CHAPTER THREE
RESEARCH METHODOLOGY AND PROCEDURE

'The subjectivity with which I dialectically relate to my world, my role in the world, is not restricted to a process of only observing what happens but it also involves my intervention as a subject of what happens in the world. My role in the world is not simply that of someone who registers what occurs, but of someone who has an input into what happens. I am equally subject and object in the historical process' – Paulo Freire (1998).

3.1   INTRODUCTION

Chapter Three discusses the research method and design used for the collection and analysis of data. It begins with a description of the research method followed by the sampling procedure and an explanation of the data collection and analysis process. The integrated process of data collection and data analysis within the interpretive paradigm is explained. The ethical considerations, validation and verification of data are set out. In conclusion, the limitations and challenges significant to this study are described.

3.2   RESEARCH METHODOLOGY

This study used a qualitative research approach involving phenomenology and the case study method within an interpretive paradigm (Cohen, Manion & Morrison, 2000; Marton, 1986) to investigate the lived experiences of six beginning teachers in their first year of teaching MST in the FP or ECP classroom (Denzin & Lincoln, 1998; Mukherji & Albon, 2010; Van Manen, 2007). The qualitative research approach was used because it would provide in-depth information and rich descriptions into the views and experiences of the beginning teachers as they attempt to make sense of their classroom practices. Casey (2007:123) describes phenomenology as the 'meaning' and descriptions people give to 'lived experiences. In this study, the lived experiences of the beginning teachers are the phenomenon of professional teacher identity formation.

The researcher tried to explore and understand the six beginning teachers' descriptions of their 'lived experience' (Casey, 2007:123) during the first year of MST teaching by listening to their voices and observing their practices, and consequently inferring how they formed their professional teacher identity in the context of teaching MST.

Phenomenology as a research approach was selected because it provided the opportunity to explore and understand the 'richness, depth, nuance, context, multi-dimensionality and complexity' (Mason, 2006:1) within which these beginning teachers formed, changed or sustained their professional teacher identity. It also helped to create an understanding of the 'meanings' (Denzin & Lincoln, 1998:3) and 'authenticity' (Mukherji & Albon, 2010:28) that the six beginning teachers brought to the formation of professional teacher identity in early MST teaching.

The six beginning teachers revealed what they believed and what they did in their MST practices through photo collages, narrative reflections and interviews. It was thus possible to gain insight into and create meaning of the identity phenomenon by considering the 'parts and whole' (Van Manen, 1990:30-31) of the varied data provided over a period of time, in this case over a period of eight months. In line with the nature of phenomenology, the multiple data collected from the beginning teachers 'subjective experiences' was used to 'create a 'description' of their professional teacher identity formation 'experiences' (Casey, 2007:123).

3.3   CASE STUDY METHOD

The case study method was used to gather and analyse the data of the participating teachers' experiences and reality (Casey, 2007:123; Creswell, 2007) in their first year of MST teaching in different ECP and FP settings. The case study method was chosen because it placed the study within a particular boundary, in a particular context and a specified time (Cohen *et al.*, 2000). Furthermore, the case study method gave 'ecological validity' to the study because professional teacher identity formation in early MST teaching was a 'real life' experience for the beginning teachers (Tobin, Wu & Davidson, 1989).

The purpose of the study was to understand how beginning teachers form their professional teacher identity when teaching early MST. The case study method combined the different data collection methods used, namely photo collages, narrative reflections, semi-structured interviews and classroom observation (field notes and beginning teacher reflection) to provide descriptions (Eisenhardt, 1989) of the professional teacher identity formation of the six beginning teachers.

The multiple case study approach was selected to understand and gain insight into the dynamics, (Nieuwenhuis, 2007) similarities and differences (Mukherji & Albon, 2010; Silverman, 2005) of the professional teacher identity formation in different cases. The multiple case study approach, using the cases of six beginning teachers, provided a 'rich, thick description' (Merriam, 1998:29) and a 'fuller' (Cohen *et al.*, 2000:183) and more detailed picture of the phenomenon of professional teacher identity formation of the beginning FP and ECP teachers on their MST teaching in different school settings.

3.4 SAMPLING PROCEDURE

This study employed purposive sampling to select the six beginning teachers — Bea, Riana, Lea, Gina, Jenna and Anne-marie. The beginning teachers were identified by pseudonyms and treated as cases. The cases were selected according to a purposive sampling procedure. Purposive sampling means that participants are selected according to preselected criteria relevant to the research question (Nieuwenhuis, 2007). Merriam (1988:48) explains that in purposive sampling, '…one establishes the criteria ... then finds a sample that matches these criteria'.

The following purposive sample selection criteria were applied:
(a)   The sample consisted of six first-year beginning female teachers who had successfully completed the same B.Ed. Early Childhood and Foundation Phase programme the previous year and who started teaching the following year.
(b)   Teachers were studied within the school context where they were appointed. They represented diverse school and teaching contexts in early childhood setting and foundation phase classrooms. They also taught in different language and cultural contexts.

(c)   The beginning teachers selected had indicated that they would voluntarily participate.

The participants in this study were six first-year teachers in different school settings. The selection of six beginning teachers for the study complies with the required number of participants acceptable for phenomenological research. The six cases were chosen to maximise variance while keeping the size of the study manageable (Cresswell, 2007). This purposive sampling procedure provided the opportunity of selecting representative cases to enable the researcher to explore the phenomenon of professional teacher identity formation (Silverman, 2005). Table 3.1 provides a summary of the profile of the participants.

Table 3.1: Profile of participants

Participants	Age	Gender	School settings
Six first-year beginning teachers.	The age of participants was between 20 and 25.	Six females (only females completed the programme in 2009).	Diverse school settings: • Two teachers taught in Grade 2 classes in two different Afrikaans primary schools in Pretoria (one was permanently employed by the department of education and one was in a contract post). • One teacher taught in Tswana in a Grade 1 class at a primary school in a township near Pretoria (she was permanently employed by the department of education). • One teacher taught in a bilingual (Afrikaans and English) private Early Childhood setting in Pretoria. She taught the three and four-year-old group (she was in a contract post). • Two teachers taught in different multicultural Early Childhood settings in Pretoria. (Language of instruction: English). One taught a Grade R class and the other teacher taught a five-year-old group (both were in a contract posts).

3.5   ASSUMPTIONS OF THE STUDY

Epistemologically, the researcher accepts reality to be a subjective concept that needs to be experienced, interpreted and described. In this respect, the researcher sought to investigate the beginning teachers' reality of their MST teaching context with its variations, practices and experiences. The research approach was also

inductive, meaning that a conceptual framework on identity formation was developed based on the literature review. The assumption is therefore that professional teacher identity is a learning process that starts during the teacher education programme and is continued during the teachers' professional lives.

The researcher further proceeded from the assumption that the selected six participants had experienced the phenomenon of the formation of professional teacher identity consistent with the philosophy of their teacher education programme. It was further assumed that they could therefore express their identity through their voices (MacNaughton, Rolfe & Siraj-Blatchford, 2001) and practices (photo collages, reflective narratives interviews, observation and observational reflections). The researcher engaged in extensive data collection to understand, explore and interpret the multiple realities of the phenomenon of professional teacher identity formation.

3.6   THE RESEARCH PROCESS

The in-depth research into the research question was planned systematically. The research procedure for this study was based on an ongoing process of data collection and analysis (Nieuwenhuis, 2007). This process entailed noticing, collecting and thinking about information.

3.6.1   DATA COLLECTION INSTRUMENTS

The study used a variety of data collection instruments, namely photo collages, narrative reflections, interviews and observation. The six beginning teachers each wrote an observational reflection on their classroom practice during the observation. Although the interviews with individuals were regarded as the main source of information – which is consistent with phenomenological research – the other data collection methods such as photo collages, narrative reflections and observations provided additional data to enrich and validate the information (Cresswell, 2007).

Each of the beginning teachers was treated as an individual case (Flick, 2008) during the data collection phase. In the following section these data collection instruments are described and justified as follows:

3.6.1.1 Photo collages

The beginning teachers were asked to assemble a collage using images and photographs of their MST teaching and classroom practice from selected sets of stimuli of their choice. Each participant had to design two photo collages, one at the beginning and one towards the end of the year. The photo collages were used to express and visualise aspects of the participants' practice in MST. Guiding questions were provided to assist the participants to select and design their photo collages (see Appendix B).

Think about the way you teach mathematics, science and technology. Select any images and/or photos that represent the way you plan and teach mathematics, science and technology (MST). Design and create a photo collage.

- What do you believe/know about MST teaching (planning) in the early years?
- How do you plan and teach MST? (Explain how you plan your lessons. Give examples.)
- What do you believe/know about MST? (Nature of MST, the content and curriculum of MST.)
- What did you learn about MST teaching and learning during B.Ed. programme and internship (practice teaching)?
- What did you learn about MST teaching and learning during your first year of teaching?

Care was taken to ensure the anonymity of the children and the teachers depicted. Each participant was required to write short comments or phrases to explain or illustrate their MST teaching through the pictures/photographs used in the photo collage.

According to Banks (2009), the use of photographs or pictures of the beginning teachers' own practice and topics that matter to them is justified, as this data collection method can enrich the insight and understanding into their practice and often lead to interesting results and discoveries. The pictorial approach (Brace-Govan, 2007; Weade & Ernst, 2001) could generate rich data for triangulating data obtained from the narrative reflections, semi-structured interviews and observation and enabled the researcher to gain insight into what they believed and how they

planned and taught MST (Flick, 2008). In addition, this method (Brace-Govan, 2007; Weade & Ernst, 2001) allowed participants to tap into personal experiences, passions and beliefs and to more clearly frame and illustrate their thoughts on their teaching and practice. The photo collages also provided data on concepts and knowledge in MST teaching by illustrating real activities in the classrooms.

A limitation of this method may be the ambiguity of visual images and the possibility of 'multiple interpretations' (Banks, 2009). To counteract this possible limitation the researcher did not use the photo collages as visual photos or images on their own, but asked the beginning teacher to explain their meaning in the narrative reflections.

3.6.1.2 Narrative reflection

According to Urzúa & Vásquez (2008), the idea that teachers' written narratives of their experiences could provide insight into their professional identities is noted in the literature. Personal narratives provide written verbal information that could help to make sense of and give meaning to how beginning teachers' everyday experiences, beliefs and practices (Olshtain & Kupferberg, 1998) reflect their professional teacher identity in MST teaching. Written narrative was thus used as an appropriate and 'highly participative' (Burton & Bartlett, 2009:127) data collection method, well suited to the interpretive research paradigm. The narrative reflection also provided an opportunity for the beginning teachers to be active participants in the research process by sharing their views, knowledge, ideas and practices about MST (James & Prout, 1990).

The beginning teachers used the guiding questions (the same questions used for the photo collage) and instructions to explain their use of specific photographs or images illustrating MST teaching in the photo collages. For example, they were asked to examine the images/photos they selected, and to reflect on how these images/photos related to the questions. The triangulation of the photo collages and narrative reflections provided clarity for interpretation. The written narrative also allowed the participants to provide a 'rich account' (Burton & Bartlett, 2009:121) of their experiences, processes, beliefs and classroom practice and gave further meaning to the other data collected through semi-structured interviews and observation.

Each participant was required to write two narrative reflections (see Appendix B), one when they started teaching and one towards the end of the year.

3.6.1.3 Semi-structured individual interviews

Semi-structured interviews formed an important part of the data collection process in the study. Semi-structured individual interviews (Nieuwenhuis, 2007; Silverman, 2005) were used to further explore the research questions and to collect data on beginning teachers' MST-related experiences and practices. The main questions used in the interviews were derived from the research questions:

- How do you teach MST in your classroom?
- What did you experience during the teaching and learning of early MST?
- What influenced the way you teach MST?

A one-on-one interview format for data collection was used because it allowed the researcher to explore through questioning additional aspects of the professional teacher identity formation such as: How do you teach MST in your classroom? Why? What do you teach?

This method allowed the beginning teachers to 'talk around' (Burton & Bartlett, 2009) and explain their professional teacher identity formation. It also allowed the researcher to pick up hunches, non-verbal clues and thoughts (attitudes and beliefs) to provide rich, meaningful data (Cohen, et al., 2000).

Two semi-structured individual interview (see Appendix C) sessions of 45 minutes were conducted with each participant to triangulate the data, one at the beginning and one towards the end of the year. The first interview was done during April/May 2010, after collection and informal analysis of the first photo collages and narrative reflections.

The second interview was done during September/ November 2010, after the observation and collection of the second photo collages and narrative reflections. The flexible nature of the semi-structured interviews (Mukherji & Albon, 2010) allowed the researcher to clarify ideas, processes and practices noted in the photo collages, narrative reflections and observations (Burton & Bartlett, 2009). This

information provided opportunities for further investigation into the professional teacher identity formation of the six beginning teachers.

Administration of the interviews

The interviews with each beginning teacher were scheduled at their convenience. Each individual interview was audio-taped and written notes were taken as the interview progressed (Lincoln & Guba, 1985). The twelve interviews were transcribed and summarised for further analysis.

During the interviews, it was important for the researcher to maintain the role of good interviewer and careful listener (Creswell, 2007). I put the interviewees at ease by being friendly and considerate, but at the same time remained as neutral as possible, by not expressing my emotions, feelings and opinions in any way that was likely to influence the interviewees (Mukherji & Albon, 2010:42).

3.6.1.4 Informal observation, field notes and beginning teachers' reflections

Informal observation of the six beginning teachers in their teaching environment (classroom practice) was undertaken to see what they did in their classrooms. Observation provided an opportunity to gather 'live' data from a natural teaching situation (Cohen *et al.,* 2000:315) to understand the different contexts in which the six beginning teachers taught early MST.

The researcher took into account that observation of human actions and interactions can only be interpreted in the situational context in which they occur (Angrosino & Mays de Pèrez, 2000), therefore no structured observation schedule was used. Consequently, the researcher did informal observation and compiled field notes during May 2010. The teaching of MST was observed during scheduled observation sessions convenient to the school and the beginning teachers. The field notes comprised descriptive notes by the researcher.

The researcher expanded on the field notes that were made *in situ* at a later stage. The researcher took care to describe the school context, the number of children in the class and the activities of the teacher in detail. Notes were made of the

restrictions or otherwise of the school curriculum that affected to what extent the beginning teacher could teach MST in the way she wanted to. The context in which the observation took place, formed an important part of the data as it provided information on the situation in which the six beginning teachers formed and reformed their professional teacher identity in teaching early MST.

The researcher was constantly aware of the possibility of bias as observer but ensured objectivity through the observational reflections written by the beginning teachers at a later stage and by asking the participants to verify the information (Casey, 2007). The beginning teachers wrote reflective notes (observation reflections) on the lesson they had planned and presented. This data was given to the researcher two weeks after the informal observation visit.

Observation was an appropriate choice of data collection, because it provided the researcher with opportunities for triangulating information from other data sources. The researcher could also establish whether the beginning teachers had changed their teaching approaches due to pressure from peers or management in the various school contexts. Observation thus gave the researcher insight and understanding about how the beginning teachers planned and taught early MST (Burton & Bartlett, 2009) in their specific school settings. The researcher could see if the teachers acted as they said they had (data from first photo collage, written narrative and interviews). Another advantage was that observation included opportunities to understand the school context within which the beginning teachers planned and presented early MST activities (Cohen *et al.,* 2000). It further presented opportunities for the beginning teachers to reflect on and write an observation reflection on the MST teaching which the researcher observed (Patton, 2002).

Through the observation, field notes and participants' observational reflections, a large amount of data was gathered within a short time, which was advantageous in the sense that rich, varied and detailed information was gathered which could be sorted into topics and themes. The observation was meant to draw attention to certain practices and behaviours that would perhaps need clarification in the follow-up interview (Burton & Bartlett, 2009). The following open observation schedule (see Appendix G) was used to collect data.

Table 3.2: Open observation schedule

Observation: actions of the teacher	Reflective notes field notes
Description of the kind of mathematics, science or technology (MST) activity – Lesson planning.	
Description of the pedagogical approach (inquiry-based approach, hands on activity, workbooks, discovery learning, exploration, problem solving approach, scaffolding.	
Interaction with the children and children's MST learning.	
Interpretation and implementation of the curriculum.	
Resource and classroom environment.	
Aspects of classroom practice and management.	

Observational reflection: The six teachers wrote an individual reflection on the planning and the presentation of the observation activity(ies).

Table 3.3 provides a summary of the research sequence and the data collection instruments.

Table 3.3: Research sequence for data collection

Research sequence	Research activity	Time
Phase one	**Introduction of the study to the participants** An individual information session was conducted with each participant. The research purpose and process were discussed with each individual participant. Then the data collection method was explained (see consent letter, Appendix A). Consent letters were given to each participant. It was explained that consent was voluntary.	20 minutes meeting with each participant at the end of March 2010

Research sequence	Research activity	Time
Phase two	**First photo collage and narrative reflection** The participants were provided with the requirements and guidelines for the photo collage and narrative reflection (see Appendix B) after they had agreed to participate. The completed first photo collage and written narrative were collected from each participant a week before their scheduled first individual interview.	At the beginning of their first year of teaching after the first term (April/May 2010)
Phase three	**First semi-structured individual interviews** The first semi-structured individual interviews (Interview guidelines – see Appendix C) were conducted to establish beginning teachers' professional teacher identity in early MST teaching and the factors that influenced this identity formation. Questions dealt with: • Their background and prior experience in MST teaching and learning. • The contribution of their initial teacher education programme to the formation of their professional teacher identity in MST. • Their classroom practice during their first year of teaching.	45 minutes during May 2010
Phase four	**Observation** After consent by Gauteng Department of Education (see Appendix D), schools Appendix E) and parents (Appendix F), the informal observation and the teachers' reflection were done.	One or two negotiated school mornings convenient to the school and participant. Observation was done between April and June 2010
Phase five	**Second photo collage and narrative reflection** Handing in of the second photo collage and narrative reflection (see Appendix B) to triangulate information and gain insight into the professional teacher identity formation process during their first year of teaching.	Towards the end of their first year of teaching (September/October 2010).
Phase six	**Second semi-structured individual interviews** Second semi-structured individual interviews aimed at triangulation of information. (Interview guidelines – see Appendix C.)	45 minutes (September – November 2010)

3.6.2 DATA COLLECTION STAGES AND DATA ANALYSIS PROCESSES: AN INTERACTIVE PROCESS

Based on the data collection plan, the collection of data was guided by the following research question:

How do beginning first-year early childhood and foundation phase teachers form, sustain or change their professional teacher identity in the teaching of mathematics, science and technology (MST) in the early years and in different school settings?

The sub-questions derived from the main question are:

1. What internal and external factors, if any, influence beginning teachers' professional teacher identity formation in the context of teaching MST?

2. How do the identified factors, if any, affect their teacher professional identity formation in the teaching of MST in different school settings?

3. Why do these teachers sustain, change or adapt their professional teacher identity?

All the data, including photo collages and written narratives, observations, field notes, participants' observational reflections and semi-structured interviews, were generated for triangulation purposes. The time frame for collecting the data was a period of one year starting in April 2010. The data gathering process started after ethical approval had been granted for the study.

The **first data collection stage** consisted of the first photo collage, narrative reflection and semi-structured interview with each of the six beginning teachers after they had taken up their teaching posts and settled into their respective classrooms and school settings (April/May 2010). Individual data analysis was done after each stage of data collection.

The second data collection stage (informal observation with field notes and beginning teachers' reflections) took place during May/June 2010.

The three stages of the data collection and the data collection methods were explained to the six participants during a short information session (April 2010). They were also provided with oral and written information to enable them to understand why and how to construct the photo collages (see Appendix B). During this session, the beginning teachers were asked to design the photo collages and to write a narrative refection on the photo collage. They were informed about the semi-structured individual interview and the informal observation that would take place during May 2010. A date was set for the first interview with each participant. After the

first interview session a date was scheduled for the classroom observation to take place. Similarly, the dates for the collection of the second photo collage, narrative reflection and semi-structured interview were negotiated. Some of the interviews and reflections were done in Afrikaans. These were first transcribed in Afrikaans and then translated into English. Table 3.4 summarises the data collection stages and data analysis processes.

Table 3.4: The data collection stages and data analysis processes

Stage	Data collection method	Time
Stage one	First photo collage, First narrative reflection and first round of semi-structured interviews.	April/May 2010
First data analysis process: Reading narratives. Transcribing interviews. Analysing narratives and interviews using interpretive analysis (Nieuwenhuis, 2007).		
Stage two	(4) Informal observation, field notes and beginning teachers' reflections.	May/June 2010
Second individual data analysis process: Analysing observation, teacher reflection and field notes using interpretive analysis (Nieuwenhuis, 2007).		
Stage three	(1) Second photo collage, (2) Second narrative reflection and (3) Second round of semi-structured interviews.	September to November 2010
Third individual data analysis process: Reading narratives. Transcribing interviews. Analysing narratives and interviews using interpretive analysis (Nieuwenhuis, 2007).		
Final data analysis process: Analysing and synthesising data. Writing a description of the professional identity portraits of six beginning teachers. Extracting the core elements present in all of the six cases. Presenting the essence of the phenomenon of professional teacher identity in a 'textual description' in answer to the research questions (Creswell, 2007:227).		December 2010 to October 2011

The following section will give examples of the instrument and the collected data. The examples of the collected data are from Bea case.
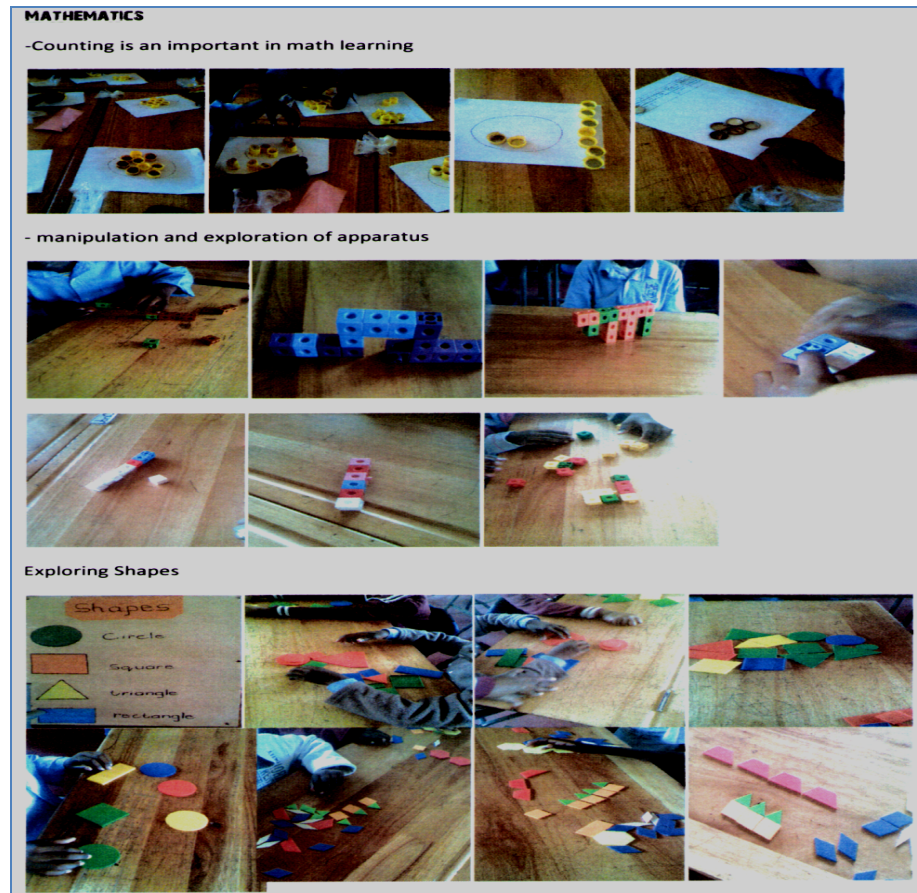
3.6.2.1 Photo collages

Figure 3.1: **Examples of Bea's photo collages in mathematics collected during stage one**

3.6.2.2 Narrative reflection

- **Narrative reflection – mathematics teaching**

Maths is a practical subject at school. Maths activities are planned well in advance and as novice teacher I have to make sure that I have all the right apparatus, the planned lesson beforehand. For example, for counters, I asked the learners to find as many bottle tops as they could find and this proceed for a few weeks until we had collected enough for each child to have about 10-15. Different approaches and strategies can be used to teach young children mathematics such as stories step-by-step instruction. Therefore how a child learn is important to me (NR1).

- **Narrative reflection – science teaching**

Science is not a focus subject/learning area in our phase. Therefore it tends to take a back seat. However, it can be incorporated in a lot of things. For example, we recently had a theme "our country" in which we talked about indigenous trees. The learners had to bring a leaf from an indigenous tree to class. The learners had to look at the leave and sort them. They then made a graph to indicate how many of each leaves they had. We also discussed that South Africa is a water scarce country and that indigenous trees use up little water and they are thus ideal for the country (NR1).

- **Narrative reflection - technology teaching**

Technology is a learning area where learners are presented with material with which they have to design and create something new or to improve something that already exists. Technology to me is about the manipulation and investigation of material and problem solving (NR1).

- **Narrative reflection - MST teaching**

I have grown in the past few months from being a 100% theoretical teacher to being one with some experience; I have seen how and what I have learnt can be implemented in the classroom. I feel that what I have learnt and seen during my four years of teacher training has helped me. I learned that teaching MST involves a lot of creativity. One can make time in the timetable to involve MST in the classroom and that it can be fun (NR2).

3.6.2.3 Semi-structured interview

- **Bea's semi-structured interviews (In1) – MST Teaching**

Maths is important to the children. It is something they must learn. They have to acquire skills so that they can love maths. I love teaching maths. Children have to practice what they learn. I need to plan carefully what I want them to do. They have to use the whole body approach. I have to plan it that I have to move from the physical to counters and then to more abstract stuff (In1).

Science is very difficult to teach. You can do it orally, and it is not taken seriously by the school. You do the maths and have to integrate the science through other subjects. This is difficult. Learners should know science and I wish I could do more. Maybe I should plan better to include science on Fridays. Make an integration day

with more practical stuff. We had no time this year. The world cup and the strike were bad (In2).

3.6.2.4 Observation

Table 3.5: The observation of Bea's lesson

Observation: actions of the teacher	Reflective field notes
Description of the mathematics, science or technology (MST) activity – Lesson planning.	
Activity 1: Counting She tells them to start counting from 0 – 100 They count in English then in Tswana She helps those who get stuck along the way. English-When the kids get to multiples of 10, there is some level of excitement and rhythm, they shout them out. The same applies in the Tswana counting, only this time it is with the numbers 7 She makes them aware of 'odd numbers' and 'even numbers'. She tells them to look at the number line and just count the odd numbers (-99). After that the children do the same with even numbers (-100)	She walks around to see if everyone is counting. When a child needs help she gives support. For example she shows them the number on the hundred chart.
Activity 2: Counting out and counting on She gives each child 20 unifix cubes (blocks). She gives them oral instructions on counting out. For example: Count out 12 blocks of one colour. Count out 2 more in another colour. Count out 12 and count on with the 2. She asks them to write the number sentence. She gives the children number sentences for example 10+3=_ They have count out the number of blocks.	Most of the children can count out and count on correctly. When children struggle she helps them by giving assistance.
Activity 3: Adding and subtraction operations The children do adding and subtraction operations in their workbooks.	Many of the children were able to use correct notations. But when children needed help she provided it by prompting, such as 'show me 10 add 2'.
Description of the pedagogical approach (inquiry-based approach, hands on activity, workbooks, discovery learning, exploration, problem solving approach, scaffolding	
She planned for hands-on activities using counters. She scaffolds learning by asking questions and helping children that need help. She also refers to resources in the classroom for example the wall frieze and number line and hundred chart.	She uses hands-on practical approaches in the planning of mathematics. She employs the problem solving approach in the questions she uses.

Observation: actions of the teacher	Reflective field notes
Interaction with the children and children's MST learning.	
She walks around in the classroom and assists the children. She repeats questions and instructions when children do not understand.	She is caring and supportive. She walks around and is aware of children that need assistance.
Interpretation and implementation of the curriculum.	
She uses: • Counting 1-100 (counting out and counting on activities on number range 1-20) • Addition and subtraction (number range)	Her interpretation of the curriculum is correct and appropriate for the grade 1 class
Resource and classroom environment.	
She uses: • unifix cubes • hundred chart • workbooks	Her classroom is a resource-rich classroom where learners work with the material shat she prepares and provides
Aspects of classroom practices and management	
The lesson she planned was well prepared and she manages the teaching and the children's learning with confidence.	The principal and H.O.D were welcoming. The H.O.D asked if she could sit in on the lesson. There seems to be a lot of support for the teachers.

3.6.2.5 Observation reflection

• **Bea's observation reflection (OR) on her planned lesson (MST teaching)**

I plan for each concept weekly with daily subheadings for each day to increase knowledge and to consolidate prior knowledge. I planned that the learners would explore the differences between odd and even numbers. The lesson was to play out so that the learners would see that odd numbers would always have one that is unpaired and that even numbers were always paired. The learners explored this by using counters to see which numbers would be paired and which would be unpaired. Planning thoroughly helps me become better at my craft than if I did not plan, and it helps me to help struggling learners.

• **I planned for children's learning by:**
   o Preparing resources *and counters or other resources to use during the lesson to encourage effective learning to foster moving from concrete to abstract concept development.*

- o *I count out the resources to see if I will have enough and if not I plan how I am going to improvise and how the lesson will play out with the limited resources.*

- **Summary of my own learning process**
  - o *The continuous interactions between the learners and myself in the teaching and learning situation and their reactions and mine to the daily happenings in the class help me reflect and fine tune how I teach for a better lesson the next time around.*
  - o *Getting to know the learners and understanding their strengths and weaknesses also helps me reflect better on how I should do things in the future and may even teach me a new skill.*
  - o *Being thoroughly planned helps me become better at my craft than if not, and helps me to be thorough at helping struggling learners (OR).*

3.6.3   DATA ANALYSIS STRATEGIES

The process of data analysis started immediately after the first data collection and transcriptions of the interviews and continued throughout. A phenomenological approach to data analysis was used to understand and to get insight into beginning teachers' professional teacher identity formation in early MST teaching and learning.

Building on the data from the photo collages, narrative reflections, observation and observational reflections, the researcher firstly used 'horisontalisation' (Moustakas, 1994) to go through all the data (e.g. photo collages, reflections and interview transcriptions). Van Manen (1990:4) describes the hermeneutical phenomenological approach to research 'oriented toward lived experience (phenomenology) and interpreting the "texts" of life (hermeneutics)'.

During this step significant statements, sentences as well as quotes were highlighted to provide an understanding of the six beginning teachers' practices and experiences in MST teaching and learning.

During the next step the researcher developed clusters of ideas (Moustakas, 1994) from the data through organising and categorising the statements, sentences and

quotes into themes. These themes were then used to write a narrative description of the participants' identity portraits (Chapter Four). During the next step the researcher focused on the common experiences of the participants (Chapter Five), giving a textual-structural description of the meanings and essences of the experiences.

The data analysis process began informally during interviews and observations and continued during transcription, when recurring themes, patterns, and categories on professional teacher identity formation became evident. The data analysis process involved the ongoing integrated process of categorisation and recategorisation of data; looking continuously for gaps, differences, similarities and connections to develop categories of description (Åkerlind, 2005) relating to professional teacher identity formation. The researcher started deductively by drawing from previous research (the literature review and conceptual framework) on topics such as beginning teachers, professional teacher identity formation, initial teacher education programmes and early MST teaching, to look for themes and to gain insight into the how beginning teachers construct their professional teacher identity.

Furthermore, Instructions, prompts and questions were generated from the literature review and conceptual framework and were used in the photo collages, narrative reflections, semi-structured interviews and observation. Because phenomenology is concerned with real-life activities and has its roots in common-sense reflections, this view was used to generate data in order to gain insight and to understand how beginning teachers formed their professional teacher identity in early MST teaching and learning (Cohen *et al.*, 2000).

The data obtained from the photo collages, narrative reflections, semi-structured interviews, observation and observational reflection were analysed and interpreted for emerging themes using either phenomenological or interpretative procedures. The researcher also used inductive analysis strategies to 'reduce the data to central themes' (Casey, 2007:123). Categories of description such as teacher education programme, school context, curriculum interpretation and implementation, MST teaching, institutional support and classroom practice emerged from reading, categorising and synthesising the data. These identified themes were used to describe the phenomenon of professional teacher identity formation.
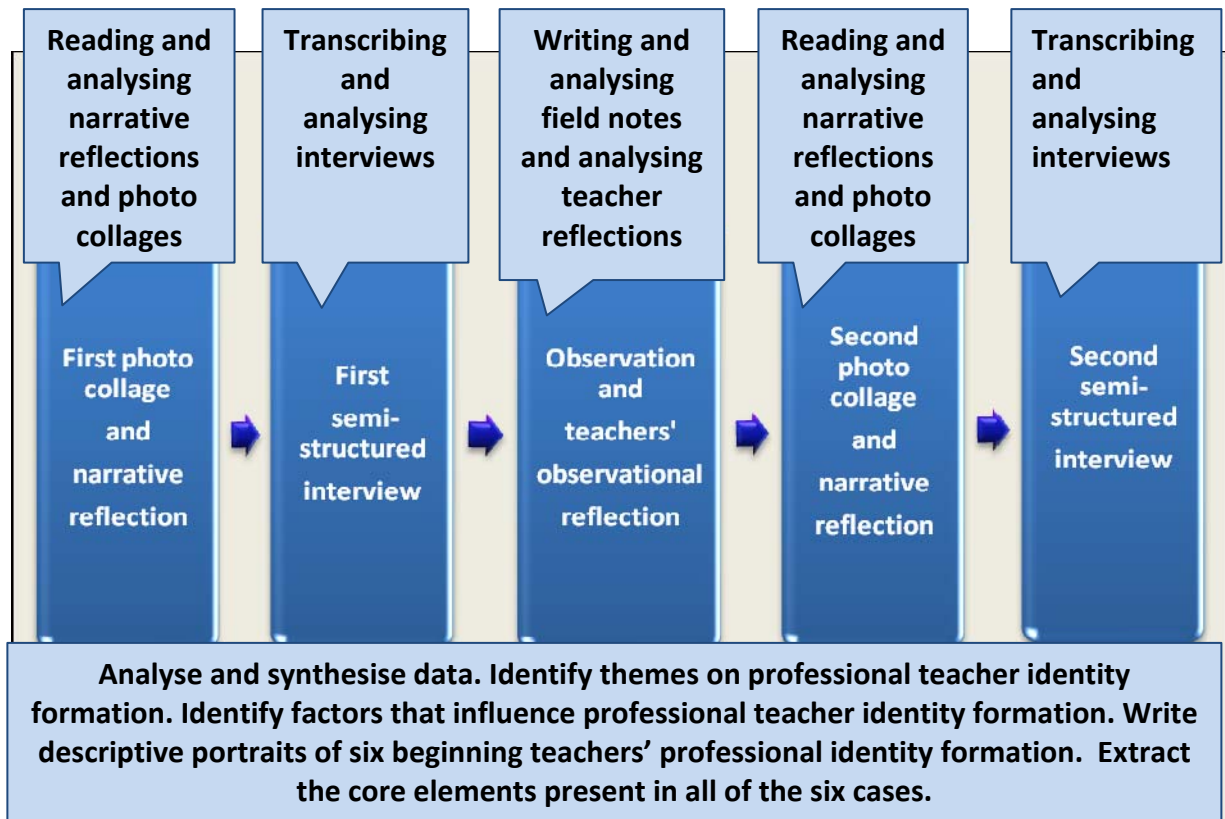
Figure 3.2:   The integrated process of data collection and data analysis

During the integrated process of data collection and data analysis (Figure 3.2) the information was processed like a jigsaw puzzle and assembled into themes (Nieuwenhuis, 2007) such as beginning teachers' background in MST, the teacher education programme, school context, curriculum interpretation and implementation, teaching MST, institutional support and classroom practice. The information collected from each stage was read several times to identify and verify the themes. The common use of words, phrases, themes or patterns by the participants assisted with the interpretation and understanding of the professional teacher identity portraits of the six beginning teachers. A quality check was done by 'rechecking' and 'cross-checking' (Flick, 2008) the interview transcripts, narrative reflections and themes.

3.6.3.1 Theme construction

Themes were formulated, based on 'statements and quotes' (Creswell, 2007:227) reflecting the six beginning teachers professional teacher identity formation. To illustrate how the description of themes was constructed the theme of 'Teaching MST' is exemplified by the following extract from Bea's case:

Step one:

Statements and quotes were on the theme identified from interviews, (In1, In2) narrative reflections (NR1, NR2), and observation (O) and observation reflection (OR).

Table 3.6: Example of statements and quotes from Bea's case

Interview one (In1)
'Maths is a priority subject' (In1)
'I think my children love mathematics because they see I love it' (In1)
'Very little science and technology, if any, is taught in the foundation phase at the school. I don't see science and technology' (In1)
Interview two (In2)
'Maths is important every day (In2)
'Learners should know science and I wish I could do more. Maybe I should plan better to include science on Fridays' (In2)
Science and technology are taught integrated with life skills and language (In2). The factors that caused me not to teach science and technology are because of lack of time (In2)
You do the maths, and have to integrate the science through other subjects … this is difficult' (In2)
I heard that science and technology are being removed from the curriculum and I am against this removal. The subjects are essential for the development of the child, and the curriculum changes every year. There is a lack of consistency (In2)
Narrative reflections one (NR1)
'I want to include science into my teaching, maybe a discovery table' (NR1)
Narrative reflections two (NR2)
'…so there is very little time to teach science … However, we could plan a science project like a discovery table' (NR2)
Observation reflection (OR)
'Our science observations (about plant growth) had to be postponed and there was very little time left in the end to make a really good observation and measurement of the processes' (OR)

Step two:

The narrative portrait of each case was written to present the results of this study (see Chapter Four). Themes were used to write the narrative portraits. The following extract is from Bea's case on the theme 'teaching MST':

Mathematics was regarded as the foundational subject at the school and it had a prominent place in the curriculum. 'Maths is a priority subject' (In1) and 'Maths is important every day' (In2). She was positive about teaching mathematics to her

children and enjoyed their reaction: 'I think my children love mathematics because they see I love it' (In1).

While mathematical knowledge and skills were regarded as the main focus of teaching in the primary school, the school curriculum did not make provision for the teaching of science and technology. There was some disenchantment in the way science was taught or not taught in the school. She insisted that 'Learners should know science and I wish I could do more. Maybe I should plan better to include science on Fridays' (In2). Bea's situation was clearly expressed when she said: 'We [other staff members] plan the subjects together and science is not a priority subject because it does not count for marks' (In1) '…so there is very little time to teach science … However, we could plan a science project like a discovery table' (NR2).

She identified factors that inhibited her from fulfilling her role as an MST teacher. 'The factors that caused me not to teach science and technology are because of lack of time' (In2) and 'Very little science and technology, if any, is taught in the foundation phase at the school. I don't see science and technology' (In1).

The final stage of the data analysis process culminated in the narrative description of the professional teacher identity of the six beginning teachers (Chapter Four). The narrative descriptions explain and try to give insight into how and why six beginning teachers, in different school settings, who have just completed their professional studies, form, retain, change or adapt their professional teacher identity in the teaching of early MST. The analysis of data and discussion of results were done within the conceptual framework and the assumptions of the study. Therefore the question of how and why the different school contexts of these six beginning teachers affected their professional identity formation and in turn their MST teaching was synthesised from the collected data. In this study both the internal and external factors that derived from the conceptual framework were used as questions and guidelines in the data collection and data analysing process. The external and internal factors that influenced professional teacher identity formation were identified in a table and described in narrative form.

3.7 ETHICAL CONSIDERATIONS

To ensure ethical conduct during the research the researcher applied for ethical approval prior to data collection (Mouton, 2001). Ethical approval was granted by the Gauteng Department of Education (see Appendix D) and the University of Pretoria ethics committee. Through this process the researcher strove to assure the rights and protection of the beginning teachers and the schools that might be affected by the research (Mac Naughton *et al.*, 2001).

The following principles guided the process of ensuring ethical conduct during the research:

- informed consent
- voluntary participation
- confidentiality and anonymity
- privacy
- safety
- trust.

3.7.1 INFORMED CONSENT

In order for the participants to make a decision on their willingness to participate in the study, they needed to be informed about the purpose of the research, as well as how and to whom the results would be made known (Cohen *et al.,* 2000). The researcher obtained written informed consent from the six beginning teachers. After expressing an initial interest, potential participants were provided with information about the research during an individual briefing and a consent form (see Appendix A) was made available to them. The information session outlined the research aims, research process and data collection methods and time frame of the research. Each participant was given time (one week) to think about their participation and only after they consented to their involvement, were they provided with the research timeline for the different stages of data collection and the data collection methods. Participants employed their power of choice to sign the letters of consent and a copy of the consent form was given to each beginning teacher. Dates and times were then negotiated with each participant. Consent was also sought from and granted by the Department of Education (see Appendix D) and the principals of primary schools and

owners of early childhood centres (see Appendix E). Finally, consent for the observation and photo collages was granted by the parents of the children in the different classes (see Appendix F).

3.7.2 VOLUNTARY PARTICIPATION (CONFIDENTIALITY, ANONYMITY AND SAFETY IN PARTICIPATION)

Participants were assured that participation was voluntary and that they could withdraw at any time without supplying reasons (Cohen *et al.*, 2000; Mason, 2006; Mouton, 2001; Silverman, 2005). Participants signed the letter of consent prior to the commencement of data collection. The researcher was available to answer any inquiries concerning the procedure (Cohen *et al.*, 2000). At each stage of data collection, anonymity was respected and applied and all the data was treated as confidential.

Because participants provided information about the formation of their professional teacher identity the researcher was constantly aware of their private space and respected this space without compromising the data. When participants felt that they did not want to reveal any private information or disclose any private domain that they felt uncomfortable with, they could withhold information or withdraw from the study at any time. The information provided in the photo collage, narrative reflection and interviews were expressions of their ideas about teaching; their own voices. Before finalising the research findings, participants had the opportunity to read and comment on the narrative descriptions of their professional teacher identity formation to ensure correctness.

3.7.3 TRUST

The principle of trust guided the process of ensuring ethical conduct during the research. Lubbe (2003:26) explains that narrative inquiry is a 'relational inquiry' and that trust is important in the relationship to share 'real' or 'true' stories. Beginning teachers had to trust the researcher and they had to know that the researcher respected them to be able to entrust their narrative reflections and stories to her. A relationship of trust between the researcher and the participants was very important throughout the research to obtain access to the data (Cohen *et al.*, 2000). The

researcher applied the principle of fairness and trust to the participants and the schools during the data collection and during data analysis (Flick, 2008). No unexpected or ethical dilemmas arose during the study (Silverman, 2005). The beginning teachers involved in this study could have withdrawn at any time, had they wished to do so.

3.7.4 RISKS AND BENEFITS

There are no negative consequences attached to this research. This study gave beginning teachers (participants) a voice on the crucial matter of early MST teaching in the FP and ECP. The findings of the study will hopefully provide schools and teacher education institutions with information on the teaching and education of beginning teachers in early MST teaching and learning.

3.8 VALIDATION OF THIS STUDY

The 'methodological rigor' of this study was accomplished through the use of validation and verification methods (Creswell, 2007:270). The validity of this study was assured by the use of a variety of appropriate phenomenological data collection instruments, the period of time (one year) during which the data was collected and through the use of phenomenological data analysis methods. The extended time (Creswell, 2007) and engagement with the participants helped the researcher to build trust and establish credibility. The verification of this study was obtained through the repeated reading of all written narratives and transcripts to obtain a broad insight (Creswell, 2007) of how the beginning teachers' professional identity was formed. Ideas, themes, patterns and gaps emerged and crystallised from the data analysis and this led to a deeper understanding of the phenomenon (Nieuwenhuis, 2007) enabling the researcher to describe the formation of a core professional teacher identity (Casey, 2007).

The researcher's position in phenomenological methodology is 'unique' because the researcher is 'central' and 'intertwined' in the research and the research experience (Casey, 2007:125). The researcher is a lecturer at the teacher education institution where the beginning teachers completed their studies. This position placed the researcher in an 'insider' situation, which meant that in a phenomenological research

approach the researcher had to discard 'prejudgement' (Creswell, 2007:237) about the formation of professional teacher identity. The nature of phenomenology further added to the possibility of subjectivity. Therefore the researcher had to be aware (as far as possible) of preconceived notions and subjectivities (Creswell, 2007) because 'the researcher and the research are intertwined' (Casey, 2007:125). This was done through triangulation of the different data sources. Furthermore, the researcher used the technique of member checking (Casey, 2007:126) and communicative validation (Flick, 2008:115) by asking the participants to read and verify their professional teacher identity portraits. This enabled her to hear the 'voices' of the beginning teachers on their professional teacher identity (Casey, 2007). However, the 'insider' position of the researcher also had the advantage of providing the possibility of deeper insight and understanding of the aspects of MST teaching and learning. A further advantage of this situation was that the rich background of experience has hopefully led to a better understanding of the phenomenon.

3.9   CHALLENGES AND STRENGTH OF THE STUDY

This study explored the experiences of beginning teachers during their first year of teaching early MST. A phenomenologically orientated research approach limited the potential for generalisation in this study, but combined with a multiple case study method (Silverman, 2005), it allowed the researcher to explore the 'richness, depth, nuance, context, multi-dimensionality and complexity' of the phenomenon of professional teacher identity formation (Mason, 2006:1).

The advantages of the multiple case study design lay in comparing similarities and differences of identity formation and MST teaching between cases and identifying themes, also called 'clusters of meaning' (Creswell, 2007:61). The case study revealed the real-life teaching situation in which each beginning teacher found herself, when she described in her own words what happened, allowing for a 'close-up reality and thick description of participants' lived experience' (Cohen *et al.*, 2000:182).

The multiple case study approach also had disadvantages. It was time-consuming, due to the extended data collection period. The large amount of data collected necessitated systematic data reduction into more manageable topics and themes

(Cohen *et al.*, 2000; Miles, 1979; Mouton, 2001). Also, the researcher had to guard against the ever-present possibility of researcher bias and subjectivity (Cohen *et al.*, 2000).

The possible challenges of the study were minimised by the use of a variety of data collection methods, the triangulation of data and the extended period of time (one year) during which the data was collected and verified (Creswell, 2007). The limitations of the data collection methods and the enrichment of validation of these methods have been summarised in Table 3.7.

Table 3.7: Data collection methods, limitations and enrichment of validation

Data collection methods	Limitations	Enrichment of validation
Photo collages	The ambiguity of visual and the possibility of 'multiple interpretations' (Banks, 2009).	The use of a variety of data collection methods (triangulation), member checking (Casey, 2007) to verify interpretation of photos and images.
Narrative reflections	Limited views, knowledge, ideas and practices about MST teaching may inhibit the information on professional teacher identity formation.	• The use of a variety of data collection methods (triangulation) • Communicative validation (Flick, 2008). • Highly participative data collection method (Burton & Bartlett, 2009). Open questions were formulated to guide the beginning teachers in their writing.
Semi-structured individual interviews	• Power relationship because the researcher was known to the beginning teachers. • Insider role of the researcher meant that the researcher had to guard against pre-judgement.	• The use of a variety of data collection methods (triangulation). • The researcher had to build in a relationship of trust. • 'Communicative validation' (Flick, 2008) and • Member checking (Casey, 2007) were done with the beginning teachers on the transcribed interviews.
Informal observation and field notes	• Researcher's own views • Time constraints, only one observation in each school. • School context may inhibit the teaching of science and technology.	• The use of a variety of data collection methods (triangulation). • The researcher had to build in a relationship of trust. • Member checking (Casey, 2007) on the field notes. • Communicative validation (Flick, 2008) through their observational reflections.

Data collection methods	Limitations	Enrichment of validation
Observational reflections	Limited views, knowledge, ideas and practices about MST teaching and may inhibit the information on professional teacher identity formation.	• The use of a variety of data collection methods (triangulation). • The researcher ensured a relationship of trust.

3.10   CONCLUSION

In this chapter the research approach and the sample selection were described. A detailed account of the data collection and analysis techniques, the stages of data collection as well as the strengths and weaknesses of these techniques were provided. The chosen research methods were justified in line with the research questions and the purpose of the research. The ethical considerations, as well as the limitations and challenges of the study were explained.

In Chapter Four the results will be presented.

---oOo---