Chapter 3 Methodology and Research Methods

Evaluation as a methodology

To determine the nature of deep subject knowledge and the impact of the MaST programme on participants' knowledge, I considered a form of evaluation as an appropriate research methodology to use. I partly based this on my experience as an Ofsted inspector and curriculum advisor, gathering evidence and making judgements to carry out educational evaluations. I agree with Bennett (2003) that educational evaluation involves the appraisal of an educational programme to determine the effectiveness of the programme while it is being implemented or for improving the programme as it is being developed.

Eisner (1985) discusses the approach of an evaluator as a connoisseur and a critic.
He highlighted the importance of the relationship between evaluator and subject (teacher in this case), with the evaluator seen by the teacher as someone who is knowledgeable about their subject and who can help support them in achieving their aims. This is a very different view to the scientific, objective approach favoured by Rossi *et al.* (2004), although a connoisseur is not too far removed from their view that the credibility of an evaluation is largely determined by the expertise of the external evaluator. I do have the expertise and experience required to be a credible evaluator, but I will be seen as an 'outsider', with the participants perhaps not actively seeing themselves as part of the evaluation process. Patton (2008) views the success of an evaluation as being dependent on the extent to which the programme stakeholders take ownership of the evaluation process so that they are actively involved in working on the evaluation findings. In the case of this study, the stakeholders are, broadly speaking, the MaST participants, the pupils in the class and school, the headteacher and the rest of the staff. However, the research focus is specifically on the impact of the MaST programme on the participants' deep subject knowledge, so the main stakeholder involved in the process is therefore the participant.

Prior to the collection of data through interview and observation I involved the participants in the evaluation process. I discussed the aims of the research, the approaches used and the intended outcomes. I also encouraged them to make suggestions on possible alternative sampling methods or ways they could help support the research aims. For example, one of the teachers wanted me to observe another teacher in a team-teaching situation to evaluate her subject knowledge. The richness and depth of the data collected, particularly in the interviews, was dependent on the willingness of the participants to share their views and answer questions openly and honestly. A positive, open relationship with the participants was

essential, which I attempted to maintain throughout the evaluation process through visits, email and telephone contact.

A range of approaches to evaluation is possible, from a positivist, quantitative, scientific model through to a more naturalist, qualitative, interpretivist standpoint. For this evaluation I favoured a qualitative approach, using observation and semi-structured interviews to gather data. I used a summative evaluation model, with the four levels of Kirkpatrick's layered evaluation model (Kirkpatrick and Kirkpatrick 2006) being appropriate for this study (Table 3.1). Despite the model being aimed at the evaluation of business training programmes, the layered model supports an evaluation of teacher performance and their increase in knowledge following their participation on the MaST programme.

Table 3.1 – Using Kirkpatrick's layered evaluation model

Evaluation Level	Evaluation characteristics	Methods used
1. Reaction	This level evaluates how the participants felt about the MaST programme and their personal reactions to the learning experience.	Interview
2. Learning	This level is concerned with determining the increase in knowledge, understanding and skill following the MaST programme and their change in attitudes.	Observation Interview
3. Behaviour	This level evaluates the extent to which the participants have applied any increase in subject knowledge and changed their practice in school.	Observation Interview
4. Results	This level evaluates the effect on the school as a result of any increase in subject knowledge of the participant.	Observation Interview

The final 'Results' level had the challenge of identifying which aspects of school improvement in mathematics are directly as a result of the participants' input and influence, specifically related to their deep subject knowledge, following their MaST training.

I needed to ensure that the evidence I gathered was valid. When collecting qualitative data, validity might be addressed through 'the honesty, depth, richness and scope of the data

achieved, the participants approached, the extent of triangulation and the disinterestedness or objectivity of the researcher' (Cohen *et al.* 2010: 133). Subjectivity is a concern with any qualitative educational research, and in particular with evaluation as a methodology. Objectivity is perhaps necessary when interviewing or during an observation to maintain a balanced account of the reality. However, disinterestedness seems a step too far in qualitative research, as a disinterested approach is likely to be unhelpful and perhaps detrimental to building up a relationship between interviewer and interviewee, or for the teacher being observed. Evaluation involves finding the value or worth of a programme, which implies the need for non-partisan research or value neutrality in the evaluation so that it is free from bias (Hammersley 1999, Scott and Morrison 2007). This could have been compounded by my involvement as a tutor in the MaST programme, so I needed to be aware of the inherent problem that subjectivity could result in a partisan approach (Tooley and Darby 1998). Hammersley (1987) clarifies the issue with his definition of validity. He asserts that the way the data is (re)presented must be 'real', with no bias and using methods of data collection that are the most appropriate for the research aims.

I have considered the issue of validity in this study, ensuring that it is acceptable to the research community, by using the data collection methods of observation and interview to carry out the evaluation. Triangulation, with the analysis of data from these different research methods, should help to ensure objectivity and validity and allowed cross-checking of the findings. Observation and interview are appropriate for an evaluation and specifically to this piece of research, as they will gain insights into the possible characteristics of deep subject knowledge and the impact of the MaST programme on the participants' subject knowledge.

Sampling group

Convenience sampling was used to select the teachers and schools. It was more convenient to identify schools that I have worked with as a MaST trainer as I already have a good relationship with these schools. I was likely to get representative and honest views from this selection of teachers, based on my previous experience working with them. I selected three volunteer participants from schools in the first cohort of the MaST Programme, so they are in the second year of their programme. The schools are all from the East Midlands and were randomly selected from the positive respondents to an email to thirty MaST participants asking for volunteers to be part of this research. The research aims and methods were explained to the teachers, the time commitment outlined and the necessary support of the headteacher made clear.

Research methods

1. Observation

To gather part of the evidence I used direct non-participant classroom observations (Cohen *et al.* 2010). From these observations I identified any elements of subject knowledge shown by the teachers and any aspects of the MaST training that had an impact on each participant in the classroom. I was also able to observe and evaluate the effect the MaST programme has had on the pupils in the class. The observations were semi-structured and based on a high level of interpretation, relying on my experience and the reliability of my observations to ensure validity (Gillham 2008). Being objective when making judgements is one of the difficulties of observation, with the aim to give a fair and balanced picture and to be open-minded (Denscombe 2010).

I considered a focused observation (Hopkins 1989) to be the most appropriate observation technique to gather qualitative data for this particular study. I used my *Deep Subject Knowledge* model (Figure 2.3) as an observation framework to identify the elements of subject knowledge that a teacher uses in the classroom during a mathematics lesson.
I developed an *Observation recording sheet* based on this framework (see Figure 3.1 for a sample and Appendices 2-4 for the complete sheets), to use during the observations.
The *Observation recording sheet* also provided a guide for discussion in the interviews.
I only recorded instances when elements of the teachers' subject knowledge were apparent, avoiding details such as behaviour management. This was explained to the teacher before the observation.

Lesson observations can provide misleading evidence if the teacher and class are not behaving in their usual way due to the observation (Wragg 1999, Gillham 2008), leading to reliability issues. It is actually very difficult for any teacher to teach in the same way when an observer is in the classroom as when they are alone with a class. I was a non-participant observer and managed to maintain a distance from the pupils in the class, so that they mostly ignored me and did not feel the need for any interaction. This meant I could observe with minimal disruption.

For this observation I wrote notes as the lesson took place, recording comments in relation to the *Deep Subject Knowledge* model criteria as it became evident. This use of specific criteria helped to ensure that the evidence collected from each observation was reliable, with a focused and detailed record kept of the evidence.

Figure 3.1: Observation recording sheet

Notes:				
Time:				
BMK				
a) Qualifications				
b) Beliefs				
c) Confidence				
KTM				
a) Connections				
b) Progression				
c) Representation				
KLM				
a) Concepts				
b) Interaction				
c) Response				

2. Interview

I collected qualitative data through the use of semi-structured interviews. I have used interviews to gather data in a number of roles, including mentoring colleagues in school, as a school support advisor and as an Ofsted Inspector. The method is an effective way to make deep enquiries that go beyond what is observable, complementing the evidence gathered through observation. Teachers' views and attitudes can be clarified and their feelings about aspects of their teaching can be explored (Wellington 2000). If the interview is managed carefully it can bring thoughts, feelings, knowledge and views to the surface, allowing the interviewee to reflect on their practice and give insight to the interviewer (Patton 2008). However, interviews can lead to problems of reliability if a teacher feels they need to give answers to 'please' the interviewer or answers that are known to show a teacher in a positive light even if they are not the actual views of the teacher (Gillham 2000).

My approach as an interviewer was to take on the role of a supportive, knowledgeable and interested questioner to allow the interviewee to have a voice and feel confident to express views freely. I did not aim to dominate the discussion, prompting if and when necessary, asking relevant open and closed questions and allowing time for full answers to those questions. In these interviews I did not want my views of the MaST programme to sway the input of views from the teachers.

To help plan each semi-structured interview, I used a range of questions set out in an *Interview questions guide sheet* (Figure 3.2) in a sequence that allowed the interview to flow. A topic list and set of questions within each topic area corresponded to the research questions for this study and were also structured around the three broad aspects and nine elements of my *Deep Subject Knowledge* model. This allowed me to determine the teachers' views of subject knowledge and which particular attributes have supported the teacher in developing their knowledge.

I did not follow or use each question slavishly, but it allowed me to probe carefully and sensitively, and follow lines of discussion within the framework of these planned questions. As issues arose I was able to focus on specific questions to support the research (Hitchcock and Hughes 1995, Patton 2008). For example, the first section of the interview on mathematical knowledge for teaching moved towards ascertaining the views of the teachers on subject specialism and their values and attitudes towards teaching mathematics. It followed questions that set the scene and built up a clear picture of their understanding of subject knowledge, which I was able to probe more deeply when necessary. I also evaluated the perceived impact on the participant and school by the MaST programme, and then analysed evidence further to determine the actual impact. I carried out each interview after the lesson observation so that we could also discuss the observation.

I gained permission from the participants to record each interview to later transcribe and analyse. If they felt uncomfortable with this before or during the interview then I was prepared to take notes only. I made brief field notes during the interview to provide further information to help analyse the transcript of the interview. I also made every assurance that the participants' anonymity would be preserved and confidentiality retained.

Figure 3.2 Interview questions guide sheet

1. Mathematical knowledge for teaching

a) What previous qualifications in maths do you hold?

b) Has this helped you in your teaching? Was it enough, not enough?

c) What was your maths training like at your college?

d) When you started teaching were you confident with maths generally?

e) What attitudes did you have towards maths before teaching?

f) Were you confident enough to actually teach maths?

g) Do you think that a maths qualification is important for primary teachers?

h) What is your view on subject specialists in primary schools?

i) What beliefs or philosophy do you have now in teaching maths?

2. The impact of the MaST programme on deep subject knowledge

a) Why did you want to take part in the MaST programme?

b) Has the course met your expectations?

c) Which aspects of the programme have been the most useful? Why? Research?

d) Which aspects of the programme have been the least useful? Why?

e) How has it influenced your teaching? Can you give examples?

f) Are there any other initiatives or influences that have altered your teaching?

g) What impact has it had on the pupils in the class?

h) Would you say you have deep subject knowledge now?

3. Classroom Observation and deep subject knowledge

a) What observations on your own subject knowledge would you make about the lesson?

b) My observations (show sheet) and further questions – why….?

When it came to analysing and interpreting the transcribed interviews, it was useful to read the views of Stenhouse (1978) on the distinction between gathering evidence and collecting data when looking at interview records. It is only after analysis, scrutiny and comparison that the data collected becomes reliable evidence. This highlights the importance of the accuracy of the interpretation and the quality of the analysis and synthesis when going through the transcript. Stenhouse (1978) also explains that this form of evidence-gathering in interviews should provide outcomes that are open to reflection or discussion.

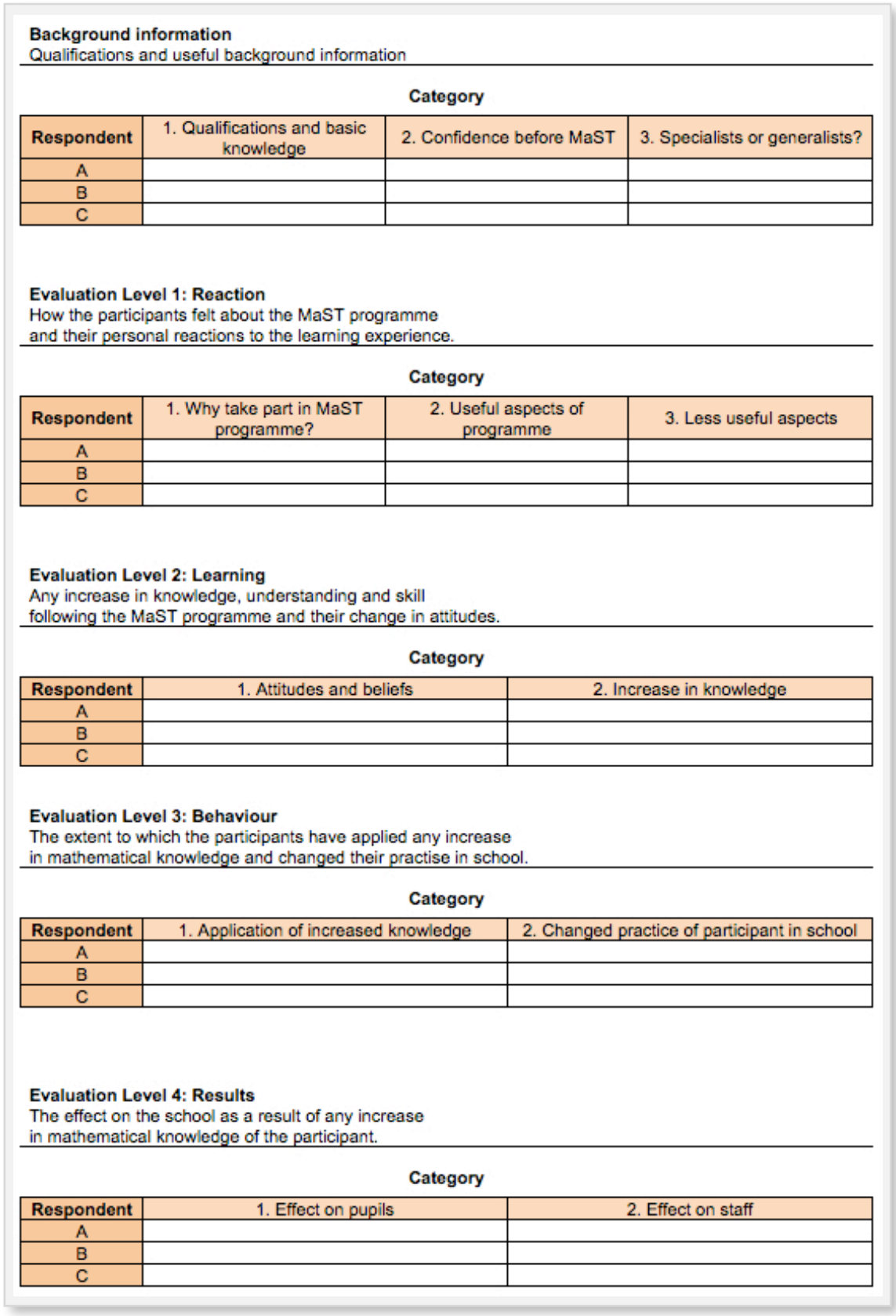
I used an *Interview content analysis sheet* (see Figure 3.3 and Appendix 3 for the completed transcribed sheets), which organised the content of the interview into the levels of Kirkpatrick's layered evaluation model with categories broadly related to the *Deep Subject Knowledge* model. While listening to each recorded interview I noted the key substantive points and recorded them in the appropriate category. Each category was exclusive so that no content was repeated and it gave me a structured but clear account of each interview, making it easier to interpret the data (Gillham 2000, Cohen *et al.* 2010).

Presenting the findings as case studies

This study involved looking for possible generalisations, transferable findings and patterns following the individual description of each case (Lincoln and Guba 1985, Patton 2008) so I organised the results as three case studies. This seemed appropriate, being descriptive and detailed, with a specific focus on deep subject knowledge and combining subjective and objective evidence to explain and judge (Stenhouse 1985, Merriem 1988, Cohen *et al.* 2010). I am aware that it is not easy to generalise from only three cases, but I have been able to make 'fuzzy generalizations' as Bassey (1999: 52) puts it, with general statements and conclusions that may hold true in other schools, for other teachers and on other mathematics courses. Yin (2003) suggests that case studies involving two or more cases can be presented in a table according to a uniform framework. Similarities and differences can then be analysed, patterns found and possible generalised statements made.

The data in this study consists of interview transcripts (Appendix 1) and lesson observation notes (Appendices 2-4), structured around the *Deep Subject Knowledge* model (Figure 2.3). I have used this structure for the case studies to analyse the participants subject knowledge, and, within the layered evaluation model, to ascertain the impact of the MaST programme on their knowledge.

Figure 3.3 Interview content analysis sheet



Background information
Qualifications and useful background information

Category

Respondent	1. Qualifications and basic knowledge	2. Confidence before MaST	3. Specialists or generalists?
A			
B			
C			

Evaluation Level 1: Reaction
How the participants felt about the MaST programme
and their personal reactions to the learning experience.

Category

Respondent	1. Why take part in MaST programme?	2. Useful aspects of programme	3. Less useful aspects
A			
B			
C			

Evaluation Level 2: Learning
Any increase in knowledge, understanding and skill
following the MaST programme and their change in attitudes.

Category

Respondent	1. Attitudes and beliefs	2. Increase in knowledge
A		
B		
C		

Evaluation Level 3: Behaviour
The extent to which the participants have applied any increase
in mathematical knowledge and changed their practise in school.

Category

Respondent	1. Application of increased knowledge	2. Changed practice of participant in school
A		
B		
C		

Evaluation Level 4: Results
The effect on the school as a result of any increase
in mathematical knowledge of the participant.

Category

Respondent	1. Effect on pupils	2. Effect on staff
A		
B		
C		

Ethical statement

My research considered and took into account ethical guidelines as outlined in the British Educational Research Association (BERA) ethical guidelines for educational research (2011) and the Bishop Grosseteste University College Research Ethics Policy (2008). I gave information about the research content, methods and timescale to each teacher involved in the study, with consent granted by the participant and the headteacher at each school to allow the research to take place. I also had the appropriate Criminal Records Bureau (CRB) clearance to enter the schools. Consideration was given to the rights and interests of those affected by the research, with participants aware that they could withdraw from the research at any time. Permission was given to write notes at each class observation and to record the interviews, with an assurance that the identity of each teacher and their school would remain anonymous. I aimed to carry out the research, as far as was possible, in an open, honest and transparent way (Denscombe 2010).