In this study, learning to teach is considered in relation to the acquisition of 'content' and 'incentives' in terms of 'knowledge for teaching' as discussed in Chapter Two. The study examines three linguistic features of talk between participants: topics in sequences of utterances, three types of utterances and 'we-statements'. Firstly the identification of 'sequences of turns' to identify 'topics'; these topics support discussion on the 'knowledge for teaching' which Trainee 1 may acquire through talking about different topics with Science Coordinator 1. The types of utterances directed by Science Coordinator 1 to Trainee 1 inform discussion on how Trainee 1 may acquire 'knowledge for teaching' and build relationships through the stimulus of Science Coordinator 1's talk which gives information, instructions and asks questions. Extant literature indicates the importance of relationships between trainees and mentors to trainee's learning to teach (McNally *et al*., 1997; Bradbury and Koballa, 2008) so 'we-statements' are identified and coded against emerging topics and types of 'we-statements' (Gergen, 2009). 'I-statements' spoken by Trainee 1 are identified and coded against emerging topics and types of 'I-statements' (Gee, 2014).

In the next section I consider linguistic feature one - the 'topic' of talk. 'Topics' in sequences of utterances were collated into common 'topics' to create fewer categories which were used to inform discussion with the extant literature on 'knowledge for teaching'.

6.3 Linguistic Feature One – Topics in sequences of utterances

For this study, the code 'topic' is the content of talk: what is being talked about. Each topic was inductively coded from the 'content analysis' of 'topics' which were identified from

sequences of utterances spoken by Trainee 1 and Science Coordinator 1 (Bryman, 2012). Sequences of utterances in the order they occurred during Meeting One and Meeting Two were coded into 'topics' and recorded in a skeleton overview (Craig and Tracy, 1983; Talbot *et al*., 2003). There were 36 'topics' in Meeting One and 41 'topics' in Meeting Two. Appendix 12 lists the topics for Meeting One. If a topic was revisited during the meeting, then it was counted as many times as it appeared.

In the next section, I present data on 'topic'.

6.4 Linguistic Feature One – topic

Eleven topics initially emerged when reducing the number of codes from topics in sequences of utterances from Meeting One and Meeting Two (Appendix 13):

- 'planning',
- 'teaching'
- 'resources'
- 'assessment'
- 'School 1 practices'
- 'placement expectations'
- 'children'
- 'Science Coordinator 1 practices'
- 'feedback and judgement about Trainee 1'
- 'External Examiner visit'
- 'research related'

In Meeting One, the most commonly occurring topic of talk was 'planning' (n=6) with 'assessment' (n=5) as the second most commonly occurring. In Meeting Two, the most commonly occurring topic was coded as 'feedback and judgement made by Science Coordinator 1 about Trainee 1' (n=10) and the joint second most commonly occurring topics were 'planning' (n=6) and 'resources' (n=6).

With reference to the debates discussed in Chapter Two, 'knowledge for teaching' in this study was considered in three main areas; Pedagogy, Context and Subject knowledge with PCK being an interface between Pedagogy and Subject Knowledge. In this study, PCK is used to refer to four aspects related to 'planning', 'teaching', assessment' and 'resources' in relation to teaching science. 'Context' is considered to relate to four other aspects of 'knowledge for teaching' which emerged as topics: 'placement expectations', 'children', school practices' and 'science coordinator practices'. In Case One, Subject Knowledge did not emerge as a topic in the two observed meetings.

In the following two sections, raw data are presented for the most commonly occurring topics in Case One: 'planning' and 'feedback and judgement about Trainee 1'.

6.4.1 Topic of talk related to 'planning'

Talk in Meeting One coded as 'planning' focused on one particular science lesson entitled 'Scientists'. Independently of this study, the 'Scientists' lesson was also observed by the External Examiner (EE) for the University programme. Science Coordinator 1 reported that the 'Scientists' lesson aimed to provide children with information about scientists as required in the new NC (DfE, 2013) and develop their understanding of how scientists ask questions. The children in the class were following the old NC.

T1 "…t*his is based on new curriculum which, 'cos these children haven't experienced" (CS1, M1b, SC1, 203-4).*

During Meeting One, Trainee 1 identified four scientists - Jenner, Newton, Curie and Fleming - and their major historical importance. She developed packs of resources to be used as the main activity in the lesson. The packs were designed to match the interests and abilities of children with the findings of each scientist, for example, Curie and x-rays were linked to broken bones for a child who has been previously knocked down by a car.

T1 *"I choose each group so they could relate to or somebody in the group could relate to what the scientist discovered, umh" (CS1, M2, T1,118-9).*

Trainee 1's planning for the 'Scientists' lesson was governed by certain expectations set by Science Coordinator 1 during the first observed meeting: the length of the lesson, the pace of learning, the teaching approach use with Key Stage One children and making the learning relevant to the children. Science Coordinator 1 stipulated that the lesson had to last no more than one hour: "*she has a maximum of one hour to deliver that lesson" (CS1, M1c, 132).* Secondly, Trainee 1 responded to earlier feedback from Science Coordinator 1 that she needed to make more use of learning time through an increase in pace and had identified a timer she could use during the lesson:

T1 *"…. oooh, I forgot to say actually because you said that pace was a problem, because I need to keep it choppy, choppy, I have found a timer on my laptop that I can use" (CS1, M1c, 29-30).*

The third expectation for the 'Scientists' lesson set by Science Coordinator 1 concerned Trainee 1 using a specific teaching strategy: move children from teacher-led to group-work activities and back to teacher-led. The Science Coordinator 1 visualised this by moving her hands in a horizontal direction together and away from each.

SC1 *"All the time send them out and bring them back, send them out and bring them back" (CS1, M1c, 93- 4).*

The fourth expectation for the 'Scientists' lesson plan related to making the content relevant to the everyday lives of the children aged between 6 and 7 years old. Science Coordinator 1 reminded Trainee 1 about this requirement by providing a visual prompt: she moving her hands in a vertical direction towards and away from each other: 'bring it back to everyday'.

SC1 *"… So bring it back up to everyday and then back up to the scientists and then back down again" (CS1, M1, 102).*

Science Coordinator 1 supported Trainee 1's planning for the 'Scientists' lesson by removing all other planning expectations for Trainee 1 to enable her to focus on the observed lesson. This was appreciated by Trainee 1 who had not considered the time that would be needed to plan the resources.

T1 *"Yeah, I would have struggled had I, had to do all the planning, I think, I wouldn't have struggled but I wouldn't have thought it through as much as I did" (CS1, M2, T1, 950-1).*

6.4.2 Topic of talk related to 'feedback and judgement about Trainee 1'

In Meeting One before the lesson observation of the 'Scientists' lesson, Science Coordinator 1 provided Trainee 1 with feedback which included the qualifiers of 'good' and 'nice' to indicate a judgement about the lesson plan because it was based on the revised NC (DfE, 2013): for example, " I *think this is a good little lesson" (CS1, M1c, SC1, 203).*

Science Coordinator 1 used 'I think' to start her utterances, coded as 'feedback and judgement about Trainee 1' with regards to responding to children, assessment for learning, differentiation and questioning. Science Coordinator 1 fed back to Trainee 1 that she had improved her awareness of being able to respond to a named individual child during a lesson to ensure they made progress during learning time.

SC1 *"and I think that* [Trainee 1] *has got that in mind" (CS1, M1c, 234).*

Science Coordinator 1 also gave feedback to Trainee 1 about her improved understanding of Assessment for Learning (AfL) strategies to gather information about learning during a lesson (Black and Wiliam, 1998).

SC1 *"Yes AfL is the big one, I think you've got much more secure understanding of" (CS1, M2, 1069-70).*

Science Coordinator 1 provided Trainee 1 with indirect feedback by informing me, as the researcher, that she thought Trainee 1 was able to differentiate work to children's abilities and that Trainee 1 would retain this learning in the future.

SC1 "certainly, I think we've got the differentiation. I think we've nailed that" (CS1, M2, 1521).

The use of 'we-statements' will be discussed further in Section 6.6.

Science Coordinator 1 provided feedback to Trainee 1 that her use of questioning, viewed as a separate skill to differentiate, in the classroom was not achieved: *"I don't think you've got the questioning" (CS1, M2, 1535).*

In the first section, I have presented data on the topics, discussed in two observed meetings between Science Coordinator 1 and Trainee 1. Extracts of raw data coded as the topics 'planning' and 'feedback and judgement about Trainee 1' were provided: details on these topics have been included as these topics were the two that occurred most frequently.

In the next section, data concerning the second linguistic feature of this study are presented: types of utterances spoken by Science Coordinator 1.

6.5 Linguistic Feature Two - Utterances of Science Coordinator 1

Learning is mediated through talk (Vygotsky, 1978; Illeris, 2009) and a summary of types of utterances is presented in this section to indicate how Science Coordinator 1 may have influenced Trainee 1's construction of 'knowledge for teaching'.

The summary of the findings in this section was constructed by manually coding the utterances of the Science Coordinator 1 to Trainee 1 during Meeting One and Two as 'giving information', 'giving instructions' and 'asking questions'. More of Science Coordinator 1's utterances were coded as 'giving information' than those that were coded as 'giving instructions' or 'asking questions'.

Type of utterance by Science Coordinator 1	Meeting One	Meeting Two	Total
Giving information	98	99	197
Giving instructions (directives)	17	22	39
Asking questions	17	11	28
Total	132	132	264

Table 6.1 Case One Types of utterances and frequency

6.5.1 Utterances coded as 'giving information'

Utterances made by Science Coordinator 1 in Meeting One and Meeting Two were manually coded as 'giving information' (Holmes, 2001). 'Giving information' was a means by which Science Coordinator 1 could 'transfer knowledge' (Blom *et al*., 2007) to Trainee 1. 'Giving information' utterances were coded using emerging topics identified in 6.4: 'School 1 practices'; 'feedback and judgement made by Science Coordinator 1 about Trainee 1'; 'Science Coordinator 1 practices'; and 'children'. Additionally, a new topic emerged, coded as 'speaking on behalf of Trainee 1'. The frequency of these utterances is summarised in Table 6.2.

Giving Information utterances and **topics**	**Number of utterances In Meeting One**	**Number of utterances In Meeting Two**
Giving information about **School 1 practices**	16	19
Giving information about **placement expectations**	0	6
Giving information about **children**	0	6
Giving information about **Science Coordinator 1 practices**	16	11
Giving information to give **feedback and judgement about Trainee 1**	22	43
Giving information to the researcher – **speaking on behalf of Trainee 1**	44	14

Table 6.2 Case One Utterances coded as 'giving Information'

In Meeting One, most utterances that were coded as 'giving information' related to Science Coordinator 1 'speaking on the behalf of the Trainee 1' to provide information about the

writing of diaries and their meetings (n=44). The second most frequent topic related to 'giving information' was coded as 'feedback and judgement about Trainee 1' (n=22). In Meeting Two, most information was coded as 'giving feedback and judgement about Trainee 1' (n=43). In both meetings, the fewest 'information giving' utterances were coded as 'children' (n=0 and n=6) respectively.

In the next six sub-sections, I present examples of data exemplifying the code 'giving information' related to each topic.

6.5.1i 'Giving information' – School 1 practices

Science Coordinator 1 provided information about the school problems with the internet and a post-it note tool for science practical work. Trainee 1 was given knowledge that the school had a possible issue with accessing wi-fi to use whilst teaching and that she would need to check it before using it in the class:

> *SC1* *"yes, and my laptop is freezing so, I do think there is a problem with school" (CS1, M1c, SC1, 45).*

Science Coordinator 1 considered that she had a role in playing in providing information to Trainee 1 about a post-it note tool used in local primary schools for completing science practical work: "*I can't leave her where she is, not knowing about the post it planner" (CS1, SC1, I1, 563).* However, there was no mention of Science Coordinator 1 providing information to Trainee 1 about this tool in the diaries, observed meetings or second interviews.

6.5.1ii 'Giving information' – Placement expectations

Science Coordinator 1 provided information to Trainee 1 on her perceptions of the 2b placement expectations. She felt the placement was too short, only three weeks, and because it was held during the summer term that 'good teaching' might not be seen. The summer term is the final term in England of each academic year and includes particular

events, for example sports days and transfer days, when primary children visit their new secondary school.

SC *"...because we are on the downhill with all the things like transfer day and all of those other things because you wouldn't see" (CS1, M2, 1611-2).*

6.5.1iii 'Giving information' – Children

The fewest 'giving information' utterances in both meetings were coded as related to 'children'. During the interviews with both participants neither talked directly about any child. During Meeting One, Science Coordinator 1 talked about four children although they were not named and during Meeting Two she talked about nine children by name and one as "*that child*" (CS1, M2, SC1, 326-7). Science Coordinator 1 provided information about a child's home life or learning needs, for example children X and XX:

SC1 *"X because mum is having a baby with the scan, they remembered XX had had a broken leg because he has had a broken leg recently and been in class" (CS1, M2, SC1 and T1, 756-7).*

6.5.1iv 'Giving information' – Science Coordinator 1 practices

Utterances coded as 'giving information' about the practices of Science Coordinator 1 included a discussion in Meeting One about her 'mantra' questions. Science Coordinator 1 told Trainee 1 that she had two key questions that she used to guide her teaching – 'how does it impact on the teaching? and how does it impact on the learning ?'. She asked Trainee 1 if she had 'picked them up' over the past 12 days as she repeatedly speaks them aloud.

SC1 *"And they are the only two questions that I use every day, all day, everything I decide, but I don't know that'll you'll have picked them up yet" (CS1, M1a, SC1, 243- 6).*

6.5.1v 'Giving information' – Feedback and judgement about Trainee 1

Science Coordinator 1 gave information to Trainee 1 coded as the topic 'feedback and judgement' directly by the use of the pronoun 'you'. Trainee 1 was given information which could be inferred to be a judgement that she could teach without the use of clock to know when to change activities and she was able to meet the needs of different children through her differentiation: *"You've got the differentiation. You've got the pitch right" (CS1, M2, SC1, 485).*

6.5.1vi 'Giving information' – Speaking on behalf of Trainee 1

The topic of 'speaking on behalf of Trainee 1' was coded as a separate topic to reflect a difference in the direction of information from Science Coordinator 1 to me, as the researcher. For example, Science Coordinator 1 provided information to the researcher on the writing of the diaries which had been coded as a topic of talk called 'research related' in 6.4.

> *SC1* *"We tend to say "we need to do our diaries". Yes, so we sit down at the same time and we write them separately" (CS1, M1, SC1, 200-1).*

In the next section, I present data on the second type of utterance spoken by Science Coordinator 1, 'giving instructions'.

6.5.2 Utterances coded as 'giving instructions'

Utterances of Science Coordinator 1 in Meeting One and Meeting Two were coded as 'giving instructions' if Science Coordinator 1 gave directives for Trainee 1 to take action. Instructions were collated by identifying the verb. These are summarised below and Table 6.3 presents the raw data for each.

- We need
- We want
- Verb – improve, bring, make
- You could have, could make

- Needs to, you need to
- Anna needs to, Anna has got to, she needs to
- Has to be, has to,
- Have to
- Don't think you need it
- Cannot
- Don't get
- I don't want you to

Verb used in instruction	**Number of occurrences in Meeting One**	**Number of occurrences in Meeting Two**	**Utterance** **You, she, Anna – references to Trainee 1**
We need	5	2	*"We need to do our diaries" (CS1, M1a, SC1, 200).* *"We need to do more of that"* [writing diaries] *(CS1, M1b, SC1, 20).* *"We need to talk about Wednesday" (CS1, M1b, SC1, 22).* *"We need to pull all of it together now"*[information from lesson observation) *(CS1, M2, SC1, 16-7).* *"We need to go back to"* [respond to children questions] *(CS1, M2, SC1, 723-4).* *"We need as few questions and we really need this to just bloom and blossom" (CS1, M1c, SC1, 197).*
We want	0	1	*"We want this tied up by Thursday"* [decision about priorities for final week] *(CS1, M2, SC2, 1489-90).*
Action verb improve bring make	 1 1 0	 0 0 2	*"Improve the resourcing" (CS1, M1a, SC1, 215).* *"Bring it back up to everyday and then back down to the scientists" (CS1, M1c, SC1, 102).* *"Make them beg a bit more" (CS1, M2, SC1, 417).* *"Make them work at why it is there" (CS1, M2, SC1, 423).*

Table 6.3 Case One Utterances coded as 'giving instructions'

Verb used in instruction	**Number of occurrences in Meeting One**	**Number of occurrences in Meeting Two**	**Utterance** **You, she, Anna – references to Trainee 1**
You could have/ could make/could just	0	4	*"You could have had"* [used real object] *(CS1, M2, SC1, 431-2).* *"You could make that accessible"* [knowledge about scientists] *(CS1, M2, SC1, 914).* *"You could just meander the room like I'm in role" (CS1, M2, SC1, 391).* *"You could have* [said] *""I can't understand this today"" (CS1, M2, SC1, 394).*
Needs to/ you need to	4	3	*"Needs to do class work"* [rather than teach groups] *(CS1, M1b, Sc1, 28).* *"So need to check it beforehand"* [IT access] *(CS1, M1c, SC1, 54).* *"So you need to think about resourcing for Newton" (CS1, M1c, SC1, 74).* *"You need to manage those things"* [manage whole class] *(CS1, M1b SC1, 41-2).* *"You need to learn to go off instinct" (CS1, M2, SC1, 228).* *"You need to take us through how the lesson went" (CS1, M2, SC1, 29).* *"You need to explain the range of resourcing" (CS1, M2, SC1, 104).*
Anna needs to Anna has got She needs to	1 0 1	0 1 1	*"Anna needs to do so…because I've said she needs to"* [teach whole class] *(CS1, M1b, SC1, 46-7).* *"Anna has got some decisions to make about next week" (CS1, M2, SC1, 11).* *"She needs to get to with her folders" (CS1, M2, SC1, 1038).* *"She needs to do, is to get that peripheral vision" (CS1, M1b, SC1, 35).*

Table 6.3 Contd. Case One Utterances coded as 'giving instructions'

Verb used in instruction	Number of occurrences in Meeting One	Number of occurrences in Meeting Two	Utterance You, she, Anna – references to Trainee 1
Has to be / has to	3	0	*"It has to be know or to understand"* [when writing learning objective] *(CS1, M1c, SC1, 136).* *"There has to be a plan B for that child" (CS1, M1c, SC1, 232).* *"She has a maximum of one hour"* [for teaching scientist lesson] *(CS1, M1c, SC1, 132).*
Have to	0	5	*"You have to value that resource and you as a resource" (CS1, M2, SC1, 415).* *"You have to take ownership of this one"* [priorities for final week] *(CS1, M2, SC1, 500).* *"But you have to be able to offer the top end things as well" (CS1, M2, SC1, 1284).* *"You have to make that decision" (CS1, M2, SC1, 1564-5).* *"You really do need to just make that decision" (CS1, M2, SC1, 1557).*
Don't think you need to	0	1	*"I don't think you need it"* [using a timer] (CS1, M2, SC2, 244).
Cannot	1	0	*"She cannot go over one hour"* (CS1, M1c, SC1, 130).
Don't get	0	1	*"Don't get bogged down"* (CS1, M2, SC1, 487).
I don't want you to	0	1	*"I said "I don't want you to do anything*" (CS1, M2, SC2, 933-4).

Table 6.3 Contd. Case One Utterances coded as 'giving instructions'

Different instruction-prompting verbs reflected Science Coordinator 1's potential level of intent for action to be taken in response to them; 30 of the 39 instructions were 'need to', 'has to,' 'want', 'have to', 'cannot' and 'don't'. Eight instructions included 'we' in which Science Coordinator 1 gave herself and Trainee 1 an instruction.

Science Coordinator 1 uttered instructions which suggested different timelines for instructions to be completed. Some instructions related to action to be taken in the future for a given named activity for example, deciding what to do in the final week; *"You have to make that decision" (CS1, M2, SC1, 1564-5).* Others suggested action to be taken in the

future for unspecified activities, for example; "*You need to learn to go off instinct" (CS1, M2, SC1, 228).*

One particular instruction recalled by Science Coordinator 1 in Interview One focused on telling Trainee 1 to 'bring a drink' to ensure she had a drink during lunch time because she had not left the classroom to take a break.

> *SC1* *"…Okay, target for the second day, you bring lunch and you bring a drink and then I am going to tell you, go as soon as we leave, and you only take 10 minutes" (CS1, SC1, I1, 335-6).*

Science Coordinator 1 thought giving this instruction *"could be wrong" (CS1, SC1, I1, 301)* because "*it can be mothering which is kind of patronising for others who don't need that*" (CS1, SC1, I1, 307-8). However, Science Coordinator 1 explained though that she felt there was a need to explore the learning needs of each student individually in order to support them.

> *SC1* *"So, it's actually taking the measure of your student in the way we do with the child really and seeing what their needs are" (CS1, SC1, I1, 312-3).*

Each 'giving instruction 'utterance was coded by considering its content in relation to emerging topics in 6.4 or new topics. For example, "*She has a maximum of one hour* [for teaching 'Scientist' lesson]" *(CS1, M1c, SC1, 132)* was coded as 'planning'. The coding process of the 'giving instructions' resulted in the following topics, with the number in brackets indicating their frequency: 'teaching' (n=14), 'resources' (n=4), 'research related' (n=2), 'External Examiner visit' (n=2), 'planning' (n=4), 'children' (n=1), 'placement expectations' (n=4) and 'School 1 practices' (n=2). There were six 'giving instructions' which did not fit the emerging topics: *"You have to make that decision" (CS1, M2, SC1, 1564-5).* These 'giving instructions' were coded as 'Trainee 1'.

6.5.3 Utterances coded as 'asking questions'

In this section, findings are presented concerning questions asked by Science Coordinator 1 of Trainee 1 during Meetings One and Two.

Coding for the utterances made by Science Coordinator 1 in Meetings One and Meeting was organised by collecting together similar types of questions (Nordquist, 2017a, 2017b). Table 6.4 presents the raw data for each.

Question Types	**Question Stems**	**Meeting One**	**Meeting Two**	**Total (% of total number of question)**
		17	11	28
Direct	Tell me..?	3	0	Direct 3
Yes –no questions	Does that..? Did I ..? Is that ? Is there ? You alright ?	3 0 0 0 1	0 1 1 1 0	Yes – no 7
Tag questions-negative tag	Wasn't it Weren't they? Didn't it ?	0 0 0	1 2 1	4
Wh - questions Where	Where will ? Where did ..? Where you think you could..?	1 0 0	0 1 1	Wh-questions 9
Wh-questions What	What else ..? What have the children done.? What are you thinking about ?	1 0 1	0 1 0	
Wh-questions How	How do you ..? How does that impact on ..?	1 2	0 0	
Alternative question	So not their working groups? For you or for the children? After the first mind mapping? So they go out cold? Wasn't it Pasteur?	4	1	Alternative 5

Table 6.4 Case One Utterances coded as 'asking questions'

Each question was coded by considering its content in relation to emerging topics in 6.4 or new topics. For example, *"Yeah, so my first question will be, where will your lesson begin? Cos, this is something we've been working on" (CS1, M1b, SC1, 53-4*) was coded as 'assessment' as it related to using the register to assess children's learning at the start of the lesson.

The coding process of the 'questions' resulted in the following topics, with the number in brackets indicating their frequency: 'research related' (n=9),'planning' (n=9), 'teaching' (n=3), 'assessment' (n=2), 'Science Coordinator 1 practices' (n=1), 'School 1 practices' (n=1), 'children' (n=1) and 'Trainee 1' (n=1). There was one 'question' which did not fit the emerging topics: "*Wasn't it Pasteur?"* This question was coded as 'subject knowledge' *(CS1, M2, SC1, 340).*

This section has considered types of utterances directed by Science Coordinator 1 to Trainee 1. Among these utterances, more were coded as 'giving information' than those coded as 'giving instructions' and 'questions'. The next section presents the third linguistic feature of this study: 'we-statements'.

6.6 Linguistic Feature Three - 'we- statements' spoken by participants

In this section, data are presented concerning the number of 'we-statements' identified in the transcripts of the two interviews with Trainee 1 and Science Coordinator 1 and the two observed meetings between them. Table 6.5 presents the frequency of 'we-statements'.

Speaker	Interview One	Meeting One	Meeting Two	Interview Two
Trainee 1	0	3	1	2
Science Coordinator 1	3	59	38	7

Table 6.5 Case One 'we-statements'

Two approaches were used for coding these data. Firstly they were coded into five groups (Gee, 2014) to identify their focus on 'cognitive', 'affective', 'state and action', 'achievement' and 'ability and constraints' codes. Table 6.6 overleaf presents this data.

Meeting and Interview in Case One	Types of 'we-statements' (Gee, 2014)					
	Cognitive	**Affective**	**State and Action**	**Ability and Constraints**	**Achievement**	**Total**
Interview One - Trainee 1	0	0	0	0	0	0
Interview One - Science Coordinator 1	0	0	2	1	0	3
Meeting One – Trainee 1	0	0	3	0	0	3
Meeting One – Science Coordinator 1	3	1	41	12	2	59
Meeting Two – Trainee 1	1	0	0	0	0	1
Meeting Two – Science Coordinator 1	4	1	28	5	0	38
Interview Two - Trainee 1	0	0	2	0	0	2
Interview Two - Science Coordinator 1	0	0	6	1	0	7
Total	8	2	82	19	2	113

Table 6.6 Case One Types of 'we-statements'

Secondly, 'we-statements' were coded against topics in 6.4: 'planning', 'teaching', 'resources', 'assessment', 'School 1 practices', 'placement expectations', 'children', 'Science Coordinator 1 practices', 'feedback and judgement about Trainee 1', 'External Examiner visit' and 'research related'. These are summarised in Table 6.7 overleaf such that 'Int.' and 'M' are used to represent 'Interview' and 'Meeting', and 'T1' and 'SC1' refer to 'Trainee 1' and 'Science Coordinator 1' respectively.

Emerging topic	Int. 1 T1	Int. 1 Sc1	M1 T1	M1 SC1	M2 T1	M2 SC1	Int. 2 T1	Int.2 SC1	Total
Planning	0	0	0	3	0	5	0	2	10
Teaching	0	0	0	5	0	1	0	1	7
Resources	0	0	0	2	0	5	0	1	8
Assessment	0	1	1	1	0	6	2	1	12
Placement expectations	0	1	0	6	0	4	0	0	11
Children	0	0	0	1	0	2	0	0	3
Science Coordinator 1 practices	0	0	0	1	0	1	0	0	2
Feedback and Judgement about Trainee 1	0	1	0	2	0	4	0	2	9
External Examiner visit	0	0	1	21	0	3	0	0	25
Research related	0	0	1	16	0	3	0	0	20
Subject knowledge	0	0	0	1	1	4	0	0	6
Total	0	3	3	59	1	38	2	7	113

Table 6.7 Case One Emerging topics and types of 'we-statements'

These two sets of codes were analysed to elicit 'we-statements' coded as 'cognitive',' affective', 'state and action', 'achievement' and 'ability and constraints' in relation to each topic which are considered in section 6.6.2.

The use of 'we' did not always lead to a 'we-statement' being recorded. For example, Science Coordinator 1 used 'we' to refer to herself and the school in terms of the practices of the school and herself in not asking children to write 'reams' referring to 'a lot' of paper.

> *SC1 "And we don't ask children to write reams and we do accept screwed up pieces of paper and post it notes" (CS1, M1c, SC1, 259-60).*

In addition, the use of 'we' in a linguistic feature referred to a tag question such as "*haven't we?"* were not coded as 'we-statements'.

6.6.1 Types of 'we-statements'

Classification was used as part of the process of coding the 'we-statements' (Gee, 2014). Literature concerned with links between 'content' and 'incentives' also informed the coding (Illeris, 2009).

- Cognitive – we think, we know
- Affective – we felt, we liked, we're hopeful
- State and action – we talked, we got, we had, we felt, we are
- Ability and Constraints – we can, we need
- Achieved – we learnt

In both observed meetings, Science Coordinator 1 uttered more 'we-statements' than Trainee 1 (Table 6.5). Among Science Coordinator 1's utterances, 'state and action we-statements' emerged as the coding of highest frequency. Science Coordinator 1 uttered all five types of 'we-statements' overall in interviews and meetings, for example: a 'state and action' 'we-statement' "*We are meeting tonight to have a good look at what she has got." (CS1, SC1, I1, 556).*

Trainee 1 uttered two types of 'we-statements' coded as 'state and action' and 'cognitive'. For example, a cognitive 'we-statement: *"But then we thought the concept of that would be too difficult for them with black holes and that sort of thing" (CS1,M2,T1,731-2).*

6.6.2 'We- statements' and topics

In this section, I present the data coded against the emerging topics Identified in section 6.4: 'planning', 'teaching', 'resources', 'assessment', 'School 1 practices', 'placement expectations', 'children', 'Science Coordinator 1 practices', 'feedback and judgement about Trainee 1', 'External Examiner visit' and 'research related'. Table 6.8 overleaf presents the data. This was considered useful in considering how participants' thinking, feeling, doing, achievements and abilities and constraints were associated with each emerging topic.

	Types of 'we-statements' for Case One					
Emerging topics	**Cognitive**	**Affective**	**State and Action**	**Ability and Constraints**	**Achievement**	**Total**
Planning	1	1	6	2	0	10
Teaching	0	0	5	2	0	7
Resources	1	0	5	2	0	8
Assessment	0	0	11	1	0	12
Placement expectations	0	0	7	4	0	11
Children	0	0	3	0	0	3
Science Coordinator 1 practices	0	0	2	0	0	2
Feedback and Judgement about Trainee 1	0	0	6	2	1	9
External Examiner visit	4	1	17	2	1	25
Research related	1	0	15	4	0	20
Subject knowledge	1	0	5	0	0	6
Total	8	2	82	19	2	113

Table 6.8 Case One Emerging topics and types of 'we-statements'

The most frequent topic in Case One coded for 'we-statements' was 'External Examiner visit' with 21 of the 25 statements occurring in Meeting One and spoken by Science Coordinator 1. The least frequent topic was 'Science Coordinator 1 practices'. Trainee 1 spoke six 'we-statements' coded as 'assessment' (n=3), 'subject knowledge' (n=1), 'External Examiner visit' (n=1) and 'research related' (n=1).

6.6.3 'We-statements' and 'assessment'

Three of the 6 'we-statements' spoken by Trainee 1 were coded as 'assessment'. In Meeting One, Science Coordinator 1 prompted Trainee 1 to remember and recount her experiences during the 2b placement of using specific assessments for learning strategies.

SC1 *"And then, I think, there are two techniques that at least you have used on the carpet for AfL where you're hot seating some children or making sure everyone is involved in the lesson?*

T1 *Erhm…Do you mean like thumbs and whiteboards? That sort of thing?*

SC1 *Yes and also using lolly sticks and…*

T1 *Oh yes*

SC1 *so you, now, as a random name generator on line as well…*

T1 *Yeah*

SC1 *…so using those things, there are all part of the AfL package. So we've got strategies built in and they're definitely there and you've definitely had some experience of them" (CS1, M1b, 128-38).*

During Meeting Two, Science Coordinator 1 spoke about the progress that she and Trainee 1 had made together in assessment for learning (AfL) (Black and Wiliam, 1998) which was summarised in a 'we-statement' uttered by Science Coordinator 1 which also provided 'feedback and judgement about Trainee 1'; "*Yes, afl is the big one, I think, we have really gone a long way on that one" (CS1, M2, 1069).*

In this section, data coded as 'we-statements' have been presented. Science Coordinator 1 spoke more 'we-statements' utterances than Trainee 1. Science Coordinator 1 spoke utterances that included all types of 'we-statements' (Gee, 2014) with 'state and action' and those related to 'assessment' were identified as the highest frequency.

In the next section, data concerning the fourth linguistic feature within this study are presented: 'I-statements' uttered by Trainee 1.

6.7 Linguistic Feature Four - 'I –Statements' uttered by Trainee 1

In this study, 'I-statements' were identified as a useful linguistic feature to examine a trainee's 'content' and 'incentives' during a placement and how these may change (Ushioda, 2008; Ticknor, 2011).

This section presents data indicating the frequency of 'I-statements' identified in the transcripts from the two interviews with Trainee 1. These data were coded according to two approaches. Firstly, a framework of five codes was applied: 'cognitive', 'affective', 'state and action', 'achievement' and 'ability and constraints' codes (Gee, 2014) as listed in Table 3.1.

Adopting this framework allowed the 195 'I-statements' that emerged in Case One to be categorised according to aspects discussed in Chapter Two on factors which may influence trainees learning to teach – their prior science NC knowledge, their aspirations, their feelings, and willingness to engage with learning (Shallcross *et al*., 2002; Smith, 2005; Hagger *et al*., 2008). Secondly, 'I-statements' were coded against topics in 6.4: 'planning', 'teaching', 'resources', 'assessment', 'School 1 practices', 'placement expectations', 'children', 'Science Coordinator 1 practices', 'feedback and judgement about Trainee 1', 'External Examiner visit' and 'research related'- to examine how topic related to 'cognitive', 'affective', 'state and action', 'achievement' and 'ability and constraints' codes.

6.7.1 Types of 'I-statements'

87 'I-statements' emerged from Interview One and 108 in Interview Two and the frequency and percentage of each type of 'I-statement' are recorded in Table 6.9.

Type of I-statement by Trainee 1	Number of occurrences in Interview One	% of occurrence in Interview One	Number of occurrences in Interview Two	% of occurrence in Interview Two
Cognitive	22	25	50	46
State and Action	43	49	35	32
Ability and Constraints	17	20	18	17
Affective	5	6	0	0
Achievement	0	0	5	5
Total	87	100	108	100

Table 6.9 Case One Types of 'I-statements'

In Case One, Trainee 1 uttered mostly 'state and action' 'I-statements' in Interview One and mostly 'cognitive' 'I-statements' in Interview Two, reflecting a shift from 'doing' to 'thinking'. There were no 'I-statements' coded as 'achievement' in Interview One and no 'I-statements' coded as 'affective' in Interview Two.

6.7.2 Types of 'I-statements' and topics

Trainee 1's 'I-statements' were coded against the emerging topics in 6.4 – 'planning', 'teaching', 'resources', 'assessment', 'School 1 practices', 'placement expectations',

'children', 'Science Coordinator 1 practices', 'feedback and judgement about Trainee 1', 'External Examiner visit' and 'research related' or new topics.

Five 'I-statements' coded as 'affective' in Interview One were made by 'Trainee 1'. Three 'I-statements' made by Trainee 1 in Interview Two were coded as 'achievement' related to 'assessment' (n=2) and 'teaching' (n=1). Two other 'affective' 'I-statements' made by Trainee 1 did not fit the emerging topics in 6.4 and were coded as 'subject knowledge' (n=1) and 'University expectations' (n=1). Three new topics emerged from these data: 'practical work in science', 'Trainee 1' and 'science coordinator from previous placement'. The data is presented in Table 6.10.

I – statement coded to topics	**Cognitive I- statements**		**State and Action I-statements**		**Ability and Constraints I-statements**	
	Interview One	Interview Two	Interview One	Interview Two	Interview One	Interview Two
Planning	0	1	0	7	0	1
Teaching	2	10	11	4	3	3
Resources	0	0	2	0	0	0
Assessment	0	4	8	5	1	5
School 1 practices	2	0	1	1	2	0
Placement expectations	0	8	2	5	2	2
Children	3	8	4	1	4	0
Science Coordinator 1 practices	0	5	0	2	2	2
Research related	0	3	0	1	0	0
Subject knowledge	2	2	3	0	1	0
University expectations	1	2	1	0	0	0
Practical Work in science	0	0	4	1	0	0
Trainee 1	4	7	7	8	2	5
Science Coordinator previous placement	8	0	0	0	0	0
Total	22	50	43	35	17	18

Table 6.10 Case One Emerging topics and types of 'I-statements'

In the following sections I present examples of each type of 'I-statements' and associated topics.

6.7.2i 'I-statements' coded as 'state and action'

43 'state and action' 'I-statements' were made by Trainee 1 in Interview One and most of these were coded as 'teaching' (n=11). Trainee 1 recalled actions coded as 'teaching' that she had already experienced, for example: "*I have just taught small groups of science" (CS1, T1, I1, 19).*

Trainee 1 indicated that she started 2b placement in a confident 'state' in regard to teaching 'forces and motion' (DfEE, 1999) because of the University sessions:

> T1 "*I was confident because at University they do loads of, well, we had two whole sessions on forces" (CS1, T1, I1, 111-5).*

In contrast, Trainee 1 suggested she was 'daunted' and 'worried' in regards to teaching practical work: "*I find it daunting" (CS1, T1, I1, 468).* In Interview One Trainee 1 repeated the use of the word 'daunting' four times in relation to practical work she observed Science Coordinator 1 doing with children during a lesson, for example:

> *T1 "So it kinda of taught me, I was kinda of watching the kids and how she interacted with the children, how she set out the practical, because it was a practical, how she went about setting it out, because that it is one of the big things I worry about and I find daunting in that if you have got a big practical experiment" (CS1, T1, I1, 418-421).*

6.7.2ii 'I-statements' coded as 'cognitive'

Trainee 1 uttered more than twice as many 'cognitive' 'I-statements' in Interview Two than Interview One. In Interview One, her 'cognitive' 'I-statements' were mainly concerned with reflecting on her experiences with 'science coordinator practices from previous placement', for example:

T1 *"Umh she. I don't think, she didn't ask me as many questions as Science Coordinator 2 does now" (CS1, T1, I1, 262).*

In Interview Two, the 'I-statements' were mostly about 'teaching', for example: Trainee 1 making a judgement about her teaching.

T1 *"I don't think my lessons are engaging enough" (CS1, T1, I2, 438).*

Trainee 1's 'cognitive' 'I-statements' about 'children' were not about individual children but children as a class, for example *"I think they were because they were so competitive*" *(CS1, T1, I2, 243).*

6.7.2iii 'I-statements' coded as 'ability and constraints'

In both interviews, Trainee 1 made fewer 'I-statements' coded as 'ability and constraints' than 'I-statements' coded as 'cognitive' and 'state and action'. The' ability and constraints' 'I-statements' were identified by the presence of words including 'can', 'able' and 'have to' and 'cannot' and 'have not'. Trainee 1 was aware that she was expected to observe other teachers as part of her placement tasks; "*I have got to do it" (CS1, T1, I1, 409).* This was coded as a constraint because the trainee appeared to feel uncertain about observing other teachers; *"I didn't want to force myself upon them" (CS1, T1, I1, 347).*

Trainee 1 felt that she was not able to assess the learning of science for the whole class: "*I can't do that with the whole class" (CS1, T1, I1, 382).* She added that she found assessment of science "*very hard compared to other subjects" (CS1, T1, I1, 321).* In her Interview One, Trainee 1 reported four times that she felt 'daunted' about the assessment of childrens' learning in science. Trainee 1 remained concerned about science being a 'daunting' subject to access children's learning: "*erhm, I think it is trickier to assess. I find it quite a daunting subject to assess" (CS1, T1, I2, 328).*

Trainee 1 identified two reasons why she felt 'daunted' to assess science. Firstly, she felt interpreting children's responses using 'concept cartoons' (Naylor and Keogh, 2000), which

she had been taught in University sessions, was 'difficult' because she had to do it on her own rather than in a group at University.

> *T1* *"Whereas when you go through it on your own you really have to try and look into it more and think "why are they saying that?" and trying to unpick it. It's hard. I have found it quite difficult but yeah, erhm" (CS1, T1, I2, 306-8).*

A second reason Trainee 1 gave for assessment of learning in science being 'difficult' related to her perception that childrens' thinking in science was more obscure and less visible than in mathematics.

> *T1* *"That way. It's tough, umh, whereas maths. It's just, yes, that's right, that's right or if it's wrong, if they have shown their workings then it's, might be clear how their thought processes gone. Whereas in science their thought processes are a bit obscure" (CS1, T1, I2, 358-60).*

6.7.2iv 'I-statements' coded as 'affective'

The analysis of 'affective' 'I-statements' was useful for coding factors which may influence a trainee learning to teach science. Five I-statements were coded as 'affective' in Interview One, one related to 'Trainee 1' and how she felt she wished to learn, "*I want to be pushed*" *(CS1, T1, I1, 287-8).* The other four related to her feelings about science, *"loved science" (CS1, T1, I1, 550).*

6.7.2v 'I-statements' coded as 'achievement'

Three 'I- statements' were coded as' achievement' in respect of data from Interview Two with Trainee 1. Two of these 'I-statements' related to Trainee 1's achievement in terms of her learning to assess children's learning in science and how to use Assessment of Pupil Progress (APP), a national assessment model for assessing children's progress in scientific skills (Qualifications and Curriculum Authority (QCA), 2009).

> *T1* *"I have learnt how to use APP assessment" (CS1, T1, I1, 299).*

One ‘achievement’ ‘I-statement’ related to Trainee 1’s changed feelings about ‘teaching’ Key Stage One. She started the placement feeling ‘scared’ because she had not taught this age group, but she suggested that talking to Science Coordinator 1 had changed this.

T1 *“That’s one thing I’ve learnt, is that it’s not scary and it’s not as free as I thought but although it’s slightly and it is slightly different and it’s yeah” (CS1, T1, I2, 32-2).*

6.8 Tracing ‘I– statements’

Changes in ‘I-statements’ were identified as signals of changes in Trainee 1 feelings, abilities and actions as well her thoughts and achievements. These changes were labelled as ‘tracing’ ‘I-statements’ and were categorised as A and B: Category A referred to the percentage of ‘affective’, ‘ability and constraints’ and ‘state and action’ ‘I-statements’ and Category B referred to the percentage of ‘cognitive’ and ‘achievement’ ‘I-statements’ (Gee, 2014).

The total number of analysed ‘I –statements’ were tabulated as percentages for Category A and B, indicated for Interview One and Two and are shown in Table 6.11.

	Interview One Number of I-Statements Total 87	**Interview One % (rounded up)**	**Interview Two Number of I-statements Total 108**	**Interview Two % (rounded up)**
Category A				
Affective	5	6	0	0
Ability and Constraints	17	20	18	17
State and Action	43	49	35	32
Total Category A	65	75	53	49
Category B				
Cognitive	22	25	50	46
Achievement	0	0	5	5
Total Category B	22	25	55	51
% A compared to B		A is higher than B		B is higher than A

Table 6.11 Case One Categories of ‘I-statements’

There was a change in ‘I-statements’ coded as Category A and B between Interview One and Interview Two such that there was a higher percentage of Category B ‘I-statements’ in the

second interview. There was a shift down from 75% of 'I-statements' coded as 'affective', 'ability and constraints' and 'state and action' to 49% in Interview Two. Category B 'I-statements' more than doubled from 25% to 51% between Interviews One and Two.

Gee's (2014) model was adapted to identify the topic associated with each type of 'I-statement'. For each type, the most frequent topic was identified as shown in Table 6.12.

	Trainee 1 Interview One Most frequent topic	**Trainee 1 Interview Two (27 days later) Most frequent topic**
Category A		
Affective	'Trainee 1'	None
Ability and Constraints	'children'	'assessment' and 'Trainee 1'
State and Action	'teaching'	'Trainee 1'
Category B		
Cognitive	'Science Coordinator 1 practices'	'teaching'
Achievement	None	'assessment'

Table 6.12 Case One Emerging topics and categories of 'I-statements'

In Interview One, the most frequent topic associated with 'ability and constraints' 'I-statements' changed from 'children' to 'assessment' and 'Trainee 1'. There was a shift concerning what she could do or was being constrained to do in terms of different topics. In Category B, there was a change in the topics related to 'cognitive' 'I-statements' from 'Science Coordinator 1' to 'teaching'.

This section has examined 'I-statements' made by Trainee 1. She uttered mostly 'state and action' 'I-statements' in Interview One which was coded as the emerging topic of 'teaching'. In Interview Two, she uttered mostly 'cognitive I-statements' which were coded predominantly as relating to 'teaching'.

6.9 Summary of Chapter Six

This chapter has focused on presenting the findings for Case One from the observed meetings, interviews and diaries. The data on linguistic features identified the different content within talk relating to PCK topics coded as 'planning', 'teaching', 'assessment' and

‘resources’ and Context topics coded as ‘School 1 practices’, ‘Science Coordinator 1 practices’, ‘placement expectations’ and ‘children’. Types of utterances, ‘giving information’, ‘giving information’ and ‘asking questions’, which are spoken by Science Coordinator 1 are associated with topics in different patterns. Science Coordinator 1 uttered more ‘we-statements’ than Trainee 1 and Trainee 1 shifted her balance in the types of ‘I-statements’ spoken. These data are discussed critically in Chapter Eight. In the next chapter, using a similar format, the findings for Case Two are presented.

CHAPTER SEVEN – PRESENTATION OF CASE STUDY TWO RESULTS

7.1 Introduction

This chapter is structured in seven sections and presents findings concerning three linguistic features in talk between Trainee 2 and Science Coordinator 2 to address research question one.

1. What are linguistic features and patterns in 'talk' between a primary school science coordinator and trainee during a teaching practice?

The second section of this chapter presents findings related to 'topics' in sequences of utterances which are coded as 'topic of talk' with particular focus on 'children' and 'planning'. In the third section, data are presented concerning the types of utterances made by Science Coordinator 2 in Case Two Meetings One and Two in respect of 'giving information', 'giving instructions' and 'asking questions' relevant to research question two which addresses linguistic features and the influence of setting, purpose and topic. The fourth section details 'we-statements' spoken by Case Two participants, which is also relevant to research question one. The fifth and sixth sections present findings for 'I-statements' spoken by Trainee 2 in Case Two Interviews One and Two.

7.2 Linguistic Feature One – Topic of talk

Following the same approach used in Chapter Six, I looked for coherence in sequences of utterances to identify topics in sequences of utterances which were reduced into fewer categories. For Case Two, 33 topics were identified in Meeting One and 24 topics in Meeting Two as listed in Table 7.1. During Case Two Meeting One, no topics which were revisited however in Case Two Meeting Two, the topic coded as 'praise' given by the Science Coordinator 2 to Trainee 2 about the science lesson planned for the following day emerged four times. 'Praise' indicated Science Coordinator 2 giving positive feedback and is addressed further in section 7.2.2.

For Case Two, the topics in the sequences of utterances were coded using content analysis. Ten topics emerged and are reported in Table 7.1:

- 'planning',
- 'teaching'
- 'resources'
- 'assessment'
- 'School 2 practices'
- 'children'
- 'Science Coordinator 2 practices'
- 'feedback and judgement about Trainee 2'
- 'research related'
- 'Trainee 2'

Emerging topics in Case Two	topic of talk in sequences of utterances	Frequency of topic occurring In Meeting One	Frequency of topic occurring in Meeting Two
Planning – talk related to before teaching has occurred	Description of planned science lesson –use of drama, build circuits Suggestion on using outside space Suggestion on taking photographs Suggestion to use photo and diagrams and annotations Group or pairing children One science lesson being taught	0	6
Teaching – talk related to teaching after it has occurred	Recall of 2 observed science lessons Describing how to organise class groups Description of first science lesson observed Variables – types and links to second lesson observed Description of observed skills lesson Description of history lesson taught before meeting using debate	5	1
Resources – (talk related to before, during and after teaching has occurred)	Description of experiment and equipment for other class Suggestion on using a book and its film Justification for paired work – equipment availability Suggestion on symbols in books and resource cards	1	3

Table 7.1 – Case Two Emerging topics and frequency

Emerging topics in Case Two	topic of talk in sequences of utterances	Frequency of topic occurring In Meeting One	Frequency of topic occurring in Meeting Two
Assessment	No assessment of children in observed lessons Ideas to assess children in another class taught by science coordinator Use of tick sheet as assessment tool Assessment - use of focus group not whole class	4	0
School 2 Practices	Recalled talk earlier in day about eco-club Work needed to run eco-club Description of eco-club activities Parking issues around school	0	4
Children	Matching children in groups – particularly child A Observation of good moments – 'light' seen with child A Description of 'er' sentences by child A Responses of child A in observed lesson Educational Psychologists involvement with child A Special Educational Needs of child A Recall of prior 'light' moment with child A Child B as leader of group Description of child C working with child A Description of behaviour of child D when younger Description of child D – home life Recall talk about children B and their needs Time of year leads to anxiety – particular child E Description of child F behaviour when younger and home life Reasons for pairing particular children B and G Description of sporty class – particularly child H	14	2
Science Coordinator 2 practices	Use of lesson with younger children Expectations of class and year groups Apologies from science coordinator for leaving maths lessons Feedback requested by science coordinator about her level of support Prior experiences of science coordinator in her teacher training course Being able to ask questions to science coordinator Explanation about lack of meetings Description of course attended by science coordinator on using drama Description of science coordinators' after school clubs Planning to talk after science lesson taught	6	4

Table 7.1 Contd. Case Two Emerging topics and frequency

Emerging topics in Case Two	topic of talk in sequences of utterances	Frequency of topic occurring In Meeting One	Frequency of topic occurring in Meeting Two
Feedback and Judgement made by Science Coordinator 2 about Trainee 2	Praise of lesson plan for science lesson tomorrow Praise on planned lesson Praise about lesson Praise of lesson	0	4
Research related	Time and location of talk	1	0
Trainee 2	Expectations by trainee of learning from observing teachers Variations in ITT student needs for learning	2	0
Totals	Total number of topics in meetings	33	24

Table 7.1 Contd. Case Two Emerging topics and frequency

In Case Two Meeting One, the most commonly occurring topic of talk was 'children' however there were only two references to 'children' in Case Two Meeting Two. In Case Two Meeting Two, the most commonly occurring topic was 'planning' however there was no reference to 'planning' in Case Two Meeting One. The following sections consider these two commonly occurring topics in Case Two: 'children' and 'planning'.

7.2.1 Topic of talk related to 'children'

Case Two Meeting One took place on the Thursday afternoon of the third week when data were collected for Case 2. Fourteen of the thirty three topics discussed during the twenty minutes were coded as related to 'children'. The meeting began with Science Coordinator 2 reminding Trainee 2 about how they had placed children into groups for one of the two science lessons taught by Science Coordinator 2 and observed by Trainee 2 in week two of her placement. Science Coordinator 2 indicated that the process had involved 'sorting' children by ability and behaviours.

SC2 *"Yeah, but you've picked it up, so how did we start? Do you remember how we started?*

T2 *Erh, did we put all the higher ability children out first? Or the backwards?*

SC2 *Yeah and then the ones*

T2 *Then we had a separate pile for the ones we had to keep separate, and then,*

SC2 *So we, we didn't have all of the higher ability in one group, did we? We spread those, so that everyone had a leader, yeah, and then the difficult one were all spread out and then the ones that worked very well with anybody were spread out and by the end, we ended up with six really good groups" (CS2, M1, 29-35).*

Science Coordinator 2 and Trainee 2 continued to talk about specific children in terms of how they worked and who they worked with in the groups and their behaviours as younger children. The children are represented as A, B, C and D.

SC2 *"And because she* [child A] *is working with C who is our very bright lad, umh, he, they like her, she is a really popular girl*

T *Mmhm*

SC2 *And particularly amongst the boys as well, they all worked. The only leader they didn't work was B*

T2 *Yeah, partially because D was very defensive of A as well I noticed, usually*

SC2 *He is*

T2 *Whenever, whenever, is, if anyone ever slightly rude to her, he tells, he does tell them to stop, which is always nice*

SC2 *Yeah, no, he's, he got a sister*

T2 *Really*

SC2 *and I am just wondering*

T2 *That makes so, no, that makes so much sense*

SC2 *And he was very different when, back in year, sort of, four, he just cruised. He was very quiet and didn't take part in the lessons, umh, not switched on. Then I got him in year 5 and I really upped the level and, umh, he cried, quite a lot" (CS2, M1, 138-154).*

In Case Two Meeting Two, Trainee 2 referred to two 'children', B and G, when she made a decision on which children she would need to pair together because of the lack of equipment for the 'Circuits' lesson she planned to teach the following day. She based her

decision on the children's behaviours in a mathematics lesson which she had taught during the placement.

T2 *"Because I doubt if I'll be able to give every child the amount to make parallel*
SC2 *No*
T2 *circuits. I thought maybe in pairs would work better and then, maybe, I was thinking maybe putting B in with G because they work together really well in maths lessons, so I was thinking of*
SC2 *Yeah*
T2 *Pairing her*
SC2 *Yeah*
T2 *And G doesn't mind it" (CS2, M2, 96-102).*

7.2.2 Topic of talk related to 'planning'

Trainee 2 planned to teach one science lesson, 'Circuits', during her placement which was taught on the Wednesday afternoon of the final week. The lesson plan had been discussed with Science Coordinator 2 on the Tuesday morning, however, this meeting was not observed.

SC1 *"so we've had, umh, one brief chat because of course, umh, Thursday, I wasn't there and Friday I wasn't there and I wasn't there yesterday. So I am sorry. Our chats have been minimum but we did chat this morning, didn't we?" (CS2, M2, SC1, 29-31).*

In the diary submitted by Trainee 2, she recalled there was a 10 minute talk about '*an impending science lesson'* (CS2, T2, Diary) but she did not recall the date, time or location.

On that Tuesday afternoon, during Case Two Meeting Two, Trainee 2 described the content of the 'Circuits' lesson which included opportunities for children to build series and parallel circuits using wires and bulbs and to stand up and pass around a tennis ball to represent a flow of energy. There was no reference to a lesson plan during Case Two Meeting Two.

T2 *"so I thought we would stand them up and we would make their own circuit, then pass a tennis ball round to represent the electrons, then every time they get the electron they have to jump up and down to represent the energy" (CS2, M2, T2, 40-2).*

Science Coordinator 2 gave feedback to Trainee 1 about the lesson plan four times using the phrases 'good' and 'really good'.

SC2 *"and erh, umh and so I know that you're doing a, erh, sounds like a really good lesson, sounds like a really good lesson that you have got planned and it's got lots of drama in it, which I like. You've got, you know exactly what your success criteria are, which is good, umh, I like the, umh, the way you, you have set it up but I think you should say what you are doing which I thought it was really good" (CS2, M2, SC2, 33-7).*

Science Coordinator 2 also suggested different ways to amend the lesson plan:

SC2 *"…and I was just thinking, you know when you do that, are you going to go outside or in the hall?*

T2 *I was thinking, we could go outside, yeah*

SC2 *Because if you can get them, if you can either get somebody like Tracey* [Teaching Assistant] *or somebody to draw, umh, if you know, if you want them in straight lines or anything, you could 'cos, it's I think the actual court is a bit big, but you could actually get it like you would see a diagram, rather*

T2 *Use tape*

SC2 *Or use tape, but usually just get big chalk and draw it on the table, draw it on the floor*

T2 *Yeah*

SC2 *Or you can get skipping ropes and lay them out" (CS2, M2, 59-66).*

During Case Two Meeting Two, there were no references to 'timing' of the activities when planning the 'Circuits' lesson. However, Science Coordinator 2 reported that Trainee 2 had told her that after the lesson was observed by her mentor, that 'timing' was still an issue. Science Coordinator 2 did not observe Trainee 2 teach the 'Circuits' lesson.

> *SC2* *"And she, she said, what did she say to me? And she, think she felt it was okay, she felt it could have been better. Umh, it could have been better, now why? What did she? I think it was more just a time issue again, I think it's more the time" (CS2, SC2, I2, 416-8).*

This first section of Chapter 7 has presented data concerning the topics discussed in the two observed meetings between Science Coordinator 2 and Trainee 2. Extracts of the topics which most frequently occurred in Case Two: 'planning' and 'children' have also been presented. The next section presents data concerning the second linguistic feature of this study.

7.3 Linguistic Feature Two - Utterances of Science Coordinator 2

This section summarises findings from manually coded utterances made by Science Coordinator 2 to Trainee 2 during Meeting One and Meeting Two. Utterances were coded as 'giving information', 'giving instructions' and 'asking questions'. A higher number of utterances were coded as Science Coordinator 2 'giving information' in order to 'transfer knowledge' from Science Coordinator 2 to Trainee 2 (Blom *et al*., 2007) (Table 7.2).

Type of utterance by Science Coordinator 2	**Meeting One**	**Meeting Two**	**Total**
Giving information	26	36	62
Giving instructions (directives)	3	9	12
Questions	24	10	34
Total	53	55	108

Table 7.2 – Case Two Types of utterances and frequency

In Case Two Meeting One, fewer utterances were coded as 'giving instructions' (n=3) compared to a similar number of 'giving information' (n=26) and 'asking questions' (n=24).

In Case Two Meeting Two, similar numbers of utterances were identified as 'giving instructions' (n=9) and 'asking questions' (n=10) with a higher number coded as ' giving information' (n=36). Data for these three types of Science Coordinator 2 'giving information' as utterances are presented in the next three sections.

7.3.1 Utterances coded as 'giving Information'

26 utterances made by Science Coordinator 2 were coded manually from the Case Two Meeting One transcript as 'giving information' (Holmes, 2001). 36 utterances from the Case Two Meeting Two transcript were similarly coded. The 'giving information' utterances were coded using the emerging topics in section 7.2: 'planning', 'teaching', 'resources', 'School 2 practices', 'placement expectations', 'children', 'Science Coordinator 2 practices', 'feedback and judgement about Trainee 2' and 'research related' and shown in Table 7.3.

Giving information utterances and topics	**Meeting One**	**Meeting Two**	**Total**
Giving information about **planning**	2	0	2
Giving information about **teaching**	1	0	1
Giving information about **resources**	0	2	2
Giving information about **School 2 practices**	1	15	16
Giving information about **placement expectations**	0	1	1
Giving information about **children**	9	2	11
Giving information about **Science Coordinator 2 practices**	12	7	19
Giving information to give **feedback and judgement about Trainee 2**	1	8	9
Giving information which was **research related**	0	1	1

Table 7.3 – Case Two Utterances coded as 'giving Information'

In Case Two Meeting Two, most of Science Coordinator 2's 'giving information' utterances related to 'Science Coordinator 2 practices' and in Case Two Meeting Two to 'School 2 practices'. In terms of the total utterances coded as 'giving information', the third most common topic concerned 'children'. Data for these three types of 'giving information' utterances are presented in the sections that follow.

7.3.1i 'Giving Information' - Science Coordinator 2 Practices

Science Coordinator 2 provided Trainee 2 with information about her use of paper during teaching, setting high expectations, completing the Statutory Assessment Tests (SATs) (DfE, 2014), "*I have done all our SATs" (CS2, M2, SC2, 135)* and her training to be a teacher.

Science Coordinator 2 informed Trainee 2 of her use of different types of paper to encourage children to talk in a group and think, for example:

> *SC2* *"And so, how I did it in there, they all had sugar paper and in a group and they had to, in a very similar way, they had to visualise what this table was actually showing so they drew a picture of the ball dropping and bouncing back and then they had to think" (CS2, M2, SC2, 201-3).*

Science Coordinator 2 informed Trainee 2 that she set high expectations and taught science ideas which were beyond the age group of the children to ensure she did not 'stunt their own development'.

> *SC2* *"I think it shows, if you, but I've done that with everything that I do, I don't, if you just, because you've got, that, you know that high ability level, if you don't go that little bit further. It, it sort of stunts their own development, doesn't it?" (CS2, M2, SC2, 74-6).*

Science Coordinator 2 provided Trainee 2 with information on how she had trained to be a teacher and the impact that she felt this had on how she wished to work with Trainee 2 in terms of enabling her to ask any questions:

> *SC2* *"Mmhm, I think it is just important from my point of view, I have never done this*
>
> *T2* *Mmhm*
>
> *SC2* *Okay, and the way I got into teaching was completely different to how you are doing it*

T2 *Mmhm*

SC2 *I was thrown in at the deep end, I did, umh, you know, I, oh what's it called again?, what did I say it was called?*

I A PGCE?

SC2 *no not, teacher training*

I Teacher training

SC2 *Graduate programme*

I GTP yes

SC2 *And it was sort of very, very different to, to you know, how you are doing it. So I, I always think, you know to me there is nothing worse than being somewhere and not actually knowing what's going on*

T2 *Oh, never felt that here, no*

SC2 *But that is absolutely dreadful and to me it was absolutely awful to think that you couldn't ask a question because you might think you, I thought it was stupid, cos, I would never think that, if it was a question, it was not stupid, you know, I mean, you wouldn't say that to a child, would you?*

T2 *No, definitely not*

SC2 *No, you wouldn't say it but and from that I learn as much as you do*

T2 *Mmhm*

SC2 *and I am finding it a learning curve" (CS2, M1, 340-62).*

7.3.1ii 'Giving Information' - School 2 Practices

Science Coordinator 2 provided information about the school's practices in terms of: use of whiteboards, school clubs and parking issues. There was one utterance about 'School 2 practices' in Case Two Meeting One. Science Coordinator 2 informed Trainee 2 that it was "*perfectly okay to photocopy the whiteboard*" (CS2, M2, 257), which were small laminated boards, in order to record children's responses to questions. In Case Two Meeting Two, Science Coordinator 2 informed Trainee 2 about the school clubs; gardening and eco-club.

SC2 "*we've got a gardening club but we don't have a science club*" *(CS2, M2, 160).*

Science Coordinator 2 provided further information which explained why there was no science club:

SC2 *"and the reason we don't have a science club other than myself there would be no one that would run it, erh. I'm part time for starters and because I am science coordinator and language coordinator. I haven't got the time, you know. I do the running club on one evening and the other two evenings. I, you know, by the time I am out of here normally I'm usually the last one to leave so I haven't got time for that" (CS2, M2, 161-5).*

Science Coordinator 2 provided information to Trainee 2 about an eco-club which was part of the school focus on sustainability. The eco-club was a lunch time club for children and it covered a range of topic including recycling and environmental awareness.

SC2 *"things like, umh, paper recycling, erh" (CS2, M2, SC2, 170).*

SC2 *"Hedgehogs, wood, erhm, and then the composting and then it involves, umh, electricity usage and they have, they go into the stock room there and they know where the cab, you know, the meter is, umh" (CS2, M2, SC2, 172-4).*

Science Coordinator 2 also provided information to Trainee 2 about car parking issues around the school, "*It's awful, it is awful" (CS2, M2 SC2, 190).*

7.3.1iii 'Giving Information' - Children

More utterances were coded as 'giving information' about 'children' in Case Two Meeting One than Meeting Two. Six children were referred to during Case Two Meeting One and three children referred to in Case Two Meeting Two. The information provided about children, represented by A and D, included details about their medical needs and family lives.

SC2 *"The very first time I came across A in year three, I went into that class and I thought, oh my goodness, A was off the ceiling. That was before A had any*

medication, and there were so many we have got about three in there, head bangers and all sorts, you don't see that anymore" (CS2, M1, SC2, 120-2).

SC2 *"D used to always talk about zombies, death. D watches the most unsuitable stuff at home, erh, very curious home life, umh, I think the mother is probably agoraphobic or has those kinda of tendencies. It's weird, weird, weird" (CS2, M1, SC2, 436-8).*

7.3.2 Utterances coded as 'giving instructions'

Utterances spoken by Science Coordinator 2 in Case Two Meeting One and Two were coded as 'giving instructions' through the identification of verbs. Table 7.4 overleaf presents the data.

Verb used in instruction	**Number of occurrences in Meeting One**	**Number of occurrences in Meeting Two**	**Utterance 'You 'refers to Trainee 2.**
You might	1	0	*"You might just have a focus group" (CS2, M1, SC2, 281).*
You could	1	0	*"You could just have somebody go around and quickly do that kinda of tick sheet" (CS2, M1, SC2, 262).*
I think you should	0	1	*"but I think you should say what you are doing which I thought it was really good" (CS2, M2, SC2, 36-7).*
If you take	0	2	*"if you take photographs" (CS2, M2, SC2, 69).* *if you take your ipad out there" (CS2, M2, SC2, 71).*
If you can	0	3	*"If you can get them"* [to go outside] *(CS2, M2, SC2, 60).* *"if you can take photographs, it will be really good" (CS2, M2, SC2, 71).* *"if you can either get somebody like Mrs Brown or somebody to draw"(CS2, M2, SC2, 60).*
If you have	0	1	*"if you have a look in the electricity box there are some laminated cards there" (CS2, M2, SC2, 105-6).*
You can	0	1	*"Or you can get skipping ropes and lay them out" (CS2, M2, SC2, 66).*
Use	0	1	*"Or use tape, but usually just get big chalk and draw it on the table, draw it on the floor" (CS2, M2, SC2, 64).*

Table 7.4 – Case Two Utterances coded as 'giving Instructions'

Each 'giving instruction' utterance was coded against topics identified in 7.2: 'assessment' (33%), 'resources' (42%) and 'planning' (25%). For example, the two 'you can' instructions were coded as 'resources' and 'if you' instructions coded as 'assessment', 'resources' and 'planning' shown by 'A', 'R' and 'P' respectively below:

SC2 "if you take photographs" (CS2, M2, SC2, 69). A

SC2 "if you take your ipad out there" (CS2, M2, SC2, 71). R

SC2 "If you can get them" [to go outside] *(CS2, M2, SC2, 60). P*

SC2 "if you can take photographs, it will be really good (CS2, M2, SC2, 71). R

SC2 "if you can either get somebody like Mrs Brown or somebody to draw"(CS2, M2, SC2, 60). P

SC2 "if you have a look in the electricity box there are some laminated cards there" (CS2, M2, SC2, 105-6). R

Science Coordinator 2 directed Trainee 2 to assess children by asking someone else to go around the class using a tick sheet and to consider focusing only on a group of children rather than the whole class:

SC2 "you might just have a focus group" (CS2, M1, SC2, 281-2).

SC2 "You could just have somebody go around and quickly do that kinda of tick sheet" (CS2, M1, SC1, 262).

No directives were given by Science Coordinator 2 to Trainee 2 that included the use of 'we' to suggest actions to be taken together.

7.3.3 Utterances coded as 'asking questions'

Utterances made by Science Coordinator 2 in Case Two Meeting One and Two were coded as questions. The questions were further coded by grouping similar types of questions (Nordquist, 2017a, 2017b) and are listed in Table 7.5 overleaf.

Type of Question	Question Stem	Meeting One	Meeting Two	Total (% of the total)
		24	10	34
Wh-questions What	What is..? What does that mean? What did they..? What do you think ? What did you do? What did you think?	1 2 0 1 0 1	0 0 1 0 1 0	Wh-questions 14
Wh-questions How	How long..? How do you think? How did we ? How would you ? How would we ..? How do you ? How did your	1 1 1 1 1 1 0	0 0 0 0 0 0 1	
Yes –no	Is it..? Are you ..? Have you ..? Did you ? Did we ? Do you remember..? Can you remember..?	0 0 0 1 2 1 1	2 3 2 0 0 0 0	Yes- no 12
Tag questions – negative tag	Didn't they ? Didn't you ? Didn't we ?	2 1 2	0 0 0	5
Tag questions – positive tag	Did we ?	2	0	2
Indirect question	I don't know how you feel?, did you feel?	1	0	Indirect 1

Table 7.5 – Case Two Utterances coded as 'asking questions'

Science Coordinator 2 used 'we' in four tag questions (Coates, 1996), 'didn't' we?' and 'did we?' and two 'Wh-questions', 'how did we?' and 'how do we?'.

Each question was considered in terms of its content in relation to emerging topics in 7.2 or new ones. For example, 'how' questions were coded as related to 'children' and 'assessment' as shown by 'C' and 'A' respectively below:

SC2 "How long have you known the children?" (CS2, M1, SC2, 22). C

SC2 "How would we test that?" (CS2, M1, SC2, 222). A

The ‘questions’ were coded in relation to the following topics with the numbers indicating their frequency: ‘planning’ (n=4), ‘teaching science’ (n=7), ‘assessment’ (n=7), ‘School 2 practices’ (n=1), ‘children’ (n=1), ‘Science Coordinator 2 practices’ (n=4), ‘placement expectations’ (n=2), ‘research related’ (n=1). Three new topics emerged in these data: ‘subject knowledge’ (n=1), ‘teaching history’ (n=5) and ‘mentoring’ (n=1). The latter reflected Science Coordinator 2 making explicit how she expected Trainee 2 to learn from observing her teach.

SC2 “What is it when you have been observing me?” (CS2, M1, SC2, 2).

Science Coordinator 2 asked Trainee 2 how she thought Science Coordinator 2 could assess the learning of science variables by children in another class taught by her.

SC2 “well, how do you think I could then assess whether they have actually understood what all these variables are?” (CS2, M1, SC2, 224-5).

Trainee 2 suggested four assessment strategies – use lolly pop sticks, check books, check tables, talk - before Science Coordinator 2 told her what she would do – ‘put a question on the board’:

T2 “So that would be, got lolly pop sticks that we do in our class, check their books as well, check they have actually put the made the table right, put left and right

SC2 Mmhm

T2 Umh, talk as well

SC2 Yeah, what, what I said. See what you think, but I said I would do. I have just put the question on the board

T2 Mmhm

SC2 Okay, and from that question, I am just going to give them two minutes to write on their whiteboard, what they think the variables are” (CS2, M1, 229-37).

This section has considered types of utterances made by Science Coordinator 2 to Trainee 2. More of these utterances were coded as 'giving information' than 'giving instructions' or 'asking questions'. The information given in these utterances related mostly to the emerging topics of 'Science Coordinator 2 practices' and 'School 2 practices'. The next section presents data on the third linguistic feature that emerged in this study, 'we-statements'; it follows the same rationale and process as detailed in section 6.6.

7.4 Linguistic Feature Three – 'we-statements' spoken by participants

'We-statements' are a linguistic feature which may indicate the existence of a connection between people (Gergen, 2009). 'We-statements' were identified in the transcripts from the two interviews with both Case Two participants and two observed meetings. 43 'we-statements' emerged in Case Two data (Table 7.6).

Speaker	Interview One	Meeting One	Meeting Two	Interview Two
Trainee 2	10	5	0	3
Science Coordinator 2	3	14	3	4

Table 7.6– Case Two 'We-statements'

The use of 'we' did not always lead to a 'we-statement' being recorded; for example, when 'we' referred to other people or the school:

SC2 *"You can, oh, you can, and last time, we had someone actually being observing her and that was during a science lesson" (CS2, M1, SC2, 100-1).*

7.4.1 Types of 'we-statements'

'We-statements' were coded following the same classification process outlined in Chapter Six. Table 7.7 shows the number of 'we – statements' uttered by both participants during the two meetings and interviews:

Meeting and Interview in Case Two	Types of 'we-statements' (Gee, 2014)					
	Cognitive	**Affective**	**State and Action**	**Ability and Constraints**	**Achievement**	**Total**
Interview -One Trainee 2	1	0	9	0	0	10
Interview -One Science Coordinator 2	0	0	3	0	0	3
Meeting One – Trainee 2	0	0	4	1	0	5
Meeting One – Science Coordinator 2	0	0	14	0	0	14
Meeting Two – Trainee 2	0	0	0	0	0	0
Meeting Two – Science Coordinator 2	0	0	3	0	0	3
Interview Two - Trainee 2	0	0	3	0	0	3
Interview Two - Science Coordinator 2	0	0	4	0	0	4

Table 7.7– Case Two Types of 'we-statements'

Science Coordinator 2 uttered more 'we-statements' than Trainee 2. Science Coordinator 2 uttered one type of 'we-statements', coded as 'state and action'.

SC2 *"so we, we didn't have all of the higher ability in one group, did we ? we spread those, so that everyone had a leader" (CS2, M1, SC2, 32-3).*

SC2 *"We put out the various pieces of equipment" (CS2, SC2, I1, 384).*

Trainee 2 uttered 'state and action' and 'cognitive' 'we-statements, for example:

T2 *"So we have talked about why science is important and we need more engineers and things like that" (CS2, T2, I1, 265-6).*

T2 *"We talked about it briefly but like just talking about like more obscure ways of assessing. But I don't think we went into detail about how we can actually do that" (CS2, T2, I1, 227-9).*

7.4.2 'We-statements' and topics

This section presents the data coded against the emerging topics Identified in section 7.2: 'planning', 'teaching', 'resources', 'School 2 practices', 'placement expectations', 'children', 'Science Coordinator 2 practices', 'feedback and judgement about Trainee 2' and 'research related'. In the table, 'Int.' and 'M' are used to represent 'Interview' and 'Meeting' and 'T2' and 'SC2' refer to 'Trainee 2' and 'Science Coordinator 2' respectively.

Emerging topics	Int.1 T2	Int. 1 SC2	M1 T1	M1 SC2	M2 T1	M2 SC2	Int.2 T2	Int. 2 SC2	Total
Teaching	0	3	0	5	0	0	0	0	8
Assessment	5	0	0	3	0	0	1	2	11
Placement expectations	1	0	0	0	0	0	0	0	1
Children	1	0	4	4	0	0	1	0	10
Science Coordinator 2 practices	0	0	0	1	0	0	0	0	1
Feedback and Judgement about Trainee 2	0	0	0	1	0	0	0	0	1
Research related	0	0	0	0	0	3	0	1	4
Science values	3	0	0	0	0	0	0	0	3
Subject knowledge	0	0	1	0	0	0	1	1	3
Total	10	3	5	14	0	3	3	4	42

Table 7.8 – Case Two Emerging topics and 'we-statements'

The 42 Case Two 'we- statements' were coded against six of the emerging topics identified in section 7.2, although no 'we-statements' were coded against 'planning', 'resources', 'Trainee 2' and 'School 2 practices'. Three new topics emerged in these data: 'placement expectations', 'science values' and 'subject knowledge'.

7.4.3 Types of 'we-statements' and topics

The topics of the 42 'we- statements' were then coded against five types of 'we-statements' (Gee, 2014). This was considered useful in considering how participants' thinking, feeling, doing, achievements and abilities and constraints are associated with each emerging topic (Table 7.9).

	Types of 'we-statements' for Case Two					
Emerging topics	**Cognitive**	**Affective**	**State and Action**	**Ability and Constraints**	**Achievement**	**Total**
Teaching	0	0	8	0	0	8
Assessment	1	0	10	0	0	11
Placement expectations	0	0	1	0	0	1
Children	0	0	9	1	0	10
Science Coordinator 2 practices	0	0	1	0	0	1
Feedback and Judgment about Trainee 2	0	0	1	0	0	1
Research related	0	0	4	0	0	4
Science values	0	0	3	0	0	3
Subject knowledge	0	0	3	0	0	3
Total	1	0	40	1	0	42

Table 7.9 – Case Two Emerging topics and types of 'we-statements'

In these data, the most frequent topic of talk associated with types of statements was 'assessment'. Trainee 2 reported that Science Coordinator 2 had talked to her in the first week of the placement about 'obscure' ways of assessing children's learning and had given her sheets on what children in different year groups should be expected to know about electricity.

T2 *"Umh, yeah. We talked about it briefly but like just talking about like more obscure ways of assessing. But I don't think we went into detail about how we can actually do that. But she did give me some really good, umh ,you know, those sheets of, like, how, what a year five should be saying about electricity, what a year one should be saying about electricity.*

I Yeah

T2 *so she give me like quite a lot of resources for assessing*" (CS2, T2, I1, 227-33).

During Meeting One, Science Coordinator 2 discussed assessing children during the 'Resistance' lesson she had taught in the first week of the placement, observed by Trainee 2.

SC2 *"We didn't assess them* [children in the class] *sort of verbally. We spoke about it* [assessment]. *Did we give it a numerical figure? We didn't do anything like that, did we?*

T2 *No, no, no way to do that really*

SC2 *No, no, I mean, what, we, didn't, umh, the way I am, I'm, well, I say. I have done it in year 5. I am actually also doing it. I have done it in year 4 as well, yep, just starting on a lower level" (CS2, M1, 191-5).*

In the final week of her placement, Trainee 2 reported that she would like to know more strategies for how to assess learning in science.

T2 *"And like more assessment strategies as well*

I okay

T2 *And more how to assess in science. I think I definitely need to get a better grounding on*

I What would you like to find out more?

T2 *Just other strategies, I guess like, how other methods rather than going through their books, like, we've discussed talk and things like that but are there other ways to*

I yeah

T2 *assess it, like things I just don't know yet. I am only a year two student" (CS2, T2, I2, 529- 536).*

In this section, data for 'we-statements' have been presented. Science Coordinator 2 used more 'we-statements' than Trainee 2. Science Coordinator 2 spoke only one type of 'we-statements' which was coded as 'state and action' (Gee, 2014). Trainee 2 spoke two types of 'we-statements' coded as 'state and action' and 'ability and constraints'. In the next section, data for the 'I-statements' spoken by Trainee 2 are presented.

7.5 Linguistic Feature Four - 'I statements' uttered by Trainee 2.

These data are presented following the same process adopted in section 6.7. I begin by presenting the data on the number of 'I-statements' identified in the transcripts from the two interviews with Trainee 2.

7.5.1 Types of 'I-statements'

Transcripts from Case Two Interviews One and Two were read to locate and code 'I – statements' (Gee, 2014). For Case Two, 125 'I-statements' emerged from Interview One and 105 from Interview Two. The frequency and percentage of each type of 'I-statement' were recorded in Table 7.10.

Type of 'I-statement'	Number of occurrences in Interview One	% of occurrence in Interview One	Number of occurrences in Interview Two	% of occurrence in Interview Two
Cognitive	40	32	38	36
State and Action	37	29	34	32
Ability and Constraints	27	22	22	21
Affective	6	5	3	3
Achievement	15	12	8	8
Total	125	100	105	100

Table 7.10 Case Two Types of 'I-statements'

There are more 'cognitive' 'I-statements' uttered by Trainee 2 in both interviews than other types of 'I-statements'. Trainee 2 uttered all types of 'I-statements' in both interviews. Trainee 2's least frequently type of 'I-statement' was 'affective'. In the following sections of data for each type of 'I-statement' are presented.

7.5.2 Types of 'I-statements' and topics

Trainee 2's 'I-statements' were coded against eight of the ten emerging topics in 7.2 - 'planning', 'teaching', 'resources', 'School 2 practices', 'placement expectations', 'children', 'Science Coordinator 2 practices', 'feedback and judgement about Trainee 2' and 'research related' - and five new topics emerged in these data: 'placement expectations', 'subject knowledge', 'University expectations', 'mentoring' and 'value of science' as shown in Table 7.11.

I – statement coded to topic	Cognitive I-statements		State and Action I-statements		Ability and Constraints I-statements		Achievement I-statements		Affective I-statements	
	Int.1	Int. 2	Int. 1	Int. 2	Int. 1	Int. 2	Int. 1	Int. 2	Int. 1	Int. 2
Teaching	3	5	5	4	2	0	3	2	2	1
Resources	0	0	0	1	0	0	3	1	2	0
Assessment	1	8	0	11	4	3	3	0	1	0
School 2 practices	4	4	0	0	2	6	0	0	0	0
Placement expectations	4	0	0	0	0	0	0	0	0	0
Children	0	4	0	0	0	0	0	1	0	0
Science Coordinator 2 practices	7	9	9	3	5	4	4	0	0	1
Research related	0	0	0	2	0	0	0	0	0	1
Subject knowledge	0	4	0	1	0	0	1	3	0	0
University expectations	6	2	3	1	1	0	0	0	1	0
Trainee 2	11	1	19	11	11	9	0	1	0	0
Mentoring	0	0	1	0	2	0	0	0	0	0
Values of science	4	1	0	0	0	0	1	0	0	0
Total	40	38	37	34	27	22	15	8	6	3

Table 7.11 – Case Two Emerging topics and types of 'I-statements'

In the following sections examples of data for each type of 'I-statements' and associated topics are presented.

7.5.2i 'I-statements' coded as 'state and action'

The most frequently occurring topic coded for 'state and action' 'I-statements' was 'Trainee 2'. These include how Trainee 2 preferred to learn, her ability in explaining an analogy and her concern over children's learning after her teaching of the 'Circuits' lesson.

In 'I-statements' coded as 'state and action' Trainee 2 described how she preferred to learn.

T2 *"I'm not much of a kinetic learner" (CS2, T2, I1, 458).*

T2 *"I'm better off watching. I'm thinking…because if you're doing it, you're not thinking about as a teacher, if that makes sense" (CS2, T2, I1, 460-1).*

Using 'I-am' statements Trainee 2 reflected on her ability to explain the use of a motorway analogy for electrical resistance: "*I am very bad at speaking*" *(CS2, T2, I1, 140)* and "*I'm explaining it really badly" (CS2, T2, I1, 149).* 'I-was' was used by Trainee 2 when she reflected on the lack of evidence of children's learning following a lesson she had taught them.

T2 *"I was really concerned because in their books it looked like they'd barely done anything" (CS2, T2, I2, 243-4).*

7.5.2ii 'I-statements' coded as 'cognitive'

Verbs coded as 'cognitive' referred to thinking and knowing. These included 'I suppose', 'I guess' and 'I realised' and 'I knew' and 'I never knew'. The most frequent topics for cognitive 'I-statements were coded as 'Science Coordinator 2' and 'Trainee 2'. Trainee 2 reflected on her learning to become a teacher since the start of the placement:

T2 *"I think it's because I read the notes so much" (CS2, T2, I1, 434).*

T2 *"I don't think I should have been as clueless as then because I do know things" (CS2, T2, I1, 645-6).*

Trainee 2 thought the role of science coordinator in her placement was different from that in other schools because Science Coordinator 2 was a '*part time' (CS2, T2, I2, 497)* member of staff:

T2 *"I think in other schools, and other schools I've been to, it's been a bigger role" (CS2, T2, I2, 506-7).*

Trainee 2 used 'I think' to reflect on her knowledge about 'differentiating' and needing to improve this skill for teaching science.

T2 *"I think I need to probably work on my differentiation a little bit more…*

I Okay

T2 *…because it's quite hard once one to differentiate I think.*

I In science?

T2 *Yeah*

I Why?

T2 *because it's not, hasn't got the same like levels that maths and English do. They don't have those" (CS2, T2, I1, 370-8).*

7.5.2iii 'I-statements' coded as 'ability and constraints'

'I-statements' made by Trainee 2 were coded as 'ability and constraints' by identifying the verbs 'can', 'able' and 'have to' and 'cannot' and' have not'. The most frequent topic coded for 'ability and constraints' 'I-statements' was 'Trainee 2'. Trainee 2 felt constrained in her ability to check children's learning during the 'Circuits' lesson because she was ill.

T2 *"like, yesterday I was not feeling ill. I was feeling very ill. I had to sit down because I was feeling really faint" (CS2, T2, I2, 160-1).*

Trainee 2 identified she was able to learn quickly and at the end of placement she recognised that she had initially been constrained by her knowledge of tables but had revised to improve her knowledge of tables used in the recording of data in science.

T2 *"I can pick things up quickly" (CS2, T2, I1, 293).*

T2 *"I had to, I had to definitely revise, umh, modelling tables and, like, where bits of tables go and things" (CS2, T2, I2, 114-5).*

7.5.2iv 'I-statements' coded as 'affective'

Nine out of the 230 'I-statements' were coded as 'affective' with three related to 'teaching science'.

T2 *"I love teaching science.*

I Why? Why do you like teaching science?

T2 Just do, it's my favourite. I think it's important" (CS2, T2, I1, 300-2).

7.5.2v 'I-statements' coded as 'achievement'

Twenty three 'I-statements' were coded as 'achievement' for Trainee 2 with fewer in Interview Two than Interview One. She reflected that had learned 'a lot' about the NC subject 'Electricity' (DfEE, 1999) and teaching 'higher ability' children:

T2 "I have learnt a lot about electricity" (CS2, T2, I1, 286).

T2 "I have learnt to extend higher people because there's a very clever bunch in there" (CS2, T2, I2, 316-7).

7.6 Tracing 'I– statements'.

'I-statements' were categorised as either Category 'A' or 'B' (Gee, 2014) to compare the balance between 'affective', 'ability and constraints' and 'state and action' 'I-statements' with 'cognitive' and 'achievement' 'I-statements'. The total number of analysed 'I – statements' were tabulated as percentages for Category 'A' and 'B' (Table 7.12):

	Interview One Percentage of 'I-statements	**Interview Two Percentage of 'I-statements'**
Category A		
Affective	5	3
Ability and Constraints	22	21
State and Action	30	32
Total Category A	57	56
Category B		
Cognitive	32	36
Achievement	12	8
Total Category B	44	44
A compared to B	A is higher than B	A is higher than B

Table 7.12 – Case Two Categories of 'I-statements'

In both Case Two interviews, a higher percentage of Trainee 2's 'I-statements' were coded as Category A than Category B. The percentage of each Category B was the same in Case Two Interviews One and Two.

The most frequently occurring topics for each type of 'I-statements were coded as Category A and B and shown in Table 7.13.

	Trainee 2 Interview One Most frequent topic	**Trainee 2 Interview Two Most frequent topic**
Category A		
Affective	'teaching' and 'resources'	Single I-statements for 'teaching', 'Science Coordinator 2 practices' and 'research related'
Ability and Constraints	'Trainee 2'	'Trainee 2'
State and Action	'Trainee 2'	'Trainee 2'
Category B		
Cognitive	'Trainee 2'	'Science Coordinator 2 practices'
Achievement	'Science Coordinator 2 practices'	'Subject knowledge'

Table 7.13 – Case Two Emerging topics and categories of 'I-statements'

The most frequently occurring topics coded to different types of 'I-statements' were identified for each Case Two interview. In Case Two Interview Two, 27 days after Case Two Interview One, the most frequent topic for 'state and action' and 'ability and constraints' 'I-statements' remained as 'Trainee 2'. There was a change in the most frequently occurring topic for both types of 'I-statements' in Category B: 'cognitive' 'I-statements' changed from 'Trainee 2' to 'Science Coordinator 2 practices' and 'achievement' 'I-statements' changed from 'Science Coordinator 2 practices' to 'subject knowledge'.

7.7 Summary of Chapter Seven

This chapter has presented the findings from Case Two observed meetings, interviews and diaries. The data on linguistic features identifies the different content within talk in relation to two sets of topics. First, topics coded as 'planning', 'teaching', 'assessment' and 'resources' which relate to PCK. Second, topics coded as 'School 2 practices',' Science Coordinator 2 practices', 'placement expectations' and 'children' which relate to Context in terms of other 'knowledge for teaching', informing the debate on what trainees need to learn to teach science. Three types of utterances - 'giving information', 'giving information'

and ‘asking questions’ - are associated with each topic in different patterns. Science Coordinator 2 uttered more ‘we-statements’ than Trainee 2 and Trainee 2 did not change the balance in her types of ‘I-statements’ although there are some changes in topics.

The following chapter critically discusses the findings presented in Chapters 6 and 7, setting them in the context of relevant studies in the field of teacher education.

CHAPTER EIGHT – DISCUSSION

8.1 Introduction

This chapter consists of seven sections. It discusses critically the findings presented in Chapters Six and Seven with reference to extant literature, in order to consider what the findings may mean in the context of the field of education, specifically teacher education. The second section considers the research questions and the responses to them. The third section discusses research question one in terms of the linguistic features of talk – topic, types of utterances and 'we-statements', before section four considers research question two. I look at the influences of setting, participants, purpose and topic on linguistic features. Section five in this chapter discusses the study research question by considering three influences of talk with a science coordinator on a trainee learning to teach science. Section six concludes this chapter by considering the findings from a socio constructivist perspective.

8.2 Introduction to the responses to the research questions

This chapter critically discusses key findings arising from the study data that are presented in Chapters 6 and 7 and considers how they relate to extant work in the field in order to highlight the contribution to the field made by this study. Following this analysis there is a discussion concerning how 'talk' with a primary science coordinator may influence a trainee learning to teach primary science. This study has, with acknowledged limitations discussed in Chapter Ten, addressed the key research question.

> How may 'talk' with a primary school science coordinator influence a primary teacher trainee learning to teach science?

Firstly, subsidiary research question one was addressed by identifying and analysing three particular linguistic features which presented in two observed meetings between the science coordinators and trainees. In each case: 'topic of talk', 'types of utterances' spoken by science coordinator and 'we-statements' were spoken by participants. The types of utterances spoken by the science coordinators were coded as 'giving information', 'giving

instructions' and 'asking questions. In addition, 'we-statements' (Gergen, 2009) spoken by all participants during two interviews were coded as 'state and action', 'cognitive', 'ability and constraints', 'affective' and 'achievement'.

The second subsidiary research question was addressed by considering four influences on the three linguistic features: setting, participants, purpose and topic (Halliday, 1979; Holmes, 2001). In addition, a fourth linguistic feature was identified and analysed – 'I-statements' (Ticknor, 2010). 'I-statements' spoken by trainees during two interviews were coded as 'state and action', 'cognitive', 'ability and constraints', 'affective' and 'achievement'.

Section 8.3 discusses findings that relate to the first subsidiary research question and Section 8.4 discusses findings that relate to the second subsidiary research question.

8.3 RQ1: Linguistic features and patterns in 'talk' for learning to teach science

This section discusses three linguistic features – (i) topic, (ii) types of utterances and (iii) 'we-statements'. It also discusses (iv) patterns in 'talk' that emerged in data capturing discussions between primary school science coordinators and trainees during two placements.

8.3.1 Topic of talk

Previous research and literature suggest that 'knowledge for teaching' is a debated issue which comprises trainees learning about subject matter, pedagogical content knowledge and contextual knowledge including information about children (Taylor, 2008). Research also illustrates the variance of topics of talk between trainees and mentors (Edwards and Protheroe, 2004; Hudson, 2005; Bradbury, 2010; Crasborn *et al*., 2011). The dyads between participants in this study showed such variance.

In terms of the findings for the first linguistic feature – topic - there were eight common topics of talk identified between science coordinators and trainee teachers during two observed meetings which were coded as PCK – planning, teaching, resources, assessment -

and Context - children, school practices, science coordinator practices and placement expectations (Appleton 2002; Farmery 2004; Nilsson, 2008a). These findings suggest that science coordinators and trainees talk about similar topics to those identified in studies of talk between primary mentors and trainees. However, the balance between PCK and Context differed in each case, a finding that resonated with previous studies which have also found that mentors focus on different aspects of 'knowledge for teaching' (Hudson *et al*., 2009; Crasborn *et al*., 2011).

In this study, talk about PCK in terms of learning to teach science to make it accessible to all children was considered useful by each trainee; this point also reflected extant findings (Gess- Newsome, 1999; Parker, 2004). In both cases, science coordinators talked to trainees about teaching science in terms of linking scientific concepts to children's present experiences; for example, linking Jenner to 'banana medicine' and electrical resistance to motorways. There was a comfortable parallel between these data and the findings of Farmery (2004) and Poulson (2001) that suggest more value was placed on science coordinators sharing their pedagogical content knowledge than their specialist subject matter.

Extant research suggests that talk is likely to include information about Context in terms of children (Wang, 2001). Teachers' Standards (DfE, 2011) require trainees to know about children in order to meet their needs. However there was a difference in the quantity of talk about children and the emphasis placed by each science coordinator on giving information to the trainee about the children's personal home lives and their behaviours in the classroom. Talk about children which focused on them as learners and their needs as learners occured more in Case One than Case Two; however Science Coordinator 2 provided information about relationships between children which Mutton *et al*. (2010) study suggested trainees lacked. This study resonates with others that have found variations in talk which has focused on children compared to PCK (Wang, 2001; Crasborn *et al*., 2011).

Subject matter was not a common topic of talk identified between science coordinators and trainee teachers during two observed meetings. The limited talk about subject matter

supports previous findings that class teachers, who act as mentors, are less likely to talk about science content than teaching strategies (Hudson, 2007; Crasborn *et al*., 2011). This finding was unexpected, given that both science coordinators had a science degree and both trainees were following the science specialism route in their teacher training course which could support talking together about science subject matter. Trainee 2 particularly felt that whilst Science Coordinator 2 had expertise in science subject matter, she hoped she would get more pedagogical expertise from other science coordinators in future placements.

Davies *et al*. (2006) argue that trainees in England need to learn about the national curriculum. However, this study did not identify national curriculum as a topic of talk between trainee and science coordinator although both science coordinators spoke about changes to the national curriculum during interviews. This is in contrast to findings from previous studies which found that mentors talked about the science curriculum (Hudson *et al*., 2009). However, in Case One, talk about the assessment of children's learning in science in the national curriculum was dominated by a target set by the mentor, from an earlier placement. The influence of targets from trainees' prior placements had not been identified in the literature and offers a new aspect for future research.

8.3.2 Types of utterances spoken by science coordinators

The second linguistic feature concerned the analysis of types of utterances spoken by a science coordinator to a trainee during two observed meetings in each case. Extant research argues that experts may use different types of utterances when talking to learners (Blom *et al*., 2007; Crasborn *et al*., 2011). The present study found that both science coordinators spoke more 'information giving' utterances than 'giving instructions' and asking 'questions'. Where 'n' is used to represent the number of utterances coded as asking questions, then the ratio of 'giving information': 'asking questions' differed. In Case One the ratio was 6.8n:n and in Case Two 1.8n:n. Similarly the ratio of 'giving instructions': 'asking questions' differed; Case One 1.4n:n and Case Two 0.3n:n. In this study, trainees experienced different linguistic environments whilst learning to teach science. Such linguistic variations may provide different incentives for trainees with different dispositions on how to learn to teach science (Hagger *et al*., 2008; Illeris, 2009).

Given the requirements within the Teachers' Standards (DfE, 2011), it could be suggested trainees would be given information in a homogenous manner; however, this study found that trainees have different experiences in terms of knowledge which is brought into talk by a science coordinator. Both science coordinators 'brought in' knowledge to their talk with trainees related to all four Context topics - placement expectations, children, school practices, science coordinator practices. These included 'giving information' about children's home life, accessing the website in the school, science clubs and science coordinators' values about learning science. However, in PCK topics - planning, teaching, assessment and resources - there was a different pattern. Science Coordinator 1 brought in no knowledge about the four common topics whilst Science Coordinator 2 uttered 'giving information' utterances for planning, teaching and resources.

Both science coordinators 'gave instructions' to trainees through the use of directives. This study found that there was a difference in terms of the quantity and strength of instructions related to PCK and Context topics which mirrors prior studies (Young *et al*., 2005; Crasborn *et al*., 2011). Science Coordinator 2 uttered no instructions related to Context topics – children, school practices, science coordinator practices, placement expectations. Even though a third of her talk with Trainee 2 was coded as the topic 'children', she uttered no instructions related to 'children'. This finding resonates with Strong and Baron (2004) who found that mentors gave fewer instructions to trainees related to 'children' and more for teaching. Similarly whilst Science Coordinator 1 did utter instructions to Trainee 1 in relation to actions to be taken with reference to children, these were fewer than those coded as 'teaching'.

The strength of instructions uttered by science coordinators differed by the addition of modal verbs. Both science coordinators included 'you' in their 'giving instructions' utterances. However, the addition of modal verbs – for example 'you could' - softened the instructions from Science Coordinator 2 (Cameron, 2001) whereas the addition of 'you need to' and 'you must' strengthened those uttered by Science Coordinator 1 (Strong and Baron, 2004). However, Science Coordinator 1 softened the obligation she placed on Trainee 1 to follow her instructions by the inclusion of her name (Trudgill, 2000).

Both science coordinators 'asked questions'. However, the percentage of questions asked by Science Coordinator 2 was nearly three times as many than Science Coordinator 1 in two meetings even though these were nearly three times shorter in duration. Both science coordinators 'brought in' questions which prompted trainees to explain and make judgements about their actions and thoughts (Hudson, 2005; Sim, 2006; Ghaye, 2011). They both asked trainees 'Wh' questions – what and how – however there were variations in the amount of tag questions – for example 'didn't we?' Science Coordinator 2 spoke nearly double the percentage of this type of question, signalling a higher focus on affective content (Coates, 1996; Trudgill, 2000).

8.3.3 'We-statements' spoken by science coordinators and trainees

'We-statements' are a linguistic feature which may indicate the presence of a relationship between participants (Gergen, 2009; Ticknor and Cavendish, 2015). This study found that there were more 'we- statements' spoken by science coordinators than trainees in both cases; the science coordinators appeared to signify the presence of a relationship with their trainee more than the trainee by their use of 'we-statements'. However, whilst Science Coordinator 1 spoke nearly four times as many 'we- statements' than Science Coordinator 2, Trainee 1 spoke three times fewer than Trainee 2. In each case in this study, there was a difference between the participants' perceptions in each case of the presence of a relationship.

This study contributes new knowledge regarding types of 'we-statements' (Gergen, 2009; Gee, 2014) spoken by a trainee during talk with a science coordinator. Both trainees spoke mostly 'state and action' 'we-statements', both spoke 'cognitive' types of 'we-statements' although Trainee 2 also spoke 'ability and constraints' 'we-statements'. For example, 'state and action' 'we-statements included: Trainee 1, "*we've got a couple in the staffroom*" *(CS1, M1a, T1, 168),* Trainee 2, "*we have talked about why science is important*" *(CS2, T2, I1, 265).* Science Coordinator 1 spoke all five types of 'we-statements' although mostly 'state and action' whereas Science Coordinator 2 uttered only 'we-statements' coded 'state and action'. For example, 'state and action' we-statements included: Science Coordinator 1, *"we*

had two, three minutes conversations" (CS1, M2, SC1, 958), Science Coordinator 2, *"we put out the various pieces of equipment" (CS2, SC2, I2, 384).*

8.3.4 Patterns in linguistic features

This study found patterns in and across three linguistic features analysed. Using numbers in terms of percentages provided a tool for looking for patterns in the content of talk (Bryman, 2012; Gee, 2014). However, the numbers were used in conjunction with the qualitative findings to provide a greater richness to understanding talk. I found using numbers a useful tool to check data in the findings chapters. These data indicate that trainees were learning to teach science in different linguistic environments.

Firstly, this study found a pattern between the types of utterances spoken by a science coordinator and the topics being discussed. In Case Two, all the Context topics were associated with Science Coordinator 2 'asking questions' and 'giving information' but not 'giving instructions'. Trainee 2 was therefore not given any instructions regarding 'school practices', or 'children'. In contrast Trainee 1 was given information, asked questions and given instructions about these two topics.

In Case One, all PCK topics were associated with Science Coordinator 1 'asking questions' or 'giving instructions' or speaking both types of utterances. However, there were no 'giving information' utterances. In contrast, Trainee 2 was given information about 'teaching', 'planning' and 'resources'. Neither science coordinator asked questions about 'resources' which may preclude the opportunity for science coordinators to ask trainees about new or different resources which they know about through their training at University.

Secondly, there were patterns noted in 'we-statements' and associated topics. In both cases the most frequent topic associated with 'we-statements' was 'assessment'. These were spoken by different participants in each case: Science Coordinator 1 and Trainee 2. Talk about assessment in science did not echo with previous studies which found that assessment is not always present in talk between trainees and mentors (Hudson, 2005). In both cases, there were no 'we-statements' associated with talk about 'school practices'; this

topic does not appear to be one that contributes to generating a relationship between trainee and science coordinator.

In Case One, 'we-statements' were coded for each of the four PCK topics. However, one topic which was unique to Case One concerned talk about an External Examiner visit to observe Trainee 1. External Examiners act as external critical friends to university programmes (QAA, 2017). In Meeting One most of the 'we-statements' were related to this topic. The influence of an External Examiner visit to a trainee during placement is an area for future study.

8.4 RQ2: Factors, including the setting, participants, purpose and topic, influencing linguistic features and patterns of 'talk'

As a researcher, my judgements about factors as a theme in this study were influenced through my professional experience, prior roles and the literature. According to Holmes (2001), influences on linguistic features may be considered as (i) setting, (ii) participants, (iii) purpose and (iv) topic.

8.4.1 Influence of setting's value placed on science

Talk may be influenced by physical and social context (Hymes, 1974; Holmes, 2001) and in this study it is relevant to consider these contexts in terms of the setting: a primary school. In this study, both studies were conducted in primary schools for children aged 4-11 years old which were graded as 'good' by Ofsted. There were variations in school size and pupil characteristics: School 1 was larger and School 2 smaller than national average, School 1 had above average and School 2 below average for the number of children who spoke English as an additional language. According to Trainee 2, the school did not prioritise science because it was already 'good' in the school whereas in Case One, science was being prioritised following a period of focus on English and mathematics to ensure children were meeting national standards which exclude focus on science. Trainees' learning to teach science was influenced by the variation in focus placed on science in a school which is similar to extant findings (Appleton and Kindt, 1999).

Both schools taught science once a week in the afternoon; however, in School 2, Science Coordinator 2 also taught separate science days and in addition she did not have her own class. In both schools, trainees had access to the science resource cupboard. However, in School 1 there was also a dedicated science room and additional resources were organised and acquired and given to Trainee 1 by Science Coordinator 1. In contrast, Trainee 2 was informed of resources available in the cupboard but did not access them. This study supports extant studies that availability of resources may influence learning to teach science (Appleton and Kindt, 1999) because of variations in talk about resources and their use.

Hudson (2004) considers that trainees are not always given instructions on how to teach science. This study found similar variations. Talking with trainees about how to teach science varied in terms of a type of utterance - 'giving instructions' – spoken by a science coordinator to a trainee. In Case One, Science Coordinator 1 gave strong instructions on how Trainee 1 should teach science to children aged 6 years old - 'send them out and bring them back' and 'bring it back up to everyday'- to reflect two actions of teaching the children together as a class and then send them out to do group work and simultaneously connect abstract science ideas with concrete experiences of children. She mirrored Crasborn *et al*. (2011) classification of mentors who gave 'direct advice' to trainees on how to teach (p.322). In contrast, there were no 'instructions' given to Trainee 2 on how to teach science to the class she was based with although she was given information about a school eco - club.

8.4.2 Influence of participants' backgrounds and experiences

One participant is the science coordinator. Both science coordinators in this study were female, aged over 40 years and had been employed as a science coordinator for several years in the study schools. Both had a first degree related to science. However, the science coordinators had different prior experiences in mentoring and assessing trainee teachers. There were also variations in the school engagement with ITT as found in extant studies (Furlong, 2005): School 1 had been engaged for several years prior to the study and School 2 had begun engagement in the study year. Science Coordinator 1 had extensive experience of working with trainees and was the mentor for Trainee 1 whilst Science Coordinator 2 had

not been trained as a mentor and no previous experience of working with trainees. Extant research has found that variations in mentors' prior experiences of science mentoring influence the ways they mentor trainees (Jarvis *et al*., 2001; Nilsson and Driel, 2008a). This study found that a science coordinator's prior experience of working with trainee teachers influenced three linguistic features of talk with a trainee during a placement - topic of talk, types of utterances and 'we-statements'.

Variations in prior experiences of working with trainees influenced topic of talk coded as 'feedback and judgement'. Science Coordinator 1 observed Trainee 1 teach science, responded to University directed tasks, and took responsibility for supporting and assessing her planning and teaching. Science Coordinator 2 did not observe Trainee 2 teach science and did not assess her planning although she did respond to questions within university directed tasks. Science Coordinator 1 spoke double the percentage of talk coded as 'feedback and judgement to trainee', compared with Science Coordinator 2; she perceived it was her role to gently confront and quietly push a trainee (Williams and Soares, 2002; Hudson, 2004; Sim, 2006). Science Coordinator 1 expressed her judgement in a positive and supportive way however she was openly critical of Trainee 1 and did not hesitate to point out areas of concern with suggestions on how to improve. Science Coordinator 2 gave limited praise and suggestions rather than being critical. Extant research has identified similar variations in mentors being willing to make judgements about trainees (Young *et al*., 2005).

The variation in the science coordinators' prior experience of assessing trainees was also reflected in variations of the strength of their 'giving instruction' utterances as considered in section 8.3.2. Science Coordinator 2's approach of mostly 'giving information' and 'asking questions' with fewer instructions aligns to that proposed by Crasborn *et al*., (2011) in their typology of mentors described as 'encourager'. Conversely, Science Coordinator 1's approach of mostly 'giving information' with fewer but similar percentages of 'giving instructions' and 'asking questions' aligns more to that of 'imperator' (Crasborn *et al*., 2011). Towards the end of the placement Science Coordinator 1 shifted her instructions encouraging Trainee 1 to 'have a go' to 'you have to make that decision' reflecting her

change in acting as an 'imperator' to 'initiator' (Crasborn *et al*., 2011). Similar findings of shifts in mentoring have been identified in other research, as a trainee moves through a journey of learning to teach (Berliner, 2004).

The variation in prior experiences in mentoring trainee teachers also influenced 'we-statements' associated with talk about 'planning'. Both science coordinators talked about 'planning' which is positive given the variations found in the quantity of talk between mentors and trainees about planning science lessons (Jarvis *et al*., 2001; Hudson, 2004). 'Planning' was the most common topic of the eight common topics of talk in the two meetings. In addition, both science coordinators looked at the trainees' science lesson plan which differs from extant findings (McIntyre and Hagger, 1993: Hudson, 2005). However only Science Coordinator 1 uttered 'we-statements' related to 'planning' - coded as 'cognitive', 'affective', 'achievement' and 'ability and constraints' (Gee, 2014). In contrast, Science Coordinator 2 uttered no 'we-statements' in relation to 'planning'. This study's findings suggest 'we-statements' associated with different topics is an area for future study.

The second participant in each case was a trainee primary teacher. In this study, both were female, aged 19 years old and had successfully completed A- level science courses in Biology and GCSE Science courses. Both had successfully passed an earlier placement in their second year of the undergraduate ITT programme and were following a science specialism route. Trainee 1 shared her target from a previous placement – to improve assessment of childrens' learning in science - with Science Coordinator 1 whereas Trainee 2 made an initial assumption that talk with Science Coordinator 2 was not about her targets as this was the role of her mentor. Trainee 2 preferred to learn by thinking and observing rather than doing compared to Trainee 1 who identified she was positively disposed to being 'pushed' by Science Coordinator 1 as part of learning to teach science as well as being given opportunities to 'have a go' and learn by doing.

Hagger *et al*. (2008) found that trainees have different dispositions to ways to learn with mentors and this study also found variations in trainee's initial disposition to ways of learning with the science coordinator which influenced 'we-statements'. Trainee 1 uttered

no ‘we-statements’ in the first interview conducted at the end of the first week of the four week placement even though she had been in the same classroom all week with Science Coordinator 1 who was also the class teacher. In the second interview, Trainee 1 uttered two ‘we-statements’. Whilst Trainee 1 had spent time in the classroom with Science Coordinator 1, including lunch times, and over seven hours in meetings self-identified in diaries, her limited use of ‘we-statements’ suggest she did not perceive the establishment of a relationship with Science Coordinator 1. This was unexpected and the findings do not align with findings of other studies on trainees developing relationships with mentors by spending time with them (Wang, 2001; Ticknor and Cavendish, 2015). Trainee 1 uttered no ‘we-statements’ coded as ‘planning’ even though it was the most common topic; nevertheless, she had a high level of intrinsic motivation to achieve her target regarding ‘assessment’ (Pintrich, 2000; Cremin and Arthur, 2014).

In contrast Trainee 2 uttered nine ‘state and action’ ‘we-statements’ in the first interview conducted at the end of the first week of the four week placement. This seemed to reflect her willingness and expectation to develop a different type of relationship with Science Coordinator 2 from her mentor. The act of teaching together in the first week of the placement seemed to have created a sense of ‘we’ for Trainee 2. However, the illness of Science Coordinator 2 reduced the available time for her to talk with Trainee 2; according to Trainee 2’s diary they spent 30 minutes together. Trainee 2 uttered no ‘we-statements’ in Meeting Two, held the day after Science Coordinator 2 returned to work. Her initial disposition to view herself as being in a ‘we’ relationship was disturbed due to the absence of Science Coordinator 2. Limited time to meet was a factor in influencing the ‘we-statements’ spoken by Trainee 2.

8.4.3 Influence of purpose of talking

Purpose of talk may be considered in various ways (Halliday, 1979; Holmes, 2001). One purpose of talking with science coordinators based on professional experience and extant research on mentoring was about giving information to trainees about school practices to enable trainees to meet the needs of a specific placement (Caires *et al*., 2012; Carroll, 2005). Findings from this study showed that this purpose influenced the topic, types of utterances

and ‘we- statements’ in a similar pattern in each case. Both science coordinators talked about the topic coded as ‘school practices’ with trainees and they both gave trainees details about the cupboard of science resources and other school practices; for example, accessing the website and school clubs (Bowe, 1995; Ofsted, 2008). Neither science coordinator asked ‘questions’ about science resources which might have prompted reflection about their use in future placements (Hudson, 2005). In addition, no participants uttered ‘we-statements’ coded as ‘school practices’ suggesting they did consider ‘school practices’ to be a joint activity.

A second purpose of talk concerned trainees’ professional development (Koballa *et al*., 2008). Both science coordinators invested in the trainees’ development and personal well-being. However, there were variations in the extent to which they did things for and on behalf of the trainee beyond the study placement (Newton, 2004; Young *et al*., 2005). The variations were reflected in the topic of talk in each case; Case One talk was mostly coded as PCK – planning, teaching, assessment and resources whereas in Case Two talk was mostly coded as Context – school practices, science coordinator practices, children and placement expectations. Trainee 1’s experience of having regular face to face meetings talking about PCK aspects supported the development of transferable knowledge and skills for the next placement as part of her learning journey (Cardona, 2005). Trainee 2 reflected that she wished Science Coordinator 2 had given her more pedagogic knowledge for teaching science although she felt Science Coordinator 2 had more science knowledge than others in such a role (Farmery, 2004; Furlong, 2005).

A third purpose which is not identified in the literature concerned meeting the requirements of a visit of a University External Examiner (EE) to observe Trainee 1 teach science during the placement. The visit influenced decisions of Science Coordinator 1 to only focus talk on planning for the observed science lesson which dominated the topic of talk in Meeting One and then the utterances concerning ‘feedback and judgement’ based on the lesson observation in Meeting Two. This factor influenced Trainee 1’s learning to teach science and, as indicated above, EE visits are worth further examination in future research.

8.4.4 Influence of topic

The topic of talk influenced linguistic features. Firstly, topic influenced the use of 'we-statements'. In both cases, talk about 'teaching' included 'we-statements' spoken by science coordinators only. Neither trainee considered talk about 'teaching' as a joint activity – it did not stimulate the development of a relationship. In contrast, talk about 'assessment' included 'we-statements' by both trainees and science coordinators. Other studies have found variations in talk about assessment (Butterfield *et al*., 1999; Hudson, 2007) between mentors and trainees and this study found similar variations in the frequency of talk in each case, nearly double in Case One, but the type and frequency of 'we-statements' uttered were similar – both cases spoke 'state and action' and 'ability and constraints'.

The topic of talk influenced the types of utterances spoken by each science coordinator. Science Coordinator 1 spoke only questions and instructions when talking about PCK topics and only provided information utterances when talking about Context topics. Science Coordinator 2 spoke only questions and gave information about Context topics and used different combinations of utterances when talking about PCK topics. Different types or different combinations of utterances for different topics may influence trainee's learning to teach science.

8.5 How may 'talk' with a primary school science coordinator influence a primary teacher trainee learning to teach science?

Findings from this study found that talk between a science coordinator and trainee may influence a trainee learning to teach science by

- acting as a stimulus to change trainees' thinking and doing science teaching
- acting as a stimulus to change trainees ' perceptions about their achievements
- acting as a stimulus to change feelings about science teaching.

Talk may influence trainees' **thinking and doing** science teaching as evidenced in a shift in the frequency and topics of 'I-statements' coded as 'cognitive' and 'state and action' spoken by trainees. Science Coordinator 1 talked with Trainee 1 mostly about PCK topics. She provided mostly 'information giving' utterances about 'feedback and judgement' and gave

strong 'instructions' on how to teach science in a particular way to children, supported by a range of question verbs and 'we-statements' for PCK and Context topics. Trainee 1 who identified that she preferred to learn by doing initially uttered mostly 'state and action' 'I-statements' about 'teaching' however, by the end of the placement, she had shifted her 'I-statements' to 'thinking' about 'teaching' and most of her 'I-statements' were coded as 'cognitive'. She shifted her mental energy from being concerned about 'Science Coordinator 1 practices' to 'teaching' (Berliner, 1992; Illeris, 2009).

In contrast, Science Coordinator 2 and Trainee 2 talked mostly about Context topics with Science Coordinator 2 providing mostly 'information giving' utterances about 'Science Coordinator 2 practices', supported by what, why and tag questions and very few 'we-statements' spoken by Science Coordinator 2. Trainee 2 identified that she preferred to learn by thinking and observing. Her 'cognitive' 'I-statements' at the start and end of the placement reflected this preference with most of them concerning 'Science Coordinator 2 practices' rather than herself. Her mental energy remained focused on learning about the Context rather than her own development as a teacher. Talk with Science Coordinator 2 had not encouraged Trainee 2 to see the isolated irregular experiences of talking with her as part of her overall learning journey (Cardona, 2005).

Both trainees identified that the action of lesson planning for science, which is embedded in Teachers' Standard 4 - plan and teach well structured lessons (DfE, 2011), was influenced by their talk with a science coordinator. Trainee 2 wrote in her diary that she had changed the lesson's structure after talking to Science Coordinator 2 about the 'Circuits' lesson and Trainee 1 also reflected in her diary that she had learnt not to plan too far ahead and be willing to adapt a plan after talking to Science Coordinator 1.

Talk may influence trainees' perceptions about their **achievements in learning to teach science.** 'I-statements' (Burr, 1990; Ticknor, 2010) may act as an indicator of trainee's perception on their achievements and both trainees uttered 'I-statement' achievements related to 'teaching' and 'assessment'. In this study, Trainee 1 perceived her achievements in terms of her deliberate focus (Hagger *et al*., 2008) during talk on PCK topics and uttered

no ‘achievement’ ‘I-statements’ for Context topics. In contrast, Trainee 2 spent most time talking about Context topics and perceived her achievements in terms of understanding ‘Science Coordinator 2 practices’ and ‘children’.

Both trainees acquired knowledge about children (Kagan, 1992). Both trainees found talking with science coordinators about children they were teaching useful in terms of how it informed their behaviours during teaching and their planning to meet the needs of children. This related to Teachers’ Standard 5 - Adapt teaching to respond to the strengths and needs of all pupils (DfE, 2011) although neither trainee nor science coordinator made reference to this. Trainee 2 said the information provided by Science Coordinator 2 helped her to know if it was best to sit with a child or to give them a question and then walk away to give them time to think. This finding suggests that Trainee 2 learnt that children need time to respond to a question rather than learning what ‘quality’ question to ask (Rowe, 1972; Corden, 2000). Trainee 1 used the information given by Science Coordinator 1 about children’s home life and experiences to make decisions on which group to place them in for studying scientists in order to make the learning more relevant to their home life experiences.

Trainee 2 perceived her achievement mostly in terms of her improved ‘subject knowledge’ related to teaching electricity; however, this was not identified as a topic of talk. The study considers that talking with Science Coordinator 2 about ‘subject knowledge’ was not an influence on Trainee 2’s learning to teach science but rather her listening to Science Coordinator 2 talking to children about resistance and circuits during a lesson observation and spending time revising to improve her own subject knowledge about electricity.

Talk may influence trainees’ **feelings** about science teaching. Extant studies on mentoring have identified the role that mentors may play in influencing an affective dimension of learning to teach (Young *et al*., 2005; Koballa *et al*., 2008). Both trainees began the placement with good feelings about ‘loving science’ and ‘teaching’ science so neither science coordinator had an initial task to use talk to persuade trainees about adopting a positive attitude towards science although Trainee 1 was ‘daunted’ about teaching practical lessons (Kenny, 2010). However, the constant availability of Science Coordinator 1, who

spoke to the whole staff on behalf of Trainee 1, checked she had food and drink and organised for resources to be made available for the External Examiner visit provided a different affective learning experience to Science Coordinator 2 who wished to be available to develop a partnership with Trainee 2 but due to illness was not present to talk to her. At the end of the placement, Trainee 1 uttered no 'affective' 'I-statements' whereas Trainee 2 was still feeling concerned about 'teaching' and 'Science Coordinator 2 practices' at the end of the placement. Trainee 2's self- confidence may have increased with more teaching experience (Appleton and Kindt, 1999). Further investigation is needed into the influence of talk on trainees' feelings about the role and practices of subject coordinators in ITT.

In the previous section I have considered the main research question for this study and identified three main areas in which talk with a science coordinator may influence trainees learning to teach science. In the next section, I consider the findings and discussion from a social constructivist perspective drawing on the theoretical framework presented in Chapter Three.

8.6 A social constructivist interpretation of the findings

A social constructivist approach to learning starts from considering the learners' present knowledge (Al- Weher, 2004). Science Coordinator 1 built on the **prior learning** of Trainee 1 by referring to a target regarding 'assessment' from a previous placement as well as one of her instructions which included taking a camera around the school to find out what she already knew about science. She wanted to build on Trainee 1's experiences and learning needs and her prior experiences as a mentor enabled her to move beyond her teaching role with children and adopt a similar process of finding out about Trainee 1 as a learner. Science Coordinator 2 was not aware of the structure of either the undergraduate training programme or her trainee's targets from her previous placement and seemed to view talking with Trainee 2 as a learning journey for herself.

A more knowledgeable other (MKO) guides a learner through to their zone of proximal development (ZPD) by collaborating with them to complete tasks and transform these experiences to higher mental functions through the mediation of language (Vygotsky, 1978).

Science Coordinator 1 made **connections** for Trainee 1 between her prior, present and future experiences. She regularly referred to Trainee 1's current issues in learning how assess children's learning in science by critically commenting on the experience in one lesson, providing encouragement and ideas on how to resolve the issue and then providing feedback from a lesson observation when there was improvement. The most frequent topic associated with 'I-statements' and 'we-statements' spoken by Trainee 1 were 'assessment'; there was harmony rather than a gap between the intention of Trainee 1 to improve her skill in this task and Science Coordinator 1 to give support (Ekborg, 2005). Such explicit connections were not made for Trainee 2 as Science Coordinator 2 did not observe Trainee 2 teach nor met on a regular basis to create a ZPD through engagement in 'joint activity that creates a context for teacher and student interaction' (Tharp and Gallimore, 1988, p.71). However, Science Coordinator 2 did communicate her enthusiasm for teaching science which connected with Trainee 2's feelings about science being accessible to all (Yung and Tao, 2004).

According to a social constructivist framework, the learner gradually takes more **responsibility** for their own learning (Muijs and Reynolds, 2005). At the start of the placement, Science Coordinator 1 established a pattern of 'giving instructions' to Trainee 1 on how she should teach science suggesting that Science Coordinator 1 assumed responsibility for what Trainee 1 needed to learn. In the second meeting, there was a shift to Science Coordinator 1 'giving instructions' to Trainee 1 that she needed to make decisions and take responsibility for the focus of learning in the final week of the placement. However, the low frequency of 'we-statements' spoken by Trainee 1 suggested she had a high level of intrinsic motivation and self-responsibility to achieve her own targets irrespective of working collaboratively with Science Coordinator 1 (Pintrich, 2000; Cremin and Arthur, 2014). Trainee 1 assumed responsibility for her learning throughout the placement. In contrast, Science Coordinator 2 did not assume any responsibility for the assessment of Trainee 2 during the placement. This was matched by Trainee 2 not expecting Science Coordinator 2 to be involved in her targets for the placement. Trainee 2 accepted responsibility at the end of the placement that she still needed to improve particular skills when teaching science - differentiation and teaching approaches – and felt concerned that

her University tutor would be disappointed that she had not taught more science. She accepted that she had not organised to observe other science teaching as directed by the University, however, she felt that the part time role of Science Coordinator 2 was different to other science coordinators. There was lack of harmony between Trainee 2 who was not experienced in accessing support from teachers other than a mentor and Science Coordinator 2 who was not experienced in supporting trainees.

Findings from this study suggest that Science Coordinator 1 **assisted** Trainee 1 through her zone of proximal development (ZPD) - by modelling to her how to teach science, giving feedback on her performance as a future teacher, giving instructions to aid her performance as a teacher, asking questions and sharing her mantra to act as a thinking aid for considering teaching science. Science Coordinator 2 assisted Trainee 2 in terms of modelling to her how to teach science, asking questions, and her science subject knowledge was identified by Trainee 2 as being extensive. However, she did not provide feedback to Trainee 2 on her teaching nor did she offer a cognitive structure for thinking about teaching which could be transferred beyond the placement (Tharp and Gallimore, 1988).

8.7 Summary of Chapter Eight

This chapter has critically discussed each research question to explore linguistic features, the factors influencing them and patterns common to them and the chapter has also included comparisons between these findings and those in extant studies. The chapter has highlighted that linguistic features during talk between a science coordinator and trainee may act as a stimuli for learning. In such contexts, topics, types of utterances and 'we-statements' may vary. They may be influenced by social factors including the topic of talk, participants in the dyads, the setting that is the science teaching in the school, and the purpose of talk in terms of meeting the needs of a teacher training placement, trainees' professional development and responding to a visit by the External Examiner. Three ways are identified for which talk with a science coordinator may influence a trainee. These influences may act as stimuli for change or development in i) trainees thinking and doing science, ii) trainees' perceptions about their achievements and iii) trainees' feelings about

science teaching. The chapter concludes with a consideration of the findings from a social constructivist perspective.

The findings are a preparation and foundations for contributing new knowledge to understanding how talk which may influence learning to teach science. The study findings resulted in the development of a new analogy – 'talk molecules' – which support an understanding of how talk with an experienced other – a science coordinator - may support a trainee to move through their ZPD in the context of a social constructivist framework of learning. Chapter Nine discusses the analogy of 'talk molecules' before concluding with a conceptual framework based on the literature, data analysis and reflection of the findings from this qualitative study.

Chapter Nine ‘Talk spaces’ and ‘talk molecules’

9.1 Introduction

The creation of new knowledge and to learn from it is a main reason for doing the research (Griffiths, 1998). In Chapter Eight, new knowledge concerning how talk may influence trainees learning to teach science was presented. In this chapter, new knowledge concerning understanding talk is presented. In the second of five sections, two analogies - ‘talk space’ and ‘talk molecules’ - are presented to support new understandings of how talk may influence learning to teach science. The third section provides a visualisation of ‘talk molecules’ for each case in relation to PCK topics – ‘planning’, ‘teaching’, ‘assessment’ and ‘resources’ and considers the use of call outs and speech bubbles to represent types of ‘we-statements’ and types of utterances for each topic. Section four concludes this chapter by presenting a conceptual framework for this qualitative study from the data analysis and reflection.

In the next section, I introduce two analogies: ‘talk space’ and ‘talk molecules’ as new ways to contribute to understanding how talk with primary science coordinators may influence primary teacher trainees learning teach to science within a social constructivist perspective.

9.2 Analogies of ‘talk space’ and ‘talk molecules’

In Chapter Eight, the findings have been discussed in terms of science coordinators acting as more experienced others to assist trainees through their ZPD in relation to learning to teach science. A ZPD was opened up during their interactions which involved science coordinator’s talking to assist trainees’ learning to teach science. Talk in this study between participants was analysed in terms of three features: types of utterances spoken by science coordinators, topics discussed in meetings and ‘we-statements’ spoken by trainees and science coordinators. In addition, ‘I-statements’ spoken by each trainee were identified. Talk features were enumerated in terms of frequency and they have been used to establish two new analogies to contribute new knowledge and understandings on how talk may influence learning to teach science.

The first analogy is **'talk space'** which is used to describe a real three dimensional space occupied and shared by two or more participants. In this study a trainee and science coordinator 'talk' during face to face verbal interactions. In a given 'talk space', which has boundaries in terms of time and location, there are vibrating 'talk molecules' which transfer energy in the form of sounds which are recognised by participants in the 'talk space' as words and utterances. However, there is no assumption that participants in a given 'talk space' give or hear or respond to these or that participants share the 'talk space' evenly.

The second analogy is **'talk molecules'** which are analogous to different molecules in air: for example oxygen and hydrogen which also occur in different amounts in air in different locations (SERC, 2017). In this study, 'talk molecules' present as three different types – topic, 'we-statements' and 'I-statements'. Tables 9.1, 9.2, 9.3 and 9.4 present the 'talk molecules' for both cases.

'Talk molecules' were constructed for the eight common topics of talk from two meetings in both cases. In both cases these were split: PCK – 'planning', 'teaching', 'assessment' and 'resources' – and Context – 'school practices', 'science coordinator practices', 'children' and 'placement expectations' (Nilsson, 2008a).

PCK 'talk molecules' and 'we-talk' molecules	PCK 'talk molecule' topic	'I-talk' molecules
5T (36D, 11Q) +T6W (71SA, 29AC)	Teaching	T17I (35C,44SA,18AC,3AH)
16P (10D, 32Q) +P9W (10C, 10AF, 60AH, 20AC)	Planning	P5I (11C, 78SA, 11AC)
13A (7Q) +A11W (92SA, 8AC)	Assessment	A13I (16C, 52SA, 24AC, 8AH)
13R (10D) +R7W (12C, 63SA, 25AC)	Resources	R1I (100SA)

Table 9.1 Case One – PCK topics

Context 'talk molecules' and 'we-talk' molecules	Context 'talk molecule' topic	'I-talk' molecule
5S (18I, 5D, 4Q)	School practices	S3I (33C, 33SA, 33AC)
5SC (14I, 4Q) + SC2W(100SA)	Science coordinator practices	SC10I (68C, 11SA, 21AC)
8PE (3I,10D) +PE10W (64SA,36AC)	Placement expectations	PE10I (42C, 37SA, 21AC)
8C (3I, 3D, 4Q) + C3W (100SA)	Children	C10I (55C, 25SA, 20AC)

Table 9.2 Case One – Context topics

PCK 'talk molecules' and 'we-talk' molecules	PCK 'talk molecule' topic	'I-talk' molecules
10T (2I, 20Q) +T19W (100SA)	Teaching	T12I (30C, 33SA, 7AC, 18AH, 11AF)
10P (3I, 25D,12Q)	Planning	
7A (33D, 20Q) +A26W (91SA, 9C)	Assessment	A13I (29C, 35SA, 23AC, 10AH, 3AF)
7R (3I, 42D)	Resources	R3I (14SA, 57AH, 29AF)

Table 9.3 Case Two – PCK topics

Context 'talk molecules' and 'we-talk' molecules	Context 'talk molecule' topic	'I-talk' molecule
7S (26I, 3Q)	School practices	S7I (50C, 50AC)
18SC (31I, 12Q) + SC2W (100SA)	Science coordinator practices	SC18I (38C, 29SA, 21AC, 10AH, 20AF)
0P (2I, 6Q) + PE2W (100SA)	Placement expectations	PE2I (100C)
28C (18I, 3Q) + C23W (90SA, 10AC)	Children	C2I (8C, 20AH)

Table 9.4 Case Two – Context topics

Firstly, 'topic talk molecules' are molecules which represent how much talk in a given 'talk space' refers to a particular topic. For example, in Table 9.1, Case One, 5% of common topics of talk in two meetings was coded as 'teaching' so 5T represents a 'talk molecule' for 'teaching'.

Secondly 'we-statements' talk molecules – 'we-talk' molecules. 'We-talk' molecules refer to talk spoken by participants in a shared 'talk space' occurring in the presence of each other or in a 'talk space' when referring to a past or future occurrence that included them both. In Table 9.1, Case One, 11% of common topic of talk during two meetings was coded as 'assessment'. This talk was then coded as 92% 'state and action' and 8% 'ability and constraints' which is summarised as A11W (92SA, 8AC).

Thirdly, 'I-statements' talk molecules – 'I-talk' molecules. 'I-talk' molecules refer to talk spoken by a participant. In this study, a trainee's 'I-statements' spoken outside of the shared 'talk –space' were identified. 'I-statements' spoken during the meetings were not identified. For example, in Table 9.1, Trainee 1 uttered 13% of her 'I-statements' during two interviews about 'assessment'. This talk was then coded 16% 'cognitive', 52% 'state and action', 24% 'ability and constraints' and 8% 'achievement' which are summarised as A13I (16C, 52SA, 24AC,8AH).

9.3 Visualising 'talk space' and 'talk molecules'

Visualising abstract concepts can support understanding (Gilbert, Reiner and Nakhleh, 2008), so an output of the present study is the visual representation of 'talk space' and 'talk molecules'. 'Talk space' includes multiple 'talk molecules' which are represented by different sized blue speech bubbles where colours represent an abstraction of some of the linguistic features of talk. Bubbles represent different topics and associated types of utterances spoken by the science coordinator (more experienced other) to the trainee (the learner). Types of utterances are represented by different coloured speech bubbles - 'giving information' (green), 'giving instructions' (orange) and 'asking 'questions' (red) respectively. 'We-statements' are represented by a yellow call out symbol.

Figures 9.1 and 9.4 represent 'talk spaces' for four of the eight common topics from two observed meetings for Case One and Case Two respectively. The four PCK topics – 'planning', 'teaching', 'assessment' and 'resources' are represented by speech bubbles. The size of the speech bubble is not to scale but provides a visual indication of the frequency of each type of utterance. In Case One in Figure 9.1, there are no green bubbles as Science Coordinator 1 did not provide speak any 'giving information' utterances in terms of PCK topics.

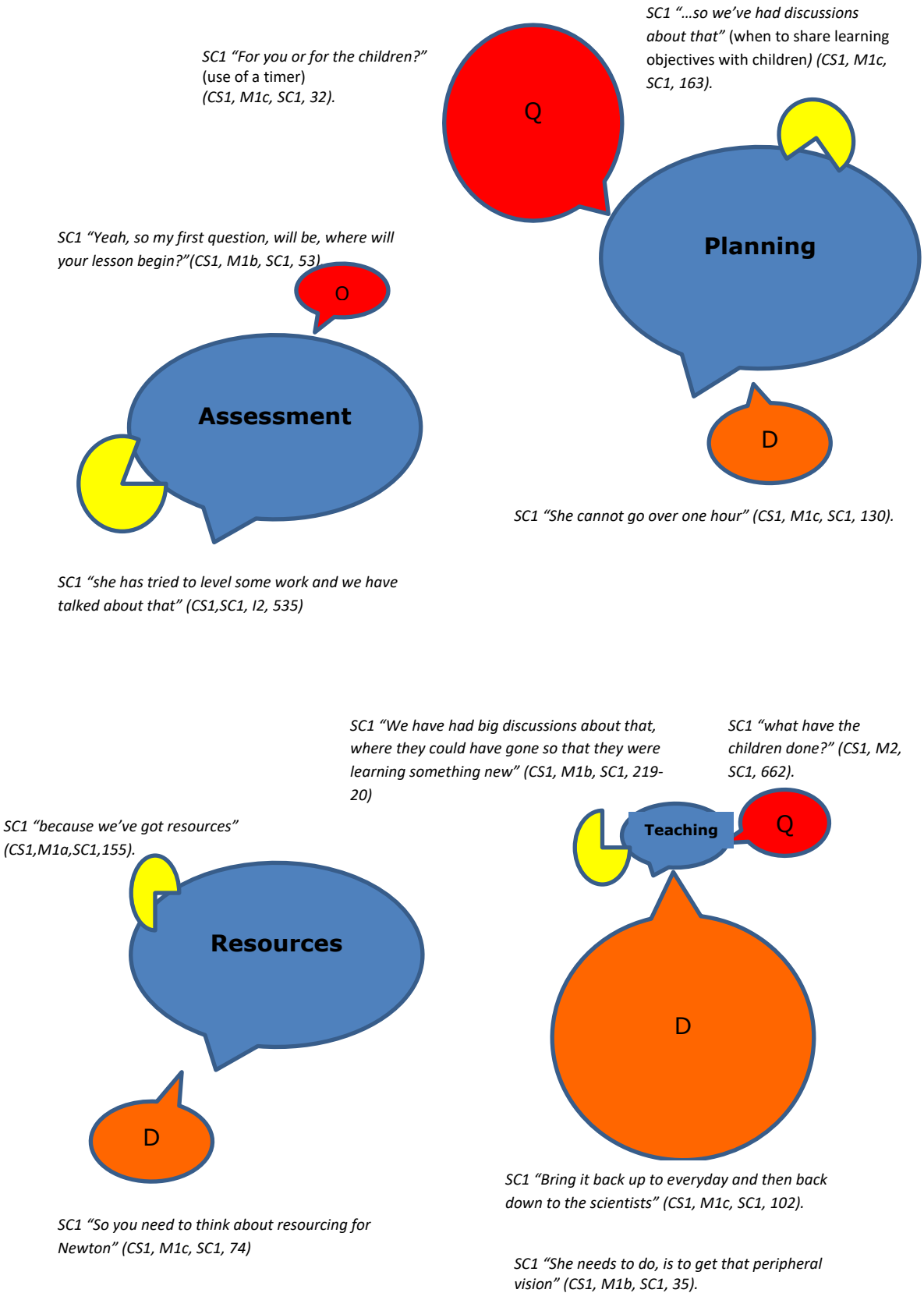

Figure 9.1 Case One 'talk space' showing PCK 'talk molecules'

The visualisation includes yellow call outs representing ‘we-talk’ molecules which may be spoken by either trainee or science coordinator with reference to a particular topic. These are composed of different types of ‘we-statements’ for example, ‘cognitive’ and ‘state and action’. Figures may be constructed to represent the different combinations and relative frequencies of each type of each topic. In Case One, ‘assessment’ ‘we-statements’ were coded as either ‘state and action’ (blue rectangular call out) or ‘ability and constraints’ (brown rectangular call out). The blue call out is larger than the brown call out, representing there were more ‘state and action’ spoken than ability and constraints’ ‘we-statements’.

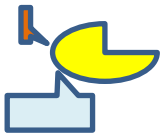

Figure 9.2 Case One visualisation of ‘we-talk’ molecule for ‘assessment’

Similarly, an ‘I-talk’ molecule may be represented by a different call out, a pink cloud call out as below, and different types of ‘I-statements’. For example, in Case One, ‘assessment’ ‘I-statements’ comprised of ‘cognitive’ (red), ‘state and action’ (blue), ‘ability and constraints’ (brown) and ‘achievement’ (green) represented by different sized and coloured rectangular call outs.

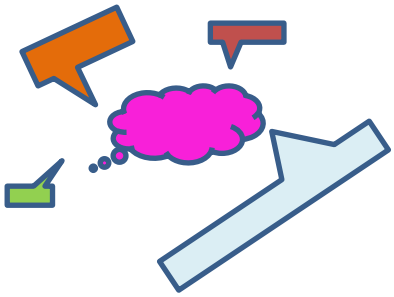

Figure 9.3 Case One visualisation of ‘I-talk’ molecule for ‘assessment’

A similar visualisation is provided for Case Two PCK topics in Figure 9.4.

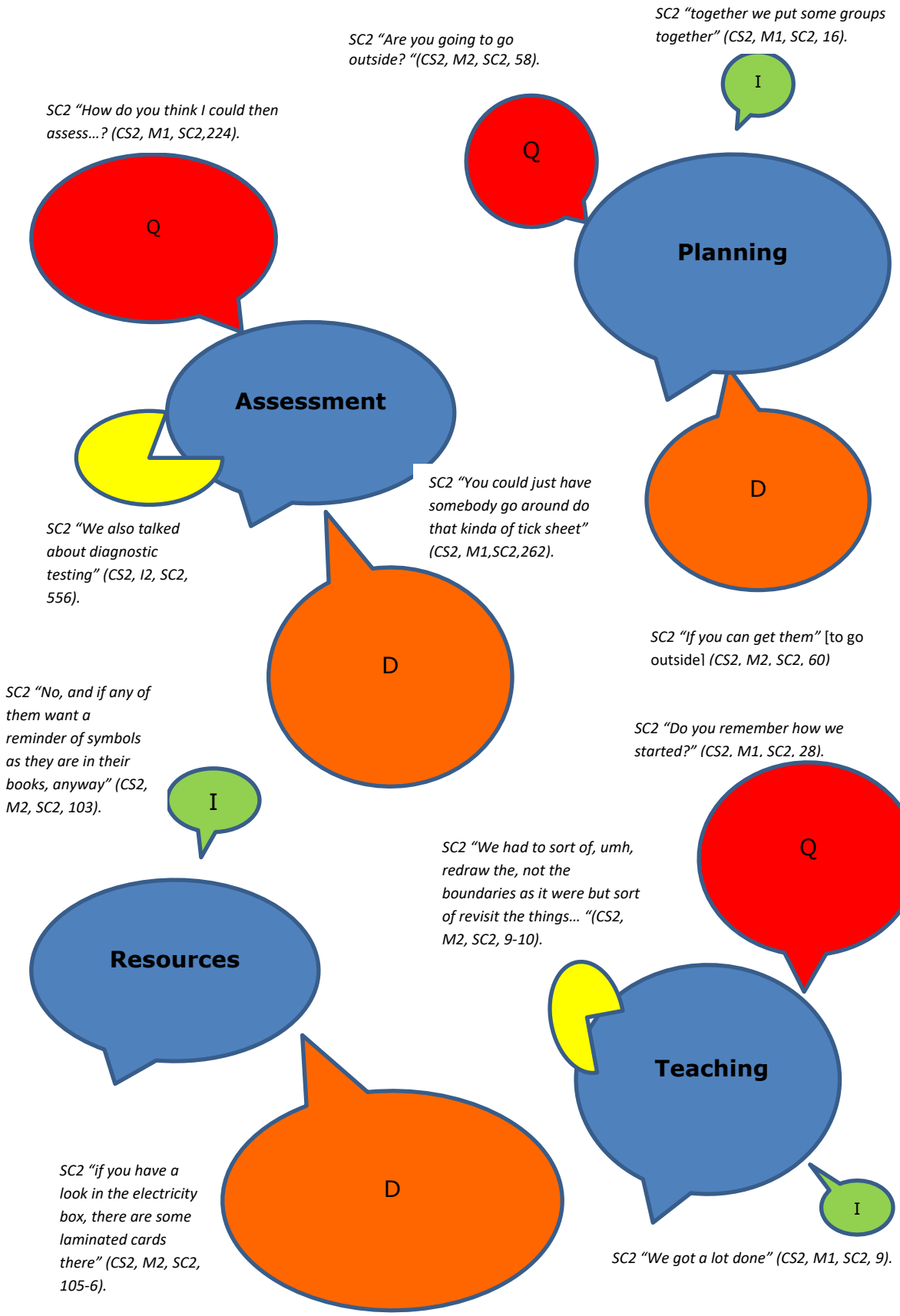

Figure 9.4 Case Two 'talk space' showing PCK 'talk molecules'

The figures provide a visualisation of possible linguistic stimulus from talk between a trainee and science coordinator which may influence a trainee learning to teach science. The study findings identify different linguistic 'talk spaces' which may or may not assist trainees in their learning to teach science. Trainees are learning to teach science through talking about different topics with a science coordinator which is further differentiated in terms of whether they are given information, asked questions or given instructions in relation to these topics and if they engage in joint activities which may create opportunities to develop relationships to support learning. Within a social constructivist perspective of learning, the more knowledgeable other may be viewed as blending together, in different ratios for different topics, different types of utterances which may influence learning to teach science as reflected in 'I-statements' spoken by trainees.

This study has considered the influence of different factors on 'talk molecules' including the setting, in terms of school's practices in teaching science lessons and the time spent together discussing planning and teaching; the participants, in terms of the science coordinators' prior experience in mentoring and ideas for teaching science to make it accessible to children, and trainees' preferences in learning how to teach science; the purpose of talk, in terms of addressing a target set from a previous placement, preparing for a visit by the External Examiner and giving information about children; and the topic of talk, in terms of the influence of the different topics on types of utterances.

In the final section of this chapter, I revisit my understanding of a conceptual framework for this qualitative study as discussed in Chapter Three.

9.4 Developing a conceptual framework

The conceptual framework presented overleaf, Figure 9.5, in diagrammatic form with a commentary evolved during the study. It took on different forms as the literature review was completed, data was collected and analysed and further literature considered.

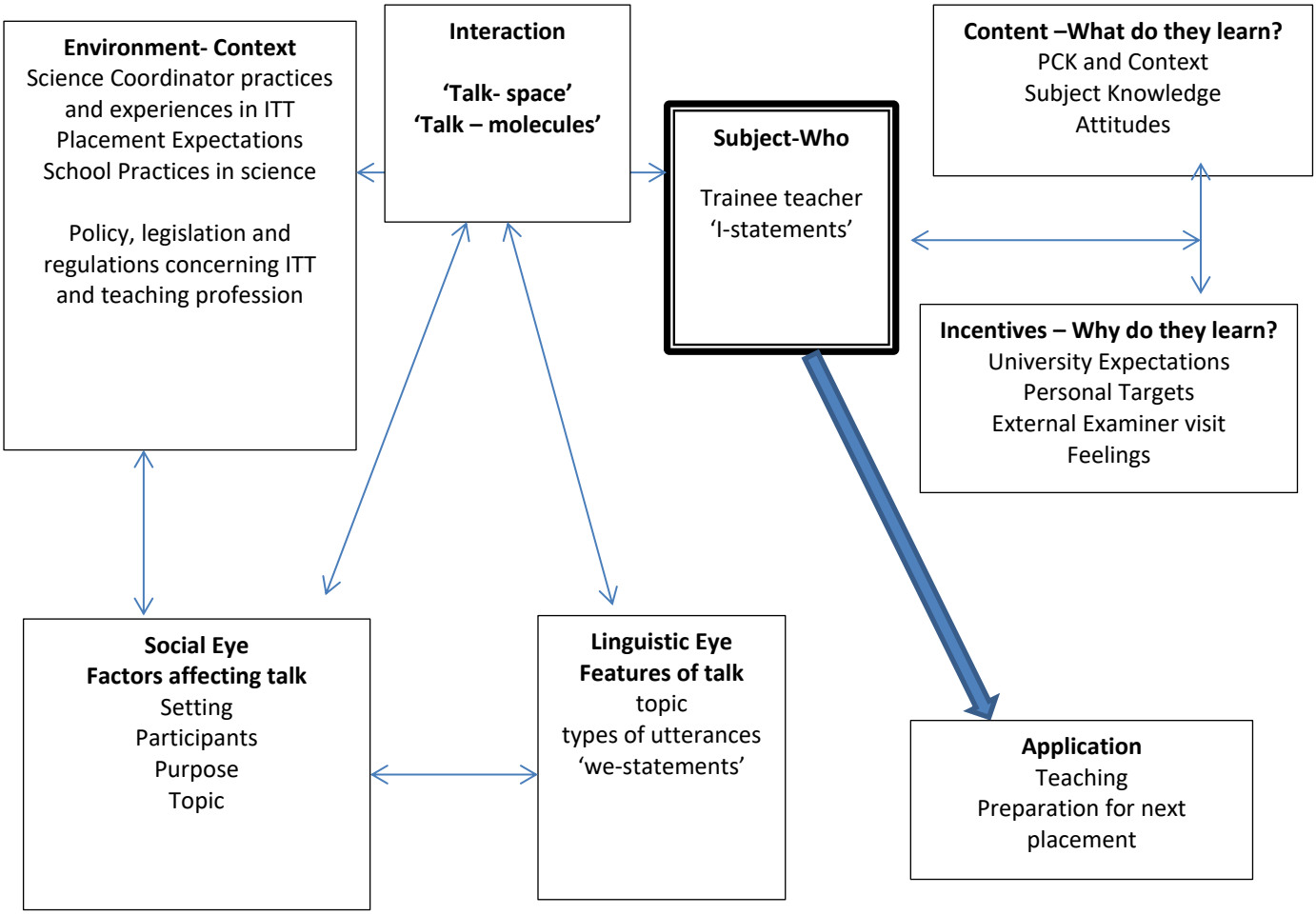

Figure 9.5 Conceptual Framework

At the heart of the conceptual framework lies the socially mediated individual, the trainee teacher who is learning 'content' in terms of 'knowledge for teaching'. 'Knowledge for teaching' is a debated topic and is considered to include different 'segments' (Bishop and Denley, 2007) including knowledge about subject matter, pedagogy, PCK, children, curriculum as well as skills and attitudes related to these in order for a trainee to develop meaning and function as a teacher as discussed in Chapter Two. A trainee may be considered to be more or less motivated to learn different 'segments' of knowledge for teaching and the double arrow between 'content' and 'incentives' represents the interplay between a trainee's motivation to learn to teach and willingness to learn different aspects of knowledge for teaching (Barber and Mourshed, 2007; Illeris, 2009).

The double arrow between the subject – the trainee - and the environment - the school and wider practices of ITT - reflects the study is positioned within a theory of learning which proposes that the interaction between subject and environment may initiate learning (Vygotsky, 1978; Illeris, 2009). According to social constructivism theory, learning is mediated through talk such that the process of talking to another more experience person may transform a sensory or emotional experience to a cognitive one by linking talk and thought (Vygotsky, 1978). The interaction between a science coordinator and trainee is viewed from a perspective that an experienced teacher will assist the learning of the trainee, building on their prior learning, to enable them to blend 'content' and 'incentives' for teaching science beyond a level they could achieve on their own (Wood and Middleton, 1975; Tharp and Gallimore, 1988; Illeris, 2009). This study finds that trainees are learning to teach science in different 'talk spaces' containing different 'talk molecules' which may influence their learning as reflected in their 'I-statements'.

The conceptual framework developed over the study was initially informed by my practitioner understanding of mentoring and then transformed into learning about social constructivism and talk during the study as I have assimilated and reflected on my new knowledge and journey as a researcher.

9.5 Summary of Chapter Nine

This chapter presented two analogies – 'talk – space' and 'talk – molecules' to contribute new understandings of features of talk and potential influence on trainees' learning to teach science. The chapter also discussed a conceptual framework which was developed in response to the findings, analysis and discussion and reflection.

CHAPTER TEN - CONCLUSION

10.1 Introduction

How teachers learn to teach is emerging as an important field of research (Beck and Kosnick, 2006; Korthagen *et al*., 2006; Postholm, 2010; Mutton *et al*., 2017). This study was conducted to examine an aspect of practice within ITT programmes that has received limited prior attention: talk with science coordinators to support primary trainees learning to teach science. This thesis proposes that paying attention to 'talk' can help to provide an understanding of how learning to teach occurs.

In this chapter, there are nine sections. The second section discusses learning to teach science and talk and considers how science coordinators influence trainees' learning to teach science through challenge and support. The third and fourth sections discuss the contribution to the field of teacher education and theory of learning. The limitations of this study are presented in section five before suggestions are made for future policy and practice in section six. The final two sections consider the opportunities for further research and my personal learning.

10.2 Learning to teach science and talk

In this study, learning to teach science is viewed within a social constructivist paradigm. It considers trainee teachers as learners who individually construct knowledge. This may be stimulated by interactions with their environment, and developed into learning through talk with an experienced other, a science coordinator, during a placement. Trainees and science coordinators bring their own beliefs and prior learning to interactions with each other which may be influenced by social and physical factors (Palmer, 2005; Illeris, 2009). Social and physical factors may also influence linguistic choices of participants during interactions (Hymes, 1974; Holmes, 2001). This study finds that variations in linguistic features of talk may influence trainees learning to teach science.

There is not agreement on the knowledge for teaching (Shulman, 1987; Nilsson, 2008a). However, in England, what trainees need to learn is not a matter of choice; it is set out in

the statutory documentation. The national ITT Content Criteria for England (DfE, 2016b) lists essential content, aligned to the Teachers' Standards (DfE, 2011), to be taught by ITT providers to trainees in England. This document includes subject knowledge, pedagogical knowledge, behaviour management as well as knowledge about legal and professional duties of a teacher in England.

This study points to the potential contribution and influence of science coordinators talking to trainees as they learn to teach science. Science coordinators are positioned in placements to influence trainees' learning to teach science. During placements, they have opportunities to interact with them and in this study; trainees were required to talk to science coordinators as part of university set tasks. Science coordinators may see trainees over a short, fixed period of time; they see them in different locations and at different times during the placement. In this study, the time spent in 'talk spaces' with trainees differed. Both science coordinators were willing to create supportive 'talk spaces' and valued talking as part of the process of trainees learning to teach science, however these differed and are worth further research.

This study provides evidence that both trainee participants acquired knowledge from talking with their science coordinator which they used or planned to use in their teaching. For example, Trainee 1 learnt how to use a teaching strategy – 'bring them back' – for teaching children in Key Stage One and Trainee 2 learnt about the use of analogies in explaining scientific abstract concepts.

This study showed that science coordinators may adopt roles of assisting trainees in learning to teach science however these roles differed for different topics of talk. The balance of types of utterances differed for PCK topics – 'planning', 'teaching', 'assessment', 'resources' - and Context topics – 'children', 'school practices', 'science coordinator practices', 'placement expectations' - so trainees experienced different 'talk molecules' for different topics which are associated with different aspects of the Teachers' Standards (DfE, 2011). If trainees are not asked questions, or are frequently asked questions, about particular topics

or given or not given instructions or information about different topics then it may influence their learning to teach science.

10.3 Contribution to the field

The study has contributed new understandings of how talk between a science coordinator and trainee may influence a trainee learning to teach science within the field of teacher education. The study contributes new knowledge by the introduction of analogies described as 'talk spaces' which contain 'talk molecules'. 'Talk molecules' are a tool for analysing and visualising talk so that it can facilitate discussions on the influence of science coordinators' talk with trainees during ITT placements.

In order to achieve the research aim, the study examined some ways in which talk with a science coordinator may influence trainees' learning to teach science in order to contribute to an understanding of assisting a trainee moving through their zone of proximal development (Fani and Ghaemi, 2011; Warford, 2011). In this study, talk was examined through a focus on understanding linguistic features of talk and factors which may influence these and 'talk molecules' offer a new analogy to consider 'linguistic scaffolding' in the ZPD. By drawing on sociolinguistic tools including speech act analysis of types of utterances spoken by science coordinators, topic analysis and 'we' and 'I'-statements analysis, it was possible to begin to understand how talk with science coordinators may influence the learning of two primary trainees.

The field of teacher education must take seriously the need to enable other experienced others in schools, as well as the nominated mentor, to be involved in a trainee's journey of learning to teach science. Despite recent calls for greater school involvement in ITT (Taylor, 2008) schools do not ensure all teachers are prepared to engage with trainees. The study suggests shifting our focus to equipping all teachers and particularly those who are curriculum coordinators in a primary school to be able to use talk to engage with trainees during placements. Curriculum coordinators are not as yet part of the fabric of ITT placements in primary schools in England. The ability to have such conversations, in the end, might prove more educative than working with mentors only during placements.

10.4 Contribution to theory

In order to achieve the research aims, the study needed some possible ways to examine talk and how this may influence learning to teach. In this study, learning to teach was examined through a focus on understanding some of the linguistic features of talk and factors which influenced these. Social linguistics and speech acts provided useful tools for examining some aspects of talk in the interaction of trainee and science coordinator and in pointing how these may develop learning. However, in adopting this perspective on talk, it means it only offers one interpretation of the data.

Taking a social constructivist perspective on learning offers one interpretation of how talk may influence learning. One consequence of social constructivism has been the development of strategies, such as 'scaffolding' which have been designed to assist a learner to achieve beyond their current competence through talking with a more knowledgeable other. This study contributes to understanding of 'scaffolding' in ITT through the use of ''talk molecules'. This study has shown that socio linguistics and speech acts can be used in conjunction with a social constructivist framework and together they can offer possibilities to reach deeper understandings of talk influencing learning to teach science. However, this study aimed only to offer some understanding of how talk may influence trainee's learning to teach science, and as such it is suggested that aim has been achieved.

10.5 Limitations of the study

This study provided useful insights into how a trainee may be influenced in learning to teach through talking with a science coordinator. It brought to light some of the linguistic features of talk which science coordinators used to influence trainees' learning and contextual factors which influenced these. However, there are several limitations noted. The limitations are considered in terms of the design and methodology which influenced the interpretation of the findings. The limitations are acknowledged to constrain the generalisability and application of the findings. The limitations are an opportunity to make suggestions for further research discussed in 10.8 although it is recognised that 'future directions are broader in scope than limitations because they are not necessarily bound in

the methodological characteristics of the research at hand' (Brutus, Aguinis and Wassmer, 2013, p.51).

The scale of this study was too small to make any generalisations about talk influencing learning to teach science a larger population of science coordinators and trainees. Two cases with two interviews and two meetings in each case provided a volume of data which was able to be compared and contrasted by an individual researcher but did not enable replication or differences to be found in several cases. Increasing the number of cases in the study was limited by my time availability within my full-time job. For example, I completed a pre-organised participant observation of a meeting for Case One before returning to University to engage in a meeting with ITT Ofsted Inspectors during the inspection of my programmes as the Head of ITT. Examining a larger number of dyads studied would enhance the transferability and generation of a 'fuzzy generalisation' (Bassey, 1999).

Only one University teacher training institution in England was included in this study. By limiting the study to this institution in one country, factors about participants, placement expectations and the courses that present in other provision cannot be assumed to have been accounted for.

The study was limited in terms of being temporally bound, having taken place when National Curriculum changes were taking place in England but before schools and science coordinators were familiar with them. The data were collected before the introduction of proposed new standards for mentors in schools in England and therefore their possible influence on ITT practices in primary schools during placements.

The study sample was confined to the talk of science specialist trainees and science coordinators, the study excluded talk between trainees and coordinators specialising in other subjects, such as mathematics or history. Talk between trainees and other curriculum coordinators would have given the study wider relevance and broader applicability. Similarly, linking the sample of trainee participants to those on the science specialism

excluded other trainees who may have experienced different talk spaces and talk journeys with science coordinators.

The selection of year 2 trainees excluded consideration of trainees at other developmental stages on undergraduate or postgraduate courses. The timing of the study placement for year 2 trainees was the same in both cases which limited the study in terms of the expected science topics taught by trainees during different terms of the academic year in England.

The study was limited to female participants. Both science coordinators and trainees were female which limited the study in terms of exploring different linguistic features and factors which may be evident between male – female and male – male dyads. The sample participants were identified using questions about specialism and location of school rather than the biological category of sex; male and female or ensuring the sample reflected the trainee population. Further research would enable possible differences related to the 'socially constructed category of gender' to be explored (Paltridge, 2012, p.18).

The age of the participants was similar and limited the study to both science coordinators being older than the trainees. Given possible differences in perceptions of ways of working with a learner who is older or younger than the more knowledgeable other, further research would address this limitation.

Data were not collected on talk between participants from non-observed interactions during lunch times or before or after school. The study relied on the selective memory of participants when recalling what they had talked about and when and where and their use of artefacts such as lesson plans and teaching resources as well their acts of attribution when attributing negative events and outcomes to external forces' for example the confusion over the External Examiner visit in Case One or the lack of time to observe others in Case Two (Xenikou, Furnham and McCarrey, 1997) which can lead to potential bias which is noted as a limitation. Collecting data from audio recorders left with participants to use independently may provide a methodological solution within boundaries of agreed ethical use by participants.

Although the findings inform on the linguistic features with reference to types of utterances and 'we-statements, the study is limited in its systematic recording and analysis of non-verbal behaviours within face to face interactions. Knapp and Hall (2006) argue that separating verbal and non-verbal behaviour is 'virtually impossible' (p.5). As the study used participant observation, this limited opportunities to write field notes at the time to aid memory of gestures, body movements, eye gaze changes to use in the interpretation of social factors influencing linguistic features. The use of video recorders may influence behaviours in a way that would jeopardize the internal validity.

The study has limitations in terms of not gathering the child's voice directly as part of the data on how talking to a science coordinator influenced a trainee's learning to teach science. There were no observations of or interviews with children who were taught by the trainees during the placement to support my interpretation of the influence of talk with a science coordinator. The interpretation of my results is constrained by my measure of influence (i.e. 'I-statements' in interviews with trainees). Because learning to teach science takes time and is complex, this measure does not allow drawing any conclusions about the long-term performance of trainees in the classroom.

The study diaries were used to gain data using a recall – minimising perspective of self-reported daily experiences about talk focusing on time, place and content over the four-week placement. A limitation of the study is the possibility of motivation influencing the self-reporting in the diaries. It is possible that variations in motivation to complete the daily task led to emergence of some entries and vice versa in not completing the task. The data collected and therefore my analysis was also limited by not asking participants in the diary protocols to reflect on their learning from specific verbal interactions. This would have also reduced the burden on participants. The possibility of backfilling diaries also constrains the interpretation of the influence of talk on learning to teach science.

A final limitation to be noted as of importance, is the influence of the External Examiner visit on talk. The influences of External Examiners in ITT placements do not appear to have been

investigated and it is thus possible that this visit in Case One led to the emergence of linguistic features and social factors which would not have been present if it had not occurred. Future research should focus on this social factor.

In summary, the study has illuminated the 'messiness' of research (Lambotte and Meunier, 2013). I started with a view that the study would be planned and take on a steady but clear path towards the research questions. It has not been so. In seeking to choose what to do and how to do there have been moments where I needed to reposition myself between science and social science in terms of the research process. I have been a bricoleur in taking ideas, often new to myself, and mixing them up to make new connections. I have had to identify the limitations of being a researcher living in my day to day practices and recognising that research involves dealing with trials and errors, hesitations, elusive and difficult to grasp ideas and that good research does not have to be linear and sequenced. Messiness has been personally physical, social and cognitive: the messy rooms and floors when sorting out papers and transcripts, the social messiness in finding some time to meet family and friends amongst the demands of reading and coding and the cognitive messiness when reconnecting or making new neurological paths to assimilate or deconstruct present understandings. Messiness has been in time management and time lines; managing personal time with time of others to undertake interviews and observations and accepting timelines to transcribe and code and read are much longer than planned. However, I overcame that messiness by developing systematic ways to plan, collect, analyse, interpret and report data and the evidence of that systematic approach is the thesis.

10.6 Implications for policy

Variation in trainee's experiences during placements has been identified in extant studies (Ferrier-Kerr, 2004; Young *et al.,* 2005). It was not surprising therefore that two trainees experienced different 'talk-spaces' consisting of different 'talk-molecules' during this study. It does suggest that there are some immediate implications for policy in a top –down model of ITT in England, where schools and ITT providers are informed about mentoring and supporting trainees and expected to adapt it within practice.

Changes in ITT policy may provide and protect 'talk spaces' to help leverage science coordinator's influence on trainees. National Mentor Standards (DfE, 2016a) recommend that mentors should 'support the trainee in accessing expert subject and pedagogical knowledge' (p. 12) which suggests that ITT providers need to encourage all curriculum coordinators in a school placement to be accessible to trainees to create 'talk –spaces' alongside the classroom teacher who is nominated as the mentor. ITT policy needs to focus on a model that values 'talk-spaces' which promote learning to teach specific subjects. This study indicates that it may be beneficial for ITT providers and schools to reframe their expectations for mentors and trainees and ensure talk is extended to other teachers, in particular, science coordinators. The present policy on one mentor for a primary trainee teacher reduces opportunities to build a community of subject specific mentors for trainee during a placement (McNamara *et al*., 2017).

There were differences in the quantity, duration and location of 'talk spaces' in this study. These differences may influence learning to teach science and therefore those who provide and monitor initial teacher training and mentor training should clarify the expectation for consistency in 'talk spaces' for science coordinators and trainees.

10.7 Implications for practice

Those who provide and monitor initial teacher training should consider providing training to trainees, science coordinators and mentors on linguistic features of talk and factors which may influence these. In addition, operational changes in placements may enable science coordinators to focus on different topics at particular points in the training programme supported by different types of utterances and opportunities for them to work together with a trainee, for example in planning a lesson, to provide a scaffolded linguistic approach to learning alongside collaborative activities.

In this study, 'talk molecules' provided useful insights into talk between a science coordinators and trainees within the different contexts of the placements. The analogy may support the identification of different practices for science coordinators when talking to trainees in terms of considering which topics to talk about, and when, including which types

of utterances - information, instructions and questions – and the use of 'we-statements' may lead to effective learning to teach science.

10.8 Opportunities for further research

This study identifies that talk between a science coordinator and trainee is a rich topic for further study. Three particular aspects are identified:

Firstly, the study of two cases was reasonable for a single researcher but further cases could add weight to the findings. The additional cases would also offer the opportunity to specifically explore the following factors - specialism of the trainee and gender and age of participants - influence on learning to teach science.

The second area for further study concerns the effects of an External Examiner visit. This study found that the expectations and preparations for the EE visit influenced Trainee 1 in terms of her lesson planning, resource development and time to meet Science Coordinator 1. Science Coordinator 1 made the decision for Trainee 1 to only focus on preparing for the EE visit. There were no extant studies identified so further study would enable ITT providers to consider the impact of these visits on trainees' learning. It is possible that trainees' learning to teach is negatively or positively influenced by assumptions and actions taken by school-based staff in preparation for these visits.

The third area for further study concerns the influence of the location of a placement within an ITT programme in terms of the timeline over an academic year. This study found that both trainees had previously taught biology science topics and were both teaching physical topics although in different key stages in the study placements which took place in the summer term of the academic year. Given recent changes to the primary NC Science, it would be worthwhile to consider if learning to teach science is influenced by the order of science topics taught.

10.9 Personal Learning

My professional identity as a science teacher built over years in response to professional roles including being a secondary science teacher and local authority science advisor. However, another identity has been emerging slowly since moving into Higher Education in 2006: my 'academic identity' (Roberts, 2014). It competes though with the demands of everyday tasks within my full time role as Head of ITT although my PhD has enabled the blending of past, present and future professional roles (Batchelor and Mohamed, 2008).

As a part- time PhD student, opportunities to take extended times to read and engage in data collection were challenging. Summarising notes, coding transcripts and taking time to reflect on findings and interpretations of data meant actions had to be systematically planned and implemented. My good time management skills were of benefit to this study as well as developing a perspective that teaching and research are not opposing elements which time and energy limitations force me to choose between (Roberts, 2014). Engaging with the community of other PhD students has been another facilitator of my academic identity and presenting interim findings from this study at European Conference on Educational Research (ECER), 2015 was a further provocation to thinking and challenging assumptions (Batchelor, 2015).

This study has challenged my ontological and epistemological perspectives. As a learner of concepts associated within the field of physics, I viewed 'reality' from a predominantly positivist perspective. Physics is 'rooted in fact and experiment' and whilst shifts in thinking about laws of physics can be accommodated these take time (Baker, 2007, p.3). However, as a science teacher, I accepted social constructivism as a dominant paradigm of teaching and learning in science (Jenkins, 2000; Palmer, 2005); children and adults can and do hold multiple and different understandings of scientific concepts and experienced others support learners through their ZPD. This study has challenged my epistemological understanding of learning and deepened my understanding of the interconnecting methodologies and methods used to enquire phenomena in fields of social sciences and natural sciences.

My engagement with a qualitative study has had two advantages. Firstly, adopting a positivist perspective and using a survey approach would not have provided first hand experiences of collecting data on talk between a trainee and science coordinator. Secondly, this study enabled the development of a conceptual framework post data collection and analysis. A positivist approach would have demanded the identification of possible variables and hypothesis to test in the data which may have missed some of unique aspects found in each case. I have developed my knowledge and understanding of concepts which may identify, describe and explain theories associated with talk and learning although I feel as if I am just arriving at the first stop of a very long bus journey of learning (Cardona, 2005). I also recognised that I need to introduce 'numbers' to support my understanding of the 'words' spoken by participants and my future research identity will need to this into account to develop an authentic self (Roberts, 2014).

10.10 Summary

In summary, the study has contributed to an understanding of how primary teacher trainees learn to teach science through talk with primary school science coordinators. It points to possible 'talk spaces' consisting of different 'talk- molecules' where science coordinators might influence trainees thinking and actions, achievements and feelings about PCK and Context with reference to science. The study indicates the importance of fostering such 'talk spaces' in ITT. Findings from this study indicate there may be value in aligning a government agenda for a school based ITT with opportunities for science coordinators to influence trainee teachers' learning.

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APPENDICES

Appendix 1 - Teachers' Standards

PREAMBLE

Teachers make the education of their pupils their first concern, and are accountable for achieving the highest possible standards in work and conduct. Teachers act with honesty and integrity; have strong subject knowledge, keep their knowledge and skills as teachers up-to-date and are self-critical; forge positive professional relationships; and work with parents in the best interests of their pupils.

PART ONE: TEACHING

A teacher must:

1. Set high expectations which inspire, motivate and challenge pupils

- Establish a safe and stimulating environment for pupils, rooted in mutual respect
- Set goals that stretch and challenge pupils of all backgrounds, abilities and dispositions
- Demonstrate consistently the positive attitudes, values and behaviour which are expected of pupils

2. Promote good progress and outcomes by pupils

- Be accountable for pupils' attainment, progress and outcomes
- Plan teaching to build on pupils' capabilities and prior knowledge
- Guide pupils to reflect on the progress they have made and their emerging needs
- Demonstrate knowledge and understanding of how pupils learn and how this impacts on teaching
- Encourage pupils to take a responsible and conscientious attitude to their own work and study

3. Demonstrate good subject and curriculum knowledge

- Have a secure knowledge of the relevant subject(s) and curriculum areas, foster and maintain pupils' interest in the subject, and address misunderstandings

- Demonstrate a critical understanding of developments in the subject and curriculum areas, and promote the value of scholarship
- Demonstrate an understanding of and take responsibility for promoting high standards of literacy, articulacy and the correct use of standard English, whatever the teacher's specialist subject
- If teaching early reading, demonstrate a clear understanding of systematic synthetic phonics
- If teaching early mathematics, demonstrate a clear understanding of appropriate teaching strategies.

4. Plan and teach well-structured lessons

- Impart knowledge and develop understanding through effective use of lesson time
- Promote a love of learning and children's intellectual curiosity
- Set homework and plan other out-of-class activities to consolidate and extend the knowledge and understanding pupils have acquired
- Reflect systematically on the effectiveness of lessons and approaches to teaching
- Contribute to the design and provision of an engaging curriculum within the relevant subject area(s)

5. Adapt teaching to respond to the strengths and needs of all pupils

- Know when and how to differentiate appropriately, using approaches which enable pupils to be taught effectively
- Have a secure understanding of how a range of factors can inhibit pupils' ability to learn, and how best to overcome these
- Demonstrate an awareness of the physical, social and intellectual development of children, and know how to adapt teaching to support Pupils' education at different stages of development
- Have a clear understanding of the needs of all pupils, including those with special educational needs; those of high ability; those with English as an additional language; those with disabilities; and be able to use and evaluate distinctive teaching approaches to engage and support them

6. Make accurate and productive use of assessment

- Know and understand how to assess the relevant subject and curriculum areas, including statutory assessment requirements
- Make use of formative and summative assessment to secure pupils' progress
- Use relevant data to monitor progress, set targets, and plan subsequent lessons
- Give pupils regular feedback, both orally and through accurate marking, and encourage pupils to respond to the feedback

7. Manage behaviour effectively to ensure a good and safe learning environment

- Have clear rules and routines for behaviour in classrooms, and take responsibility for promoting good and courteous behaviour both in classrooms and around the school, in accordance with the school's behaviour policy
- Have high expectations of behaviour, and establish a framework for discipline with a range of strategies, using praise, sanctions and rewards consistently and fairly
- Manage classes effectively, using approaches which are appropriate to pupils' needs in order to involve and motivate them
- Maintain good relationships with pupils, exercise appropriate authority, and act decisively when necessary

8. Fulfil wider professional responsibilities

- make a positive contribution to the wider life and ethos of the school
- develop effective professional relationships with colleagues, knowing how and when to draw on advice and specialist support
- deploy support staff effectively
- take responsibility for improving teaching through appropriate professional development, responding to advice and feedback from colleagues
- communicate effectively with parents with regard to pupils' achievements and well-being.

PART TWO: PERSONAL AND PROFESSIONAL CONDUCT

A teacher is expected to demonstrate consistently high standards of personal and professional conduct. The following statements define the behaviour and attitudes which set the required standard for conduct throughout a teacher's career.

- Teachers uphold public trust in the profession and maintain high standards of ethics and behaviour, within and outside school, by:
    - Treating pupils with dignity, building relationships rooted in mutual respect, and at all times observing proper boundaries appropriate to a teacher's professional position
    - Having regard for the need to safeguard pupils' well-being, in accordance with statutory provisions
    - Showing tolerance of and respect for the rights of others
    - Not undermining fundamental British values, including democracy, the rule of law, individual liberty and mutual respect, and tolerance of those with different faiths and beliefs
    - Ensuring that personal beliefs are not expressed in ways which exploit pupils' vulnerability or might lead them to break the law
- Teachers must have proper and professional regard for the ethos, policies and practices of the school in which they teach, and maintain high standards in their own attendance and punctuality.
- Teachers must have an understanding of, and always act within, the statutory frameworks which set out their professional duties and responsibilities.

Appendix 2 – Modules in BA Primary Programme during period of study

All modules are identified by a numerical code following ITT. Placement modules are identified by the addition of P. 2b Placement is coded as ITT2036P

Year 1 Modules

Code	*Title*
ITT1001	Professional Studies 1
ITT1026P	School Experience 1a
ITT1027P	School Experience 1b
ITT1023	English 1
ITT1021	Mathematics 1
ITT1024	Science and Design and Technology1
ITT1004	Primary Foundation Subjects 1
ITT1025	RE/PSHE and Computing/Technology Enhanced Learning 1
ITT1005	Subject Specialism 1 – History
ITT1006	Subject Specialism 1 – English
ITT1007	Subject Specialism 1 – Maths
ITT1008	Subject Specialism 1 – Science
ITT1009	Subject Specialism 1 – PE

Year 2 Modules

Code	*Title*
ITT2001	Professional Studies 2
ITT2034P	School Experience 2a
ITT2036P	School Experience 2b
ITT2030	English – 2
ITT2033	Mathematics -2

ITT2031	Science and Design and Technology 2
ITT2039	Foundation Subjects 2
ITT2037	Computing/Digital Literacy and RE/PSHE
ITT2017	Subject Specialism 2– History
ITT2018	Subject Specialism 2 – English
ITT2019	Subject Specialism 2 – Maths
ITT2015	Subject Specialism 2 – Science
ITT2020	Subject Specialism 2 – PE

Year 3 Modules

Code	*Title*
ITT4001	Principle Module
ITT3020	Professional Studies 3
ITT3025P	School Experience 3
ITT3022	English 3
ITT3023	Mathematics 3
ITT3021	Science 3
ITT3005	Subject Specialism 3 – History
ITT3006	Subject Specialism 3 – English
ITT3007	Subject Specialism 3 – Maths
ITT3008	Subject Specialism 3 – Science
ITT3009	Subject Specialism 3 – PE

Appendix 3 – Directed tasks for 2b placement

There were directed tasks in the School Experience Booklet and the Leadership Booklet during 2013-14 and 2014-15.

1. All trainees were issued with a 2b School Experience Booklet which included information on the tasks to be completed with the relevant subject coordinator for their specialism.

a. Complete an observation schedule of the teaching of your specialism across KS1, KS2 and, if appropriate, Foundation Stage.
b. Observe and reflect on your specialism taught across the school.
c. Meet with specialism subject leader.

2. All trainees were issued with a 2b Leadership School Experience Booklet.

During your school experience, arrange to meet the science subject leader as well as observations and talking to other staff to find out about the scope for taking science "out of the classroom".

a. Consider the context, contacts, geography and any other aspects which can affect this.
b. If there are occasions where science is taken out of the classroom (trips or scheduled lessons) during your school experience, evaluate these as learning episodes and consider how effective these have been. What are the implications for this in the whole school? Does the science leader have a role to play, and if so, what?
c. If there are no occasions where science is taken out of the classroom (trips or scheduled lessons), action plan to consider how this might be done, with anticipated learning intentions and scope. What would be the implications of this for the whole school? Could the science leader have a role to play, and if so, what?

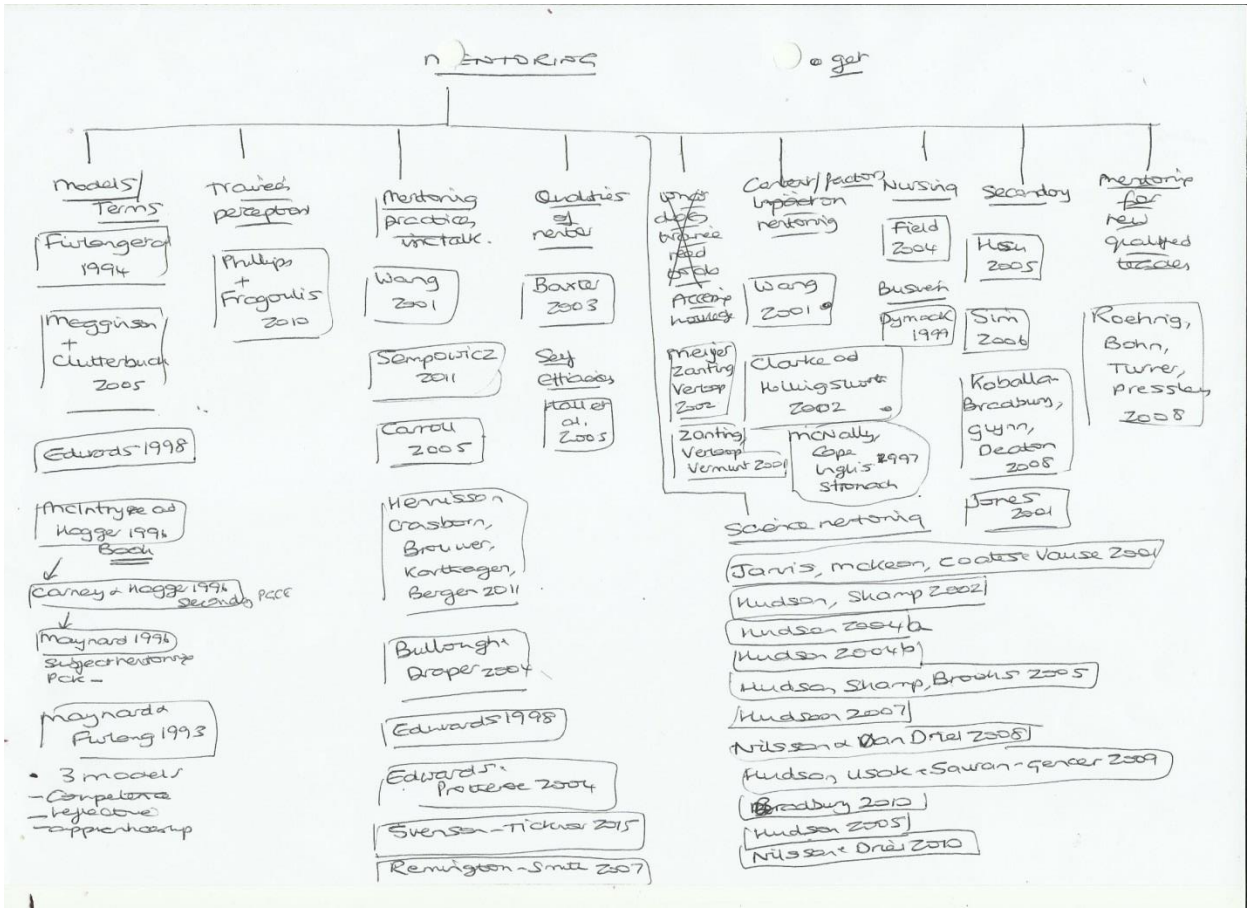
Appendix 4 – Types of science enquiry

Key stage 1 programme of study - years 1 and 2 (DfE, 2013)

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking simple questions and recognising that they can be answered in different ways
- observing closely, using simple equipment
- performing simple tests
- identifying and classifying
- using their observations and ideas to suggest answers to questions
- gathering and recording data to help in answering questions

Appendix 5 – Example of a Literature Map



Appendix 6 – Ethics summary points

BERA (2011)	**Method to address each point.**
Responsibility to Participants. BERA 8 and 9	Participants were considered as active subjects. The study was not about gaining privileged knowledge about the participants, nor just about satisfying personal curiosity, nor gaining prurient data or trying to carry out an 'experiment' (Denscombe, 2010, p.49).
Voluntary informed consent. BERA 10	Voluntary informed written consent was sought from each participating primary science coordinator and each participating trainee teacher before any interviews and observations were conducted and recorded. I provided the Headteachers with details on how to contact me after providing them with information about the study and waited over 48 hours to ask for their verbal consent after the initial contact to discuss participation. Neither of the Headteachers provided written consent but both were met face to face in their schools after verbal consent was given to request again their consent. Both Headteachers confirmed their consent for their teachers and schools to be involved which was considered within BERA (2011) guidelines. Given the high level of participant involvement a contract (Simpson and Tuson, 1995) based on 'informed consent' (Bell, 2005, p.45) was given to the trainees and science coordinators. It provided details in terms of time, what will be studied and what data will be stored and shared with participants (Opie, 2004) as well as a guarantee of confidentiality and anonymity.
Participants understand the	Letters were provided to schools and trainees about the nature and purpose of the study including its methods, the expected benefits

process in which they are to be engaged. BERA 11	to themselves, other trainees or science coordinators, possible harm to themselves and their school and a statement that made clear the separation of my role of Head of ITT and researcher. After providing time for the participants to read the content of the study details, they were asked to provide verbal assurance of their understanding of what it entailed and the implications of participating. After this, each participant voluntarily signed the consent form.
Impact of dual role as researcher and Head of ITT. BERA 12	The study was not action research however, a key ethical issue concerned the impact of my role, as the Head ITT, on the wellbeing of the participants to 'reduce intrusion and minimise risk of harm' (Denscombe, 2010, p.103). It was important that my roles as a researcher and a university lecturer were kept clear and separate. I acknowledge this was not fully possible though as I engage in lectures throughout the course where the trainee participants are present and I am responsible for discussing all trainee progress with appropriate staff and monitoring school involvement. I was aware of the power that I have as Head of ITT and started the study with the premise that a power imbalance existed between me and the trainees (Creswell, 2014). I recognised perceived risks to schools who engaged with this research given my role as Head of ITT which may have related to making their practices available for study. I recognised the risks to the primary science coordinator's position in their school. Researching talk in the workplace context means acknowledging that people are very aware of the need to protect their relationships with colleagues as well as information that may be

	talked about. I was aware that I was at times 'on and off' as a researcher during my visits to the school; 'the quality of social interactions may facilitate or inhibit access to information' (Orb, Eisenhauer and Wynaden, 2000, p.93) The ethical standards (BERA, 2011) were used to inform my behaviours and the complicated business of getting knowledge on people (Griffiths, 1998) during a visit to a school during a placement which were not part of the normal practices in visiting a school to observe and talk to a mentor and trainee.
Openness and Disclosure. BERA 14	No data was collected until voluntary informed consent gained. If illegal or harmful behaviours were reported by participants, these would be reported to the supervisors before considering disclosure.
Right to Withdraw. BERA 15	In order to ensure voluntary consent, the participants were given details about the goals of the study and their rights to withdraw throughout the project. I informed the participants they were not obliged to respond to all questions and they could stop an interview or observation at any time. If the science coordinators had moved schools to another post during the study, there was not an assumption that the study would continue with them.
Children, Vulnerable Young People and Vulnerable Adults. BERA 16, 17 and 18	I was not involved in the assessment of the trainees during their placements. I did not discuss them with other colleagues who may be involved in their assessment. This addressed a potential issue of adding undue pressure on the trainee.
Legal requirements in relation to children	Using digital tape recorders in the workplace where children who are vulnerable required careful consideration. There was a

and vulnerable young people and adults. BERA 19	continual alertness to the changing context in the school. If there were any interruptions by staff or children to the interviews or meetings the tape recorders were stopped or the data was not used. Trainees were provided with information on being able to talk confidentially to a named tutor in a different department to mine if at any time they felt pressurised or concerned. This tutor was assured by me that they would be able to raise issues with me in a comfortable and ethically assured manner.
Sense of intrusion and ease. BERA 20	Participants were not expected to respond adversely to the interviews or observations however in case they did become distressed, as an experienced Higher Education tutor, I aimed to respond in a sensitive and appropriate manner which included rephrasing questions and pausing the audio recording.
Impact of research on normal working and workloads of participants. BERA 21	I needed to ensure I did not overburden the participants in terms of their normal workload. Interviews and observations were carried out in an accessible, safe and comfortable place in the school but where they could not be overheard by children or other adults in the school.
Incentives. BERA 22	No incentives were used. I made it clear that 'that participants are doing the researcher a great favour by volunteering to be part of the study' (Miles *et al*., 2014, p.60).
Detriment. BERA 23 and 24	I recognised perceived risks to schools who engaged with this research given my role as Head of ITT which may have related to making their practices available for study. I recognised the risks to the primary science coordinator's position in their school. Researching talk in the workplace context means acknowledging that people are very aware of the need to protect their relationships with colleagues.

	I ensured that trainees were not pressurised to take part simply because a science coordinator had agreed. In addition, I ensured that the contact I had with the participant trainees was not different to any other trainee in terms of teaching or assessment requirements for their programme. Other trainees may have felt that the participants were in a privileged position, if they knew about their involvement, therefore I ensured there was no preferential treatment of the trainees.
Privacy. BERA 25	I was not involved in the assessment of the trainees during their placements. I did not discuss them with other colleagues who may be involved in their assessment. This addressed a potential issue of adding undue pressure on the trainee. Participants' privacy was protected through anonymity by not naming them and not providing information which would reveal their identity. Secondly by providing confidentiality. Trainees were given training on how to record information about children as part of pre-placement lecture to ensure the privacy of data. Information disclosed about children's families/carers during interviews and meetings was considered as personal and potentially sensitive. The rights to privacy were recognised and accorded rights to confidentiality and anonymity.
Storage of data. BERA 26, 27 and 28	I informed the participants how electronic and paper based data would be stored. I informed the participants that I would retain the data for as long as it takes to disseminate the study in a manner

	congruent with good scholarly practice taking into account the time it takes to get papers published. Data collected as part of the research process was only accessible to me and my supervisors.
Disclosure. BERA 29 and 30	Should the researcher uncover matters or have matters disclosed to them, that are of wider concern about the trainee (e.g. participant's involvement in criminal offences, illness or a condition in respect of which the participant may not have been aware of initially), trainees will already have been made aware that the researcher would follow the same procedures that are presently in place for all trainees – i.e. advice would be given on where to seek support within the University systems and personnel.
Disclosure. 31	Participants will be contacted at the conclusion of the research to provide a debrief of the PhD.

Appendix 7:

Interview One Questions – Trainee

1. What science have you taught so far? (this placement and before) What will you be teaching here?

2. Have you talked to science leaders/coordinators before in previous placements? What, when, where and why did you talk about? Did you ask specific questions? How did they talk to you?

3. What do you think a science leader/coordinator may provide for you as a trainee teacher?

4. What do you know about these things in relation to learning to teach science? (how are you learning about them?)

- resources
- schemes of work
- assessment
- teaching strategies
- aims of science learning in primary schools
- subject knowledge

5. Have you observed a science leader/coordinator teaching science?
(What did you learn from this?)

6. What have you learnt so far about teaching science? What do you need to learn to teach it well? How do feel about teaching science?
(how have you learnt this, who has helped your learning?)

7. Can you draw how you think you have talked and will talk to the science coordinator over the teaching practice.

Interview Two - Trainee

1. What science subject knowledge did you wish to learn to make sure you can teach Keystage Two/One science well ? (how do you know if you have this subject knowledge or if it has improved?) (how did the science coordinator help?) (Are you more confident and competent?).

2. What science skills did you wish to learn to make sure you can teach science well in Keystage Two/One? (how do you know if you have these skills or if they have improved?) (how did the science coordinator help?) (Are you more confident and competent?).

3. How do you think you have been learning to teach science ? (what has been the role of the science coordinator?)(how do you like to learn?) (do you think you can learn or will it be instinct?).

4. What do you think you need to learn in order to assess learning in science ? (why do you need these, is there a difference in what is needed to learn to teach science compared to teaching maths or history ?) (how has the science coordinator helped you to see any differences or not between science and other subjects (if there are any?)

`

5. What particular words or phrases or questions or information have you noted that have
   a) Supported you learning to teach science ?
   b) Challenged you when learning to teach science?
   (do you feel like it has been meetings, or talks, or conversations – how would you describe it ?)

6. What do you think have been the most important factors in helping you during this teaching practice to learn to teach science ? (list them, why)
7. Checklist overleaf

Have you learnt about these – and if so how ?

Aims of this school in relation to science	
Targets within this school in relation to science (including levels of achievement , teaching strategies, assessment, resources)	
Science resources	
Planning for science • National Curriculum content (new and present) • Medium term plans in KS2 for science or lesson plans	
Teaching and Learning in science • Strategies to teach KS1/KS2 children AT1, AT2, AT3, AT4	
Assessment of science learning • KS1 • KS2 • Transition points (being scientifically ready for KS3)	
How science learning is recorded / presented • Learning logs, interactive working walls, written work	
Understanding what is 'science in primary schools'	
Science Subject Leader role	

8. Draw a shape to show your talk with the science coordinator – at the start of placement and now.

Interview One -Science Coordinator

1. What science topics/themes have the children been learning this year? What topics will the trainee be involved in during this placement?

2. How would you describe your role as the science leader/coordinator in the school overall?

3. What do you think science leaders/coordinators may provide to trainees as part of their learning to teach science?

4. What do you think trainees expect from science leaders/coordinators?

5. Do you provide information or guidance on the following in relation to learning to teach science?

- resources
- schemes of work
- assessment
- teaching strategies
- aims of science
- subject knowledge

6. During a placement would you expect to talk to trainees? What, when, where and why would you talk to them? Do they ask particular questions?

7. Have trainees observed you teaching science? Have you observed trainees teaching science?

8. What do think trainees need to learn to be able to teach science?

9. Can you draw how you think you have talked and will talk to a trainee during a teaching practice.

Interview Two - Science Coordinator

1. What science subject knowledge did you wish Trainee to learn to make sure she can teach Keystage Two science well ? (how do you know if she has this subject knowledge or has improved?)

2. What science skills did you wish her to learn to make sure she can teach science well in Keystage Two? (how do you know if she has these skills or has improved?)

3. How do you think she has been learning to teach science ? (what has your role been as science coordinator?)

4. What do you think she needs to learn in order to assess learning in science ? (why does she need these, is there a difference in what is needed to learn to teach science compared to teaching maths or history ?)

5. What particular words or phrases or questions or information have you used to

a) <u>Support</u> Trainee's learning to teach science

b) <u>Challenge</u> Trainee' learning to teach science
(do you feel like it has been meetings, or talks, or conversations – how would you describe it ?)

6. What do you think are the most important factors that help a student during teaching practice to learn to teach science ?
(list them, why)

7. Checklist overleaf

Has the trainee learnt about these – and if so how ?

Aims of this school in relation to science	
Targets within this school in relation to science (including levels of achievement , teaching strategies, assessment, resources)	
Science resources	
Planning for science • National Curriculum content (new and present) • Medium term plans in KS2/KS1 for science or lesson plans	
Teaching and Learning in science • Strategies to teach KS2/KS1 children AT1, AT2, AT3, AT4	
Assessment of science learning • KS1 • KS2 • Transition points (being scientifically ready for KS3)	
How science learning is recorded / presented • Learning logs, interactive working walls, written work	
Understanding what is 'science in primary schools'	
Science Subject Leader role	

1. Draw a shape to show your talk with Trainee– at the start of placement and now

Appendix 8- Template for Participants' Diary

The template was discussed in the first interview with each participant.

Verbal instructions were given - use this as a template – but please feel welcome to write as prose, or email, or merge the prompts together.

Day	Time of meeting	Place of meeting	How long did you talk ?	What did you talk about ?	What do you remember about any words or phrases that were said by you or said to you ?	Reflection on learning to teach science ?

Appendix 9– Consent Form for Science Coordinator

The form was sent via email to the participants and then provided in the first interview. The statements were discussed before participants signed.

Informed written consent for primary science coordinator

A study into the talk between a science coordinator and trainee.

Year 2b BA Primary School Experience 2015

Name .....

School .....

Please tick if you agree to the following:

I have read the details about the study and I understand the nature and purpose of the study	☐
I understand there will be three observations, two interviews and the writing of a reflective diary	☐
I understand that I may withdraw at any time without a reason	☐
I understand that my name and the school name will be kept confidential and anonymised	☐
I agree to the data being kept for as long as needed to complete the study and publish papers	☐
I understand that I can ask for the material related to me to be only used for the PhD study	☐
I understand that I can ask for the material related to me to be withdrawn from the study	☐
I have talked to my Headteacher about this study and they agree to my participation	☐

I agree to participate in the study.

Signed ..... Date .....

Appendix 10– Placement Expectations for mentors

All ITT Mentors in the study University are provided with training about the expectations for their role during a placement. This is an extract from the Mentors' Handbook.

The Role of the Mentor

The mentor is the class teacher with whom the trainee is placed. The mentor is a teacher with at least two years' experience who has attended mentor training within the last year.

The mentor will:

- Support the trainee in a positive and professional manner in order to support them successfully demonstrating the Teachers' Standards.
- Demonstrate the Teachers' Standards, in particular, Section 2.
- Negotiate teaching and observation opportunities and provide opportunities for trainees to engage with assessment of children.
- Observe the trainee and complete a written observation form at least once a week, identifying areas to develop and actions to achieve set targets, with referencing to the Teachers' Standards.
- At the end of each week hold a tutorial with the trainee to review progress and set targets for the following week (on the Weekly Review & Target Setting sheet) which provide the focus for future observations.
- Monitor the trainee's planning, assessment and evaluation, including ensuring pre-placement planning is satisfactory.
- Liaise with the school-based ITT Co-ordinator about the trainee's progress and development and alert the University if any trainee is giving cause for concern following a formal observation by the school-based ITT Co-ordinator.
- Monitor the development of the trainee's School Experience File.
- Assist the trainee in the development of his/her Record of Professional Development and evidence of the Teachers' Standards.

- Write a formative and summative report on the trainee at the end of a school experience including setting targets.
- Grade trainees on a weekly basis against the Teachers' Standards and overall, at the end of his/her placement using the criteria published by UoN, as appropriate to the particular placement.
- Act in a fair and even-handed way seeking guidance from school-based ITT Co-ordinator or University as required.
- Follow the Cause for Concern procedure if necessary.
- Complete an evaluation form for the school experience.

Appendix 11 – Case One Diary Entries for 'talk spaces'

The data from the diaries written by participants in Case One were summarised in the table below.

Talk Nos.	Date	Time started	Time – according to T1	Time – according to SC1	Place *	Comment
1	27/05/14	10.00am	3 hours	3 hours	C	Took place during half term
2 3	02/06/14	3.30pm 4.15pm	10 mins 10 mins	10 mins 10 mins	C C	
4	03/06/14	12.00pm	5 mins	5 mins	C	No start time recorded by SC1
5	04/06/14	4.00pm	5 mins	Mins	C	No quantity of time recorded by SC1.
6	05/06/14	2.00pm	30 mins	10 mins 20 mins	S S	Recorded as different quantities of time. Different topics recorded
7 8 9	05/06/14	4.35pm 4.55pm 5.00pm	20 mins 15 mins 5 mins	15 mins 15 mins 5 mins	S C C	
10	09/06/14	Short periods (2 mins) all day	2 -5 mins		SF / C	Different day recorded,
10	10/06/14	Ongoing few minutes each time 4.20pm		Mins Few mins	SF/ C C	
11	11/06/14	8.00am	10 mins off/on	Few mins	C	
12	12/06/14	1.00pm	2 hours	2 hours	S	T1 only recorded location
13	18/06/14	8.30am		5 mins	C	Different start time recalled
13	18/06/14	8.45/9.00am	2 mins		H/C	
14	18/06/14	4.15pm	5 mins		C	Different start time recalled
14	18/06/14	4.00pm		5 mins	C	
15	19/06/14	8.00am	10 mins		C	

Appendix 12 – Case Study One - Skeleton Overview Meeting One

1. Completing the diaries Re
2. Responding to phone calls from University and impact EE
3. Completing the diary – time, location Re
4. Planning for EE visit EE
5. Describing how they talked and the shape of talk Re
6. Completing the diary – location Re
7. Completing the diary – length of time talked, writing them together Re
8. Mantra of science coordinator, carrot SC
9. Completing the diary Re
10. Class teaching for trainee not group work PE
11. Starting a lesson using the register As
12. Levelling packs for resources As
13. Impact on learning – using register as afl As
14. Other afl techniques – examples to prompt pacey learning As
15. Structure of observed lesson – use of clock Pl
16. Mind mapping incident recalled - feedback Fe
17. HOTs and MOTs Te
18. Examples of mind maps Ro
19. Weekly review target set PE
20. Organisation of class for science observed lesson – use of TA, group organisation Pl
21. Issue of timing – 1 hour long, use of clock Pl
22. Problems with internet access Sl
23. Lesson description – use of packs Ro
24. Website issue Sl
25. Resourcing for lesson Ro
26. Pedagogy in KS1 – questions and discussions, bring them back Pl
27. Time and length of lesson Pl
28. Scientists and resources for observed lesson Ro
29. Lesson objectives – how to construct them As
30. Confusion from Uni on observed lesson – feelings about the lesson EE
31. Lesson plan and resources for observed lesson Pl
32. Planning for specific children and responding to them Ch
33. School practices (use of post it notes) and response to Ofsted Sl
34. Priority for the lesson – target from previous placement, pace PE
35. Follow up lesson after EE PE
36. Negative impact on changes in planning lesson EE

Appendix 13 - Case One Emerging topics from Meeting One and Meeting Two

Emerging topics in Case One	These are 'topics' in sequences of utterances	Frequency of topic occurring In Meeting One	Frequency of topic occurring in Meeting Two
Planning – talk related to before teaching has occurred	Structure of observed lesson – use of clock Issue of timing – 1 hour long, use of clock Time and Length of lesson Lesson plan and resources for observed lesson Organisation of class for science observed lesson – use of TA, group organisation Pedagogy in Keystage One – bring them back Priorities for final week – ideas on enquiries Planning for final week Ideas on what to do in final week What to do next week Tasks for final week Decisions on tasks for final week	6	6
Teaching – talk related to teaching after it has occurred	HOTs and MOTs (use different activities) Differences in teaching different topics Bubbles – previous practical lesson recalled How long it took to plan lesson	1	3
Resources – (talk related to before, during and after teaching has occurred)	Examples of mind maps Resourcing for lesson Lesson description – use of packs Scientists and resources for observed lesson Resourcing for a lesson Value of resources – manipulating them Connections game Making use of resources Scientists in packs – relevance to children	4	6
Assessment	Starting a lesson with the register Impact on learning – using register as AfL Leveling packs of resources Other afl techniques – examples to prompt pacy learning Lesson objectives – how to construct them Learning objectives – how they were assessed Use of questioning by the trainee with children Mr Gove and assessment Attainment targets Attainment target and APP	5	5

Emerging topics in Case One	'topic' of talk in sequences of utterances	Frequency of topic occurring In Meeting One	Frequency of topic occurring in Meeting Two
School 1 Practices	Problems with internet access Website issues School practices and response to Ofsted Activities in the school (parents' evenings)	3	1
Placement expectations	Class teaching for trainee not group work Weekly targets and reviews Priorities for the lesson – target from previous placement on pace Follow up lesson Target from observation Conflict between placement length and focus and expectations for trainees	4	2
Children	Planning for specific children and responding to them Children's responses in observed lesson with EE Knowledge of children and matching to scientists Making science accessible to all children – EAL and SEND Responding to all groups during lesson Matching resources to children	1	5
Science Coordinator 1 practices	Mantra of Science Coordinator 1 – carrot Supporting trainee in preparing for externally observed lesson Reflection on support provided Facts on scientists versus practical work	1	3
Feedback and Judgement made by Science Coordinator 1 about Trainee 1	Mind mapping incident recalled - feedback Feedback on observed lesson Wrong use of app in observed lesson/ ways to improve app External Examiner feedback Feedback on use of time in observed lesson – buy time Feedback on timing and differentiation Feedback - being brave Feedback from children Feedback on differentiation Feedback on differentiation and questioning	1	**10**
External Examiner (EE) visit	Planning for EE visit Responding to phone calls from University and impact Confusion from University on observed lesson Negative impact on changes in planning lesson	4	0
Research related	Completing the diaries Completing the diary – time, location Completing the diary – location Completing the diary – length of time talked, writing them together Completing the diary Describing how they talked and the shape of talk	6	0
Totals	Total number of topics in meetings	36	41