CHAPTER THREE RESEARCH DESIGN AND METHODS

3.1 Overview

This chapter describes the research design and methodology. A retrospective or post-hoc case study design was selected as the most appropriate approach in attempting to understand the influence of the *mathematics profiles* of pre-service mathematics teachers on their *instructional behaviour*. This study aims to explore the afore-mentioned relationship in the hope of generating additional theory in this domain. The case study encompasses seven single cases from one university in South Africa and draws on qualitative data. The chapter first expands on the case study design, followed by a brief description of the social constructivism epistemology that underpins the study. The site and sample are then discussed prior to an explanation of data collection methods and analyses procedures. The chapter concludes with an outline of the quality control of the data before the actual data is presented in chapter 4.

3.2 Research design

A qualitative approach was chosen to guide the methodology of this study with the approach being a case study. A case study seeks to understand the dynamics present within a setting through single or multiple cases. It allows one to examine features on people or units in depth for a specified duration, depict the context of the case and examine how the parts are configured (Neuman, 1997). The method also aims to provide a description of the phenomena or constructs being investigated, and to either test or generate theory (Eisenhardt, 2002). Utilising case studies permits one to use numerous levels of analysis (Yin, 2003) while also providing a rich and in-depth description of each case. It is on this basis that I elected a case study approach to guide the research design of this study. It is however a **retrospective or post-hoc case study**; in other words events that have already happened are being investigated in an attempt to describe and understand them (Porter & Carter, 2000).

The intention is not to provide a cause-effect relationship between the mathematics profiles of the pre-service teachers and their instructional behaviour. Rather my aim was to use

descriptive research to present a picture of the specific details of the participants' mathematics profiles and their instructional behaviour within the social context of the PGCE course. Using this I tried to understand how the composition of each profile may or may not have an influence on the instructional behaviour the respective students develop and display during the course of the year (Neuman, 1997).

Although I was the specialisation lecturer for the students, I did not actively analyse data during the course of their PGCE year. The data used are being used retrospectively (from the past 3 years) and were part of students' standard requirements for their PGCE course. No additional data were gathered for the purpose of this study. However, the study was being conceptualised during that time. Initially I considered collecting and analysing data during the course of the PGCE academic year, but decided against this for two reasons. Firstly, from an ethical perspective, I did not want to the students to feel obligated to take part in the study or that my assessment of them would be influenced by their being part of the study or not. Secondly, during the process of conceptualising the study I took a methodological decision to work with “private” data that participants chose to make “public” (Ribbens & Edwards, 1998). The professional portfolios that students submit at the end of the year in substantiating their professional development are compiled by the students from their choice of lesson plans, reflections, video recordings of lessons, personal profiles and any other information they deem important. This decision provided me with a different research perspective compared to if I had decided when and where to collect the necessary data. In effect, for this study, the participants did the initial selection of the data.

3.3 Research procedures

As their lecturer during their PGCE year, I was emotionally involved with the participants during the time that the data were being generated. At the time I did not assume the role of researcher. Gans (1982) terms this type of involvement as "total participant" (p. 357). Of course, because I am not blindly studying the portfolios, but know each of the participants, my personal knowledge of and potential bias towards individuals needs to be made as transparent as possible. In order to do this I first discuss the participants in this chapter and in chapter 4, as they present themselves in the data. Subsequently in chapter 5, I present their mathematics

portfolios and instructional behaviour descriptions as my second-order interpretation (Neuman, 1997) of the data in their portfolios mixed with my knowledge and experience of them as PGCE students. In chapter 6, I draw on both their first-order interpretations of themselves as well as my second-order interpretation of the data in constructing and comparing the third-order interpretation in the form of visual representations of each profile. These are then used for the cross-case comparisons and to draw the final conclusions.

3.4 Research paradigm

In this investigation the seven individual participants are viewed as the main source in shedding light on the research question being addressed. Their actions, thoughts and knowledge are seen as crucial determinants to establish and investigate the relationship being examined. Creswell (2007) focuses on four worldviews (or paradigms): postpositivism, social constructivism, advocacy/participatory and pragmatism. Simply, postpositivism is more reductionistic and logical with an emphasis on empirical data collection and an orientation towards cause-and-effect. Research in the advocacy/participatory paradigm follows the central tenet that research should contain an action agenda for reform that may change the lives of the participants, institutions or the researcher. Pragmatism comes in many forms but individuals subscribing to this worldview are usually focused on the outcomes of the research rather than antecedent conditions. The problem being studied is the focus of the research rather than the methods being employed. According to Creswell (2007) social constructivism is often combined with interpretivism. As he puts it:

> *The goal of this research then is to rely as much as possible on the participants' views of the situation. Often these subjective meanings are negotiated socially and historically….The researchers intent, then, is to make sense (or interpret) the meanings others have about the world. This is why qualitative research is often called "interpretive" research (p.21).*

Methodologically, the positioning of my research within the social constructivism paradigm assumes a participatory stance for myself as the researcher and requires the description of specific cases through narrative articulation and interpretation. In terms of epistemology, an underlying assumption I bring into the inquiry is that people have and use interpretive schemes

that should be understood. Ontologically, this social constructivist paradigm locates the participants in this study, as well as the constructs being investigated, within inter-subjective social fields (in this case the educational context) which structure and constrain activity (Packer, 2007). As the researcher I am ontologically focused on investigating the complexity within this contextualised and authentic situation. This therefore highlights the need to explicitly articulate the character of the local context within the study. The broader local context of teacher training and education in South Africa was discussed in chapter 1. In the next section I elaborate on what I see as the more central and immediate context of the study: the PGCE course within which the study was conducted, followed by a brief introduction to each of the participants in the sample.

3.5 Research methods

3.5.1 Site

The population of this study is the Post Graduate Certificate in Education (PGCE) course at a large university in South Africa. The PGCE course is a one-year professional diploma in which students who have obtained an initial degree are trained to become teachers. Students are required to specialise in a particular phase of education, i.e. the Early Childhood Education phase (Grades R – 3), the Intermediate phase (Grades 4 – 6), the Senior Phase (Grades 7 – 9) or the Further Education and Training Phase (Grades 10 – 12). They subsequently carry out two school-based education (SBE) periods, of one school calendar term each, within the specific phase and subject(s) in which they have elected to specialise.

Students complete a number of professional modules which pertain to more generic educational principles such as assessment, diversity within the classroom, facilitating learning and compiling their professional portfolios. They are then also required to study certain specialisation modules according to the phase and subject(s) in which they intend to specialise. Intermediate and Senior Phase students specialise in two subjects during the year, while the Further Education and Training students only specialise in one subject. When the students are not on their school-based practical periods at the school, they spend intensive time at the university completing theory and assignments relating to their professional and specialisation

modules. Specialisation lecturers of the students are required to then also visit and assess the practical teaching of their students at least three times during each school-based teaching period.

The particular context of this study is the Mathematics Specialisation module within the PGCE course (see Appendix B). I am the lecturer for this module and have been the lecturer thereof for the past five years. The contact times I spend with the students are often more pedagogical by nature rather than content based. The reason for this is that the orientation of the PGCE course assumes that students come to the course with an initial degree in the subject they have chosen to teach. There are approximately nine months in which to equip students as much as possible to be effective facilitators of learning in their chosen field. This entails introducing them to the new curriculum as well as equipping them to stand up in front of a class and make the knowledge they have gained accessible to their learners. My concern relating to this approach is that the students often do not gain the necessary content knowledge required to teach mathematics in their initial degrees. They appear to study a lot of mathematics without gaining the necessary conceptual depth or understanding thereof, especially within elementary, school-related topics that they will be required to teach. It is my experience that in their initial degrees, the mathematics courses they take are not geared towards providing them with the knowledge to teach mathematics, but rather with the knowledge of how to use it.

The PGCE course forms the broader context for the study, and I believe the design thereof hopefully can be enhanced by this study. However, the PGCE course is not being researched or evaluated herein, although I do offer my own critical reflection on the current design through the course of this study. In chapter 1 an overview of the training of teachers in South Africa was provided. Within that context and according to the policy guidelines, the PGCE I am involved in has developed a programme with the explicit purpose:

> *…to educate facilitators of learning to engage in the highest possible level of education quality with the result of the highest possible level of learning quality in every possible context, recognising the requirements of existing education requirements, as well as the challenging demands on education for an unknown future (Slabbert, 2007, p. 1).*

The theoretical/conceptual framework of the PGCE (Slabbert, 2006 – see Appendix B) is founded on teacher self-knowledge, radical socio-constructivism, experiential learning, holistic education and contingency theory. The development of the course was mainly informed by the work of Korthagen (2001). His research has shown that when student teachers are exposed to and challenged with living through new experiences that they continually have to reflect on, they understand the principles that cause their practice to be successful. This allows them then consciously to construct new conceptions and internalise fundamental change in their own learning and the way they educate learners. This construction process represents the theory of practice. In the PGCE course, this is known as the practice-theory.

The practice-theory is the pivotal point around which everything in the PGCE programme revolves. It is the student's construction of a personal practice-theory of and for facilitating learning. It is intended to be a principle-centred, context-dependent theory that forms the foundation for guiding students' instantaneous decision-making to solve the problems of their professional practice and improve subsequent practices (Korthagen, 2001; Slabbert, 2006). The rationale for this is based on the departure point that education as a professional practice requires professional knowledge (rather than disciplinary-based theory) that is derived from practice.

According to Korthagen (2001), the traditional goal of teacher education focussed on equipping students with expert knowledge (resulting from psychological, sociological and educational research) so that they can use this expertise in their practice. Research shows that this scientific understanding of education (episteme) has "very little effect on practice" (Korthagen, 2001, p. 255) and does not produce the fundamental change necessary in education. Korthagen (2001) suggests that practical wisdom (phronesis) is required and the practice-theory approach outlined above is a means to achieving this knowledge derived from practice. The practice-theory, while serving as a theory (practical wisdom – phronesis) of education is also continuously informed, enriched and improved by each individual student's practice through reflection by the student and/or action research on their own practice. It can also be enlightened and enhanced by practices of other facilitators of learning as well as other existing theories (research) in education (Slabbert, 2006).

All PGCE students complete a module known as Facilitating Learning which takes them through five phases intended to prepare them as facilitators during the course of the year. The first phase is designed to help students find their personal voice to answer the question: Who am I and what do I need to maximise me? The second phase affords students the opportunity to compile a repertoire of education methods, tools and techniques that suit their personal strong points, and to implement these in practice. Phase three focuses more on the nature and structure of the students' areas of specialisation (for example mathematics) and adding to and implementing the repertoire of education methods, tools and techniques in this regard. The fourth phase requires that students construct a macro practice-theory that uses as its basis the facilitating actions necessary to ensure the highest possible level of quality learning, irrespective of personal preferences or the area of specialisation demands. The fifth and final phase builds on the fourth phase in that students develop their own personal (micro) practice-theory that incorporates all the essential professional decisions to be made to ensure the highest possible learning quality that a context may demand. A more detailed explanation of this module can be found in Appendix B.

The explanation above is an ideal theory though guiding the PGCE programme. In practice, during these five phases, students are still "taught" the theory of facilitating learning and what actions (stages, approaches and methods) are essential to ensure the highest possible level of learning quality. As part of the course requirements, students are required to implement these actions in their practice in order to defend their professional development. Students are given a framework that outlines four major teaching paradigms (see Appendix C) mainly drawing on the work of Miller's holistic education (Slabbert, 2006). By the end of the year, students need to be able to demonstrate their competency in the highest teaching paradigm (transcendental) in order to pass the course. The paradigms are now briefly discussed in hierarchical order from low to high.

The transmission paradigm is best described as imparting knowledge or lecturing. The transaction paradigm requires participatory understanding and questioning, involving the learner more in the lesson. The transformation paradigm also requires more participation from the learners in the form of exploration and projects. The highest learning quality (according to

Slabbert, 2006) emanates from lessons in the transcendental paradigm where real-life learning tasks are designed so that learners can create their knowledge.

The PGCE students are allowed to frame their lessons during their first school-based education (during the second term of the year) in the transmission and transaction paradigms. However, having gained experience during the first school-based education and also from their specialisation modules, students are required to produce a learning task design and video evidence of facilitating learning in the transcendental paradigm for at least two lessons. While I see the value in this, I question this as being the envisioned phronesis (practical wisdom) rather than episteme (scientific understanding) as the students are required to implement a prescribed and structured framework (see Appendices B and C) according to rigid guidelines. In saying that, however, it has been my experience while lecturing the mathematics specialisation module over the past seven years, that when students actually implement their first transcendental lesson with success, it has an enormous impact on their practice-theory and subsequent practice. The problem is that not all (or even many) of our students get to the point of *successfully* implementing a lesson in the transcendental paradigm. For them it remains a compulsory but elusive challenge from which they never really gain any phronesis.

The PGCE course is made up of a professional curriculum and a specialisation curriculum. The entire Professional Curriculum, and in particular, the comprehensive, integrated, holistic practice-theory of facilitating learning in the form of a concept map informs (is the foundation of and supports) the specialisation curriculum in which the actual professional practice is manifest. This means that the practice-theory of facilitating learning (in the form of a concept map) contains the fundamental (core) concepts that constitute facilitating learning. However, how the particular field of specialisation is practised, depends on the nature and structure of that particular specialisation. The specialisation curriculum, therefore, focuses on the identification of the nature and structure of the field of specialisation and the identification and selection of the relevant education practices of that specialisation. It is the particularisation of the specialisation and personal assets and preferences – where applicable – which will give the practice-theory of facilitating learning in a particular specialisation its individual and personal character and will contribute largely to the differences between the practice-theory of one individual and another (Slabbert, 2006).

The professional curriculum consists of the following subjects: Facilitating learning, Learning theories, Assessment, Global perspectives in education (including dealing with learners with special needs), Foundations of education, Social context of education (including diversity and HIV/Aids), Professional ethics and law, Professional portfolio development and Information and communication technology. The specialisation curriculum is the learning area(s) in which the student chooses to specialise. In the case of this study, all of the participants chose to become teachers in the FET phase and therefore all of them only had one specialisation learning area, namely mathematics. These participants are now introduced.

3.5.2 Sample

In this population, the sample chosen was selected based on a theoretical (Eisenhardt, 2002) rather than random sampling. Students specialising in the FET phase during 2006, 2007 and 2008 were asked if they would be prepared to make their portfolios and other relevant documents available for the study. From the 2006 cohort one of the two students gave consent for her data to be used, both students who completed the course in 2007 gave their consent and from the 2008 group, all four students signed consent. This resulted in a convenience sample of seven cases, varying in their backgrounds as far as their schooling and prior university experiences, but similar in their training in becoming teachers (i.e. the PGCE course).

The sample consists of six female students and one male student varying in age between 21 and 50. All of the students speak Afrikaans as their home language but are all competent in English as their second language and this was also used as the common language of instruction throughout their PGCE course. Students could choose to teach at either Afrikaans or English schools during their SBE's and could also decide on the language in which to present their portfolios in. Some of the students taught both of their school-based education terms, and later also wrote their portfolios in Afrikaans. Where quotes have been used, these have been translated. My home language is English but I am also competent in Afrikaans. I therefore did the necessary translations, with assistance and verification from an Afrikaans speaking colleague.

As part of the requirements for the final professional portfolio, each PGCE student is required to select a metaphor that they think best depicts the information presented in their portfolios. This metaphor needs to be explained and carried throughout the portfolio. It is also used in the final oral presentations where they present and defend their professional practice. I have chosen to include narratives on each of these metaphors as they provide good insight for the reader into the thinking, experiences and perspectives of the participants. They therefore provide more background on and context for each participant against which the mathematics profiles and instructional behaviour profiles can be understood in the chapters that follow.

Each participant is now introduced individually below as they portray themselves in their final portfolios. Figure 3.1 shows an initial "snapshot" of their initial visual mathematics profiles. These are further explained in chapter 6. For ease of narrative purposes, I have re-written the introductions below in the third person but want to stress that no interpretation has been added; these introductory narratives are completely constructed from information that the students made available in their portfolios.

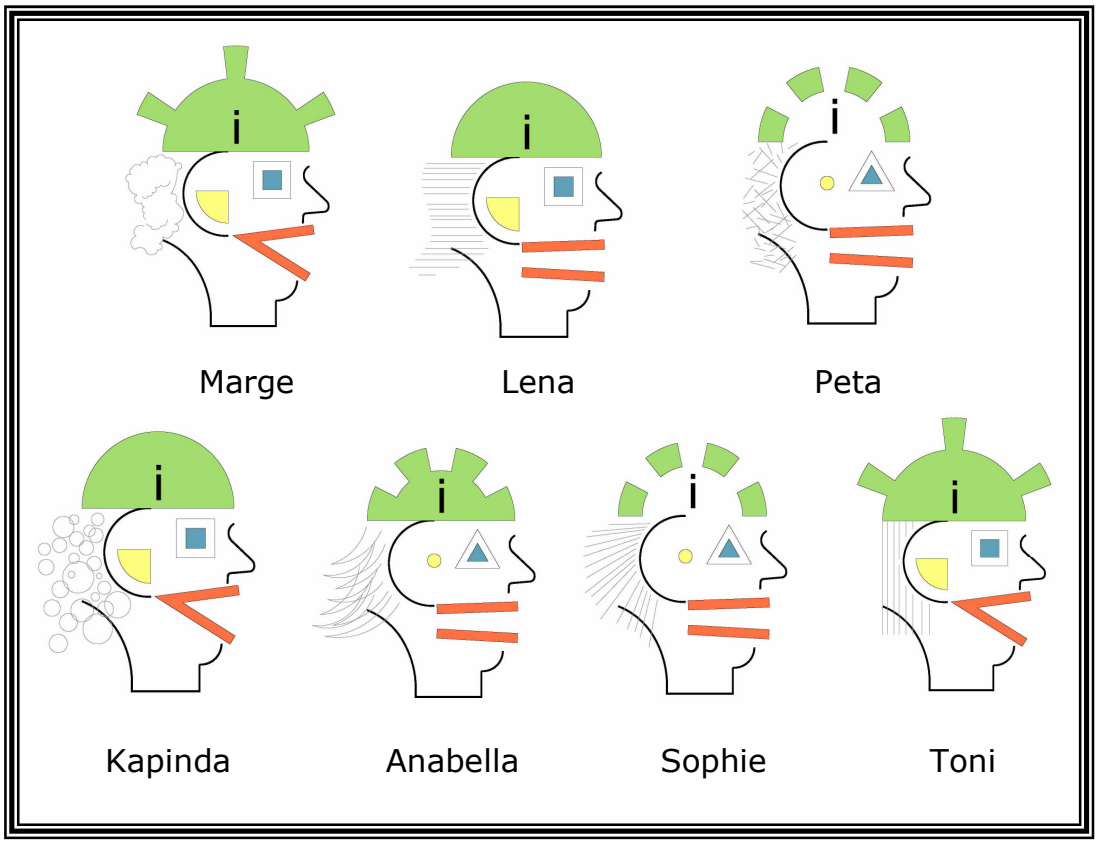

Figure 3.1 Initial "snapshot" of participants (Class of 2006 – 2008)

Marge (2006)

Marge has a different background compared to many of the PGCE students who register for the course in that she is older than the average PGCE student. She was born in 1958 and completed her initial Bachelor of Science (BSc) degree in mathematics and chemistry at the University of the Freestate in 1976. She then worked for a few years before having children. Marge stopped working for 20 years in order to raise her children, before she took on some part-time work again teaching extra mathematics. From 2003, Marge taught mathematics part-time at a local FET college before deciding to qualify as a mathematics teacher through our PGCE programme. Marge completed the PGCE course during 2006 and openly admits that she was "not prepared for what facilitating of learning implies." In her portfolio she describes the self-examination she went through during the year and the "bravado" she was freed from on which her self-image and confidence were based at that stage.

Marge describes her strengths as being a sense of responsibility and her self-sacrificing nature. Her weaknesses she admits come in the form of "fear, perfectionism and control freak". Her ideal is to eventually qualify academically so that she can lecture at a tertiary institution. The PGCE was her first step to realizing this ideal, and she has since also enrolled for a research Masters degree in education.

Marge describes herself as having a passion for mathematics. She says not a day goes by without her thinking of herself within the context of mathematics. She views herself as someone who is qualified and able to teach mathematics to Grade 12. She sees herself as someone who will continually and repeatedly strive to make the mathematics clear to learners in a variety of ways. She admits to being unsure of the new curriculum content such as financial mathematics, statistics and transformation geometry but she claims that her confidence and ease with the other parts of the content put her in good stead to master these sections.

Toward the beginning of the year she confessed that she understood her role in the classroom only in terms of the transmission and transaction paradigms. She saw motivating learners to develop a passion for mathematics, to infuse learners with self-confidence, to explain concepts in mathematics, and to prepare learners for examinations, as her main roles within the

classroom. In a reflection she sent to me in May 2006, after I sent her a report on a class I had visited during her first SBE, she makes the following statement:

> *I still agree that Mathematics is not a set of rules, recipes or algorithms, but simultaneously I doubt very much whether negative learners taking a compulsory subject like mathematical literacy are capable of constructing their own, CORRECT knowledge…I am always under pressure not to waste too much time. I feel concerned about letting them construct wrong ideas and then have to demolish again. I have always thought that is more harmful to construct wrong ideas than no ideas at all. My idea always has been to show the way with clear explanations, embedded in theory and have the learners exploring with those examples as analogy.*

Marge takes readers through her portfolio by likening herself to Paul of Tarsus from the Bible. She claims that her journey through the PGCE reminded her of Paul's journeys as he depicts them in the Bible. She adds that she could always identify with Paul's style and his way of reasoning. Her school-based periods at two different and unfamiliar schools are paralleled with Paul's temporary visits to synagogues in each town that he visited. She explains that "just like him [Paul], some accepted the new ideas and the majority rejected them. Just as Paul had to make adjustments to his programme or had to negotiate about travel companions or had to consolidate about problems, I had to also adjust my practice-theory."

Lena (2007)

Lena attended a local Afrikaans school after which she immediately went on to do a Bachelor in Secondary Education (BSecEd) degree at the University of Pretoria. In 2007 she enrolled for the PGCE programme which is the compulsory fourth year of the BSecEd course. Since she can remember Lena wanted to become a teacher and later on in her life she dreamt of becoming a great mathematics teacher who makes mathematics a subject that is loved and enjoyed by all the learners. That is why she decided to do the BSecEd(Sci) degree. This is a BSc mathematics degree combined with the PGCE programme. She decided to do this degree because it presented more of a challenge than doing a normal Bachelor of Education (BEd) degree and she felt that doing the PGCE programme was a great chance to develop all the necessary personal and professional skills needed to be a great facilitator of learning. She

experienced the PGCE programme as a good way to find out who you are and develop the weak points in your life to become good attributes.

Lena says that her life revolves around her Christianity in that she tries to do everything for the Lord. She wants to make Him smile when He looks at her life! She states that this is what keeps her motivated and why she tries to do everything as best she can. The most important things in her life are her family, friends and dancing! Her family and friends are always there for her and she shares everything with them, they make life so much better! Lena portrays herself as someone who always tries to help other people and who has a very tender heart. She tries to always keep her word. She admits that she sometimes lets people walk over her because she is not aggressive enough, and that she sometimes says things before thinking. Her biggest fear is growing old alone.

Lena presents her strengths as her self-discipline, self-respect and character. Her good self-discipline enables her to be organized and punctual. She adds that she also has integrity, faith and trust. Her one weakness she says is that she doesn't see the bigger picture; that she usually concentrates on the here and now, failing to think bigger.

Lena wants to be "the teacher that everyone respects" not because she is "mean and strict" but because she intends to treat learners "with respect and love." She strives to "be the fun teacher who is never grumpy, always making jokes but still maintaining discipline in the class." Lena hopes that her class will be the one "learners are always looking forward to and always enjoy." She sees herself as "the person who gets the discovering going." She portrays herself as the "person who gives and explains the work, but the learners need to try and discover the work on their own as well…because there are many ways of solving a problem, you just need to find the method that suits you best." If they struggle, she says she will help them but thinks that "a good way of understanding mathematics is to try it on your own." Lena also views herself as "an elder in the classroom." She doesn't want learners to feel that she is totally "above them and unreachable" but she does want them to "have the necessary respect that they should have for someone older than themselves."

Lena depicts her role in the mathematics classroom as "firstly to give learners the self-confidence to believe that they can do mathematics." Her next important role is "to explain the work in such a way that everyone can understand it and then apply the work to their everyday life." She also subscribes to "the role to supply the learners with the necessary life skills to reach their full potential in this world." Lena would like her learners to "be excited about mathematics" and to "realise that everything in this world has some form of mathematics in it. She hopes learners will "not only do the mathematics because they are told to, but because they want to do it and enjoy it." She hopes learners will "feel the satisfaction of discovering the world of mathematics."

Lena wants her classroom to "have a friendly and relaxed atmosphere." She wants learners to respect her and to treat her accordingly. She hopes to establish a culture in her classroom of "openness and friendliness" and for the "learners to feel free to express themselves" and to feel "that they are special". She intends to accomplish this by getting to know the learners in her class and giving them "the respect they deserve and being a fair teacher with integrity." She will strive to live out her Christianity in the classroom by just being herself, "without discriminating against any other religion."

Lena chose the board game "Snakes and Ladders" as her metaphor for the portfolio. She says that as a little girl, this was one of her favourite board games. She enjoyed "how you can be slowed down by the snakes that take you back a few blocks but that you can also advance a few blocks when you land on a block with a ladder." Lena felt that this was exactly what had happened to her throughout her PGCE year. As she moved through the blocks of the year, there were times when she landed on a block that made her feel like she went backwards in her professional development. This helped her though to realise that there were aspects of facilitating learning that she still needed to work on and develop. She compares the positive experiences and feedback she received to blocks with ladders in them. These represented her development and how she moved forward as a facilitator of learning.

Peta (2007)

After school Peta completed a BSc degree in Medical Sciences in 2005. In the collage that she compiled at the beginning of the PGCE year, she included a picture of a stethoscope which she

said symbolised her parents' dream for her to become a medical doctor. In 2006 Peta enrolled for her Honours in Pharmacology which she did not complete. Instead she chose to do the PGCE course in 2007 with a focus on mathematics.

Peta wanted to become a teacher for as long as she can remember. She enjoys working with people and also doing mathematics. Peta believes that she is "naturally drawn to work with other people." She likes "helping others find their way in life, often inspiring them to grow as individuals and to fulfill their potential." She thinks that she will "be a teacher whose students can really depend on to be fair." She wants to "be consistent and balanced" in her approach. She does not want to raise her voice and intends to always "treat every student the same without any favouritism." She claims to "have high expectations", always following up with people she has helped.

Peta indicates her strengths in the classroom being that she is "a calm and relaxed person." When asked about her weaknesses, she noted that she does not like fighting because she says she has a tendency to hurt people with what she is saying. Peta summed up her values in one Zulu proverb: "Umuntu Ungumuntu Ngabantu." This means that a human being becomes human through other human beings. She also emphasizes that in our South African constitution every person has the right to be treated like a person.

Peta views herself "as someone who should be able to make progress easier. To convey content in such a way that it will be easy to interpret." She doesn't just want "to teach learners what to learn or master, but how to do it." She would like to "show the learners how they can use mathematics in everyday life so that their gained knowledge may be power." She hopes learners will be "inquisitive with an enthusiastic and curious attitude towards mathematics" and her learners will experience the fact that she loves mathematics through her teaching and "that they would also start to think positive about it." Peta states that she "won't like to have any disruptions" in her classes and wants "students to realise that they will be dealt with according to the rules but in a fair and consistent way."

Peta tells the story of herself and the heart of an eagle as her metaphor for the final portfolio. The story is told in seven phases each symbolizing a corresponding phase in her PGCE year.

The story begins with an eagle's chick hatching. The second phase describes a strong wind blowing the baby eagle out of the nest. Phase three tells how a farmer found the baby eagle on the ground and placed it in his chicken run at home amongst all the chickens. One day a nature conservationist came to the farmer's house and found the eagle in the chicken run. He was shocked to hear the farmer explain how he had reared the eagle as a chicken and how the eagle had taken on their habits. The nature conservationist stressed how wrong this was and felt sure that the eagle could still learn to fly. Phase four and five tell of the two men (the farmer and the nature conservationist) together embarking on teaching the eagle to fly. Phase six tells how on the third day the nature conservationist took the eagle to a high mountain, pointed her to the sun and instructed her to fly like an eagle. The scared eagle looked around her, gave a loud call, stretched out her wings and flew! Phase seven concludes with Peta foregrounding the excellent sight and courage that eagles are known for. She stresses one should not keep "your eyes on the ground like a chicken because you doubt your own competences." Eagles belong in the air.

Kapinda (2008)

Kapinda enrolled for BSecEd(Sci) in 2004. Therefore similarly to Lena, she had to complete the PGCE as her final year in order to graduate. Although she thought that the PGCE is a good course to open doors for future career opportunities, she did not plan to become a teacher after completing the PGCE. Her career goal was to rather go into ministry.

Kapinda tells in her portfolio how she was “born as a mentor and tutor and facilitator!!!!” Kapinda means "grace and favoured by God; sparkling". Her dominant intelligences are interpersonal and intrapersonal which makes sense to her as she has a deep love for people. She enjoys being around people and being actively involved in their lives. She is also a 'thinker' and often is introspective to analyse situations. According to Meyer-Briggs personality type indicator, she is extrovert, intuitive, feeler and thinker. She learns the best when movement is part of the learning environment and learning task. According to her brain profile she is very creative and very emotional with organizational skills not very dominant. She believes that her calling is to "help people discover and develop their potential. To be a mirror of truth."

Kapinda describes the PGCE as a life-changing experience. She admits that she really learned a lot about herself. She says she now realises how important this is, since if one doesn't know who one is, it is impossible to believe in oneself. Kapinda mentions that the PGCE equipped her to prepare for an unknown future. She says she was often confused about what tomorrow would hold, but realised that is what life is about: learning to prosper amidst uncertainty. Kapinda also shared the changes in her views on the education system and teaching paradigms. She realised that we are dealing with learners who have a post-modern mindset, and should meet them at the place where they are. This is why, she says, we cannot teach in the transmission paradigm any longer and should encourage discovery learning in the transcendental paradigm. She felt that during the PGCE she and her peers learned what they did through Authentic learning, and the PGCE really applied to the Practice-theory of Facilitating Learning.

Kapinda identifies herself in the classroom just as a person, as not being more important than the learners, but that she too is a life-long learner. She aspires to be open to learn new skills, more human knowledge and more about life and people while also facilitating the learners to learn more. She believes that one of her main roles in the mathematics classroom is to encourage learners. For Kapinda, helping learners to believe in themselves is of "utmost importance". She strives to "encourage learners to be positive and not to underestimate themselves". She also wants to "make them hungry to investigate mathematics, and not be afraid to try."

In addition she also sees her role as enabling learners to relate the theory they learn to their daily lives. She believes that "spoon feeding doesn't promote maximal learning" but that it is good to "give some form of guidance and structure and help learners towards solutions." She envisions a relaxed but focused attitude in her mathematics classroom. She wants learners to be active rather than passive and to encourage them to keep on searching for meaning. She describes her desired classroom culture as an "interactive culture". Her ideal is for learners to find meaning in the subject content of mathematics. She hopes that what they learn will make sense to the learners and "be relevant to real life". For Kapinda the best part of mathematics is "to find a solution after struggling for long." She wants to encourage learners "to keep on trying, in order to experience that satisfaction of finding the solution."

Kapinda used the Fish River Canyon hike in Namibia as her analogy to navigate her journey through the PGCE year. She says that "every hiking trail has its ups and downs" as was her experience during the year. Kapinda actually hiked this Fish River Canyon trail during the student recess in her PGCE year. This therefore made this metaphor particularly relevant for her. She starts by identifying herself as the hiker before providing the reader with a packing list for the canyon hike that she parallels to characteristics in herself she needed to "pack" for the PGCE. She then summarises the ups and downs of the PGCE year in terms of Phases.

Sophie (2008)

Sophie started a Bachelor of Arts (BA) degree at the University of Pretoria directly after completing school. She completed her BA degree in 2007 with an emphasis on educational subjects, including mathematics courses that our BEd students do as part of their degrees. In 2008 she enrolled for the PGCE course with the intention of spending some time teaching in the United Kingdom in 2009.

Sophie describes herself as a very confident person who has faith in herself. She views herself as "a person who loves children" and "someone who really communicates well with children." She expresses that she is "not shy and will say when and what is needed for a situation." Her personality test indicated that she is dominantly introvert with intuition, feeling and judging scores being the same.

Sophie lists her strengths as “love easily and care about others”, “strong bond with children” and that people get on well with her as she understands people and sees herself as someone that “anyone can talk to.” She also feels that an advantage for her in the classroom is that she can “speak loud and clear to learners and people” and that she can do something and not let others interfere with her work. Her weaknesses she professes are that she sometimes gets despondent, especially when she is stressed. She adds that she then also gets “a bit confused with the things” she has to do. She admits to buying too many shoes, being mad about watching television, loves food and overeats and finally that she loves her sleep and is not friendly if someone wakes her up.

In the classroom Sophie sees herself as the facilitator and the children are her learners. She feels that in the classroom she cannot be a friend to learners like she is "with other children." The context of the classroom is different and she views herself as a "different person" there. She wants learners to see her "as their superior and facilitator" and she expects them to respect her. Her role is "to educate learners, especially in maths and to maximize their potential for their own futures and lives." She wants to strive for "equity in the classroom" and "not have any favorites." Sophie states that she "will not discriminate against race, colour or culture" and intends to "be fair in everything" she does in the classroom and in the school. She intends to tell her learners "to keep their cultural beliefs outside the classroom" if it disturbs her facilitating and insists that "all learners must also be considerate towards other learners' cultures."

Sophie hopes learners will be themselves in her classroom and "participate in all the activities" she does. She doesn't want them to be afraid of her so "that they don't want to ask questions" but she also doesn't want them to see her as their friend. She expects learners to "ask questions when they don't understand, and if they don't and they also don't understand" she states that "the rest of their problems are not my responsibility." She aspires to "plan fun and interesting activities and be organized" so that learners can see that she knows what she is doing.

Regarding mathematics, Sophie would like "learners to experience the learning area/subject of maths … as interesting, fun and challenging" in her class. She says learners must "want to come to class" and she will do her "best so that all the learners understand the work, therefore all of them will not find it frustrating." Her aim is to "connect the work with real-life situations and careers so that learners will want to do mathematics and "find it interesting, because they then know that they will make use of the information, somewhere in the future."

Sophie ran the Comrades Marathon (87km) for the first time in 2008, while also completing her PGCE course. She used the analogy of running the Comrades in describing her PGCE "marathon". She admits that both undertakings were strenuous and "had a lot of uphills and difficult times." She adds that at least "there is a downhill on the other side of every uphill." She enjoyed the downhills very much and the supporters made the marathons pleasant and

worth the effort. Sophie divides her portfolio into 14 sections that parallel sections of the Comrades marathon.

Anabella (2008)

Anabella, like Lena and Kapinda also completed a BSecEd (Natural Sciences) which has the PGCE course as the fourth year. She admits that initially she did not want to consider teaching as a career. Both her parents are involved in education. Her mother is the principal of one of the largest pre-primary schools of the South African Women's Federation and her father is both the principal of a school for physically disabled children and a counsellor at the South African Council for Education. She claims that she therefore knew "exactly what education entails" and subsequently made herself believe that she is not a teacher and that she is meant to do something different with her life. In retrospect she admits that the only reason for this self-indoctrination was because she didn't want to do what her parents did; she thought this would be a mediocre and uncreative decision.

She remembers though, sitting in a mathematics learning period in Grade 11, when she suddenly became aware that she was critically assessing the educator teaching them. She tells how in her head she thought of everything that she would have done and said differently if it were her teaching. When she realized this, she immediately forced the thought out of her head! She subsequently started studying BSc, Biological Sciences to become a vet and after a year it "hit" her that she was busy lying to herself and if she was not going to be honest with herself that she would eventually miss her "calling from GOD!" She now says that she was always "born a teacher" and recalls how everybody told her this, but that she just "always stayed hard headed and stubborn about the issue."

That is how it came about that she enrolled for the BSecEd (Natural Sciences) degree in her second year and for the PGCE. She feels that the PGCE is not only part of her degree but "also the most important course" that will eventually contribute to her "fulfilling her purpose in life!" She admits how disappointed she was after realising that the PGCE year wasn't what she expected it to be and that she, "kind of, had the wrong perception of teaching." She knew she had to "build new knowledge and get equipped with the foundation, the rhythm, the melody of facilitating learning" before actually applying it in her practice-theory.

Anabella believes that "mathematics is one subject that the average learner fears and avoids practising because it's a complex concept subject and the fear of getting a problem and to not know how to solve it is a terrifying feeling". That's why she believes that her "role as mathematics facilitator is to really kill that fear and to help the learners understand and enjoy mathematics" like she did. She wants to strive to be 100% herself in the classroom and by doing so to get the maximum fulfilment out of each day whilst teaching her favourite subject and "working one on one with children."

Anabella expects to work "with learners that want to learn, work hard and grow through struggling and failing." She wants to see "perseverance, discovery, relief, satisfaction, focused and ambitious learners with a zest for life and mathematics." She believes that mathematics is the subject that can really teach one all of this. She hopes that her learners will "have the courage to continuously ask questions if they don't understand, to participate in class discussions and to always question the work by using their critical thinking."

She plans to share her own mathematics history with learners in her class to "highlight that nothing is impossible and that our goals are always reachable with the right mindset and attitude." She intends to give learners "control over their own learning, so they feel responsible for their own growth and development in the subject, that they also feel undependable [independent] and get to experience a little bit of adult-life in the mathematics classroom." Her demeanour in the classroom will be "strict but approachable and will influence the difficult/stubborn learners' thoughts/minds to try and give mathematics a chance."

Anabella predicts that her classroom culture will "definitely be positive, to always strive for higher, better and faster in every way possible. No learner must be afraid of not knowing, and they must see challenges as an opportunity to grow." She wants learners to walk out of class "with a smile and something to think about" and she wants them "to fall in love with the subject and as a result also with life." She hopes learners will "go out and live life to the fullest by using their maximum potential." Anabella believes that "through mathematics, [learners] can experience the important life skills that's needed for life."

Anabella begins her portfolio with the following quote by Sergei Prokofiev:
"It is the duty of the composer to serve his fellow man, to beautify human life and point the way to a radiant future. Such is the immutable code of the artist as I see it." She chose the composition of music and the listening thereof as the metaphor that she felt really describes her and also represents her professional development as a facilitator of learning. She describes in her portfolio how she cannot imagine living without music as it is such a part of her life. It allows her to escape from the busyness and stress of the world, in order to "get refreshed and ready to face the struggles". She quotes Martin Luther saying: "Beautiful music is the art of the prophets that can calm the agitations of the soul; it is one of the most magnificent and delightful presents God has given us." She presents and uses 11 steps in composing music that link with her own personal high or low points in her professional development. Anabella also uses the colour green throughout her portfolio as she sees the green as being representative of the growth and development that she experienced throughout the year.

Toni (2008)

Toni (the only male in the sample) came to the PGCE with a different background from the other students. He is a BSc Financial Actuarial mathematics graduate from the University of Pretoria. He says that he realised during his high school education that he has “a calling to be an educator.” He admits that he did not want to accept this and that “the financial gains and status in the corporate world are much higher.”

Toni views himself as having “exceptional mathematics ability.” This is shared with a great love for mathematics. He wanted to use this skill to the utmost of his ability and is the reason he enrolled for “arguably the toughest mathematics course at varsity.” He never had any real dreams of becoming an actuary. When he was nearing the end of undergraduate studies he realised that he needed to pursue his “dream and calling of becoming an educator.” He started to inquire about the possibility of enrolling for a PGCE in education. He did not do this immediately since there was strong opposition from his parents. He says he felt as if he would not make them proud if he became an educator. He admits to struggline with things that did not interest him anymore, trying to complete an honours degree in Actuarial Science. Finally during December 2007 Toni decided to pursue his dream “at all costs” and enrolled, albeit late, for the PGCE course.

In the classroom Toni intends "to be involved in mathematics education." This means that he will "be the facilitator but also a student of the subject." He describes himself as having "a positive attitude towards life", being "a confident person and … a good speaker." He believes that he will be able to use these attributes to his advantage in the classroom. He feels he has "a responsibility to be a positive role model" in the lives of his learners who will be "teenagers who are busy constructing their own identities."

Toni believes his role in the classroom is "to create opportunities for students to experience the richness and wonders of the world of mathematics. This includes creating and generating learning tasks and experiences focused on the wonder of the mathematical world." He reflects on his recent introduction to the "idea that education is mainly an emotional activity." In relation to this, Toni mentions that "many students experience a feeling of failure when they are confronted with mathematics." He believes that he "will need to provide students with the emotional support they require to master the subject." He confesses that this will be a challenge for him because he does "not respond well to people who are emotional" and does "not know how to provide them with emotional support when they need it."

Toni cites "openness and trust" between himself and the learners as important in order to "create an environment where I [he] can identify students who experience difficulties with the subject much faster. If these difficulties are identified at an early stage it will be much more effective … to try remedy the problem." Toni believes that "the role of the facilitator is not just to provide learners with the opportunities to engage in a mathematical problem." As a facilitator he states that he "will have to create opportunities for learners to develop their fundamental life skills as well."

His ideal of a student is one who is "inquisitive, enthusiastic and willing to persevere while confronted with a problem. Problem solving is fundamental to grasping concepts and discovering mathematics. Only through perseverance will the learner solve a problem and create an 'AHA' effect. Once this effect is reached it can become an addiction and mathematics will no longer be a burden but enjoyable." Toni believes that the best way to get students interested in the subject "is to be enthusiastic about the subject that you facilitate. A positive

attitude towards a subject will influence the learners in that class. If students are exposed to the greatness of their mathematical abilities when it is put into real life context they will enjoy the subject. It is important to ask the students to try and link everything they learn to real life. Mathematics is not just a set of rules to manipulate numbers. It is science that is used to discover, analyse and describe all natural phenomena around us."

Toni hopes to create a positive culture in his classroom, "one where students can feel free to share ideas and information about topics related to mathematics and things in general." He states that "the greatest level of achievement and construction of knowledge will be when every person in the classroom can contribute to the process of learning." He confesses that he does "not know everything about the subject" and that he can "still learn from students in the class." He believes his learners "should experience mathematics in a practical real world problem. Seeing and realising the impact that mathematics has on the world around us is the only way to get students involved in the subject." He would like to "incorporate some of the other intelligences of the MI [Multiple Intelligences] theory" into his classroom. He cautions that because he will be "facilitating the study of mathematics it is easy to forget about the other intelligences and only focus on the mathematical intelligence." Finally Toni believes that learners "should not experience mathematics as being separate from other learning areas." He would like to "create learning tasks that involve the learner in a holistic way" but he admits to not being sure how to succeed in doing this.

Toni tells his story of professional development with the analogy of "a farmer who had a dream to create a new cultivar of grape and use it to create an extraordinary wine." The perfect grape represents the way he changed during the year while "perfect wine represents the quality of learning that took place" because of his transformation. After the introduction the nine sections in the portfolio guide the reader through a series of learning tasks that he developed and uses to show his development.

3.5.3 Data collection

As the final portfolio comprises a large part of the summative evaluation of the PGCE students, there is a module within the course known as Professional Portfolio Development

(Slabbert, 2004). Students are guided from the beginning of the year on how to prepare for and what documents and evidence to collect as part of their professional development throughout the year (see Appendix B). They are required to keep daily reflections, learning task designs, video recordings of some of their lessons as well as their practice-theories to include as evidence in the final portfolio. Following the stipulated guidelines, students decide what documents and artefacts from the duration of the year to include in their final portfolios.

During the course of the year the PGCE students develop three portfolios prior to the final portfolio that they submit for examination. Students are given feedback and further guidance on these interim portfolios by the lecturers responsible for the Professional Portfolio Development module. As the specialisation lecturer, I only receive the final portfolio at the end of the academic year to assess. Once the portfolios had been assessed and the students had also completed an oral presentation and defence of their professional development, I sought their permission to use their portfolios as the source of data for this study. Students have the option to collect and keep their portfolios once they have been assessed but most students leave them at the university, as was the case with these participants. Once I had ethical clearance and permission from the participants, I retrieved their *portfolios* from the storeroom as well as other relevant documents I had stored from their PGCE year. These relevant documents included a *mathematics baseline assessment* students complete on selecting mathematics as their area of specialisation and any *assessment reports* issued to students on lessons I have observed them teaching during classroom visits. These documents are elaborated on below.

Portfolios

The professional portfolios that PGCE students submit as part of their summative evaluation for the course are the main source of data for the case study. The portfolios are extensive and contain reflections, learning task designs, video data from school-based practice periods, brain profiles, graphical representations of their emotional journeys, their changing mission and vision for teaching and education, the concept maps that are a representation of their practice-theories as well as any artefacts or documents they choose to include to demonstrate their professional development. Each student is required to choose a metaphor or analogy that they think best describes their journey through their PGCE year. The portfolio needs to be

organised in such a way that the analogy portrays the storyline that guides the examiner or reader of the portfolio through the students' professional development.

For the purpose of this study, in describing the mathematics profiles and instructional behaviour of the participants, I include the following data from students' portfolios (an example of each can be found in Appendix G):

- Their vision and mission statements on education from their portfolios or their initial and later views of education
- Their learning task designs (comprising a series of lesson plans)
- Their reflections from their portfolios as well as class-based tasks
- Video recordings of a selection of lessons during their school-based education periods that students chose to include in their portfolios

At the beginning and again at the end of the year, students are required to write a *vision and a mission statement* on education or their *initial views on education*. Students include these statements in their portfolios as evidence of how their views on education have developed and changed during the year. Students do a *written lesson preparation* for each lesson that they teach during the course of the year. These are known as Learning Task Designs (LTD's) and there are guidelines students need to follow in developing these LTD's. This written preparation also needs to be available for mentor teachers at the school who are assisting the students during their school-based education as well as for the specialisation lecturer when they attend a lesson for assessment purposes. Students include a selection of LTD's in their final portfolios to demonstrate their professional development, especially with regard to teaching in the four different paradigms mentioned in Section 3.4.1. The PGCE course also requires students to keep *daily reflections* during their school-based education periods, reflecting on the lessons and LTD's they planned, how they worked out in practice and what literature they have read or what they need to do to improve on or change in their practice-theories. At the beginning of the year, students are made aware of the responsibility they have to make and keep *video-recordings* of a selection of the lessons they present during their two school-based education periods. For their final portfolios, students select the recordings that they have identified as most representative of their development. These are included on DVD's in the portfolio for the examiner to view. Students also show clips from these video-

recordings during their oral presentation and portfolio defence that also forms part of their summative evaluation. I therefore did not decide which lessons to record for data purposes. I used the video-recordings that students included in their final portfolios.

Mathematics baseline assessment

The *baseline assessment of students' mathematics content knowledge* is a "traditional" assessment (see Appendix D) that I developed and introduced into the course in 2005. Although this baseline assessment is in the form of a traditional assessment, I do not use it as a measurement tool. Instead I perform a deductive content analysis of the assessment, specifically with regard to the types of errors students make in completing the assessment. I code the errors into one of three categories, namely, fundamental errors, solutions omitted or incomplete and careless errors. The content analysis provides me with some insight into the students' mathematical thinking and pre-empts the personal and individual consultations I subsequently carry out with each student on aspects of their understanding of school mathematics. Students are given the baseline assessment and asked as mathematics teachers to set up a memorandum for this particular instrument (test) that covers work included in the curriculum up to a Grade 9 level. The memorandum needs to show how students would expect learners to solve the questions posed and also needs to indicate how marks would be allocated in the marking of the questions. This may seem to contradict the reform ideology suggested in chapter 2. However, traditional test instruments still dominate the assessment in most mathematics classrooms. I believe these test instruments can still be a valuable part of the reform ideology depending on how they are used.

If students are encouraged to show their thinking in the tests and teachers use the tests to gain more insight into the mathematical processes and understanding of learners, then the tests become an important diagnostic tool. If teachers focus predominantly on learners' answers and how learners apply memorised facts and algorithms in the test, then the test instrument remains supportive of the more traditional ideology. I therefore use this baseline assessment task for a dual purpose: as the departure point to addressing this aspect of assessment in mathematics and as a tool that offers me insight into the PGCE students' mathematical thinking and their understanding of some basic mathematical concepts. In this study I used the content analysis of the baseline assessment as one of the indicators of the subject matter

knowledge of participants within their mathematics profiles. This is further explained in chapter 6.

Assessment reports

In addition to the portfolios, another aspect of the students' summative assessment is the evaluation of their school based education periods by their specialisation lecturer. The lecturer is required to visit each student within their particular subject domain at least twice during each of the two terms (the duration of each being approximately six weeks) that the students spend based in the schools. Students usually invite lecturers to attend a specific lesson or the lecturer may choose to indicate a specific day or week during which they will visit the student. For the mathematics specialisation module I try to make at least three visits to each student during each school based education period. For the first lesson I attend, I ask the students to invite me to a particular lesson. For the second visit, I request their teaching timetable and indicate a week during which I plan to visit. For the third visit, I leave it open-ended and visit at any time unless they have a particular concern or indicate a lesson they require assistance with.

During the course of the lessons I observe, I write down any comments. At the end of the lesson, I usually have a short debriefing with the student (if their timetable permits this) and then email them a comprehensive report during the following 24 hours (see Appendix H). In this assessment report I include questions that I require students to reflect on in their response to my assessment. They are required to submit this response back to me via email within a week of receiving their assessment report. In observing subsequent lessons of the student, I try to focus on aspects within their classroom practice that they have improved on and those that still need attention. Students often use these assessment reports as part of their final portfolios in demonstrating their professional development. I keep a database of the assessment reports so I was able to draw reports from this database as required even where students did not include the reports in their portfolios.

3.5.4 Data analysis

For the data analysis I used the guidelines from Miles and Huberman (1994) as my main reference source. Their flow model of data reduction, data displays and conclusion drawing/verification represents an outline of the components of data analysis as I applied them. According to Miles and Huberman (1994) *data reduction* entails the process of selecting, focusing, simplifying, abstracting, and transforming the data from their original format in which they were presented. For this study, this involved a number of phases. First I worked through each of the portfolio collections for each student. This included reading through all the reflections, metaphors, personal accounts, learning task designs, brain profiles and commentary, concept maps of practice-theories, reports and assessment from the lecturer (myself), the mentor, their self as well as peer assessment. At this stage, data were also sorted according to where they fit into the conceptual framework.

The video data included in each portfolio were also transcribed and coded during this stage of the data reduction using Transana[16]. The software allows one to separate the data into different series, episodes and finally clips, which become the unit of analysis. In this study, each participant is represented as an individual series. The videos of different lessons during their SBE periods that they provided in their portfolios were entered as episodes in their particular series. Each episode was transcribed and analysed visually through the identification, coding and categorizing of clips. Clips can be grouped into categories (that have been inductively or deductively constituted) but they can also be allocated descriptive keywords and later regrouped or organised according to common keywords. This conceptual process is iterative and multi-layered, continually forcing one to challenge and raise the level of analysis. I started off by allocating the clips descriptive keywords and later grouped them into categories. For example, if a participant was teaching a lesson and made a mathematical error, I would allocate the keywords “mathematical error” to that clip. Later the clip was organised into the category of subject matter knowledge for the purpose of reporting on this component of the mathematics profile.

[16] This is a video data software analysis tool available from the Wisconsin Centre for Educational Research. For more information see www.transana.org.

The text and video analysis represented the first level of inductive analysis (to see what possible codes might emerge from the data) as I read and sorted the data for any emergent patterns or themes. It was during this phase that I started to notice varying degrees of discrepancies between the way the participants viewed and represented themselves and their practice and how I (or the other specialisation lecturer)[17] and their peers or mentors perceived them. The main theme that I inductively established in this phase therefore related to what Skemp (1971, 1989) calls "reflective intelligence". This is further expanded on in chapter 7. Other less dominant themes that were induced related to depth of reflections, mathematical errors, level of mathematical ability, type of mathematics (e.g. process versus conceptual), teaching and learning approach, usefulness of planning, autonomous versus democratic classroom culture continuum and traditional practice versus reform practice.

Having noticed the theme of reflective intelligence emerging from the initial data reduction, I decided to provide three *data displays* for this report in order to enhance the credibility of the data. These included: introductory reflections of how the participants portray themselves (in Section 3.5.2), participant reflections written in the voice of the participant (chapter 4) and a researcher reflection written by myself on each of the participants' mathematics profile and instructional behaviour (chapter 5). Each of these data displays in turn provided another phase and level of data reduction and simultaneous inductive analysis. This therefore created a multi-stage process of organising, categorising, synthesising, interpreting and reporting on the available data (Gay & Airasian, 2003). This process is further outlined in chapter 6.

During this time I was also continuing to review additional literature for the study in further developing the conceptual framework. Additional themes and categories started emerging there too. I therefore constructed a more detailed (pre-determined) analytical framework within the conceptual framework to apply to the participant and researcher reflections (see chapter 6). This was done using the initial inductive themes with a view to again ensuring further credibility of the data and also in order to produce the profiles in a fourth data display

[17] Another lecturer sometimes assisted me with presenting lectures or visiting students for assessment purposes during their school-based education periods. Some of the assessment reports of the students included as data are therefore written by the other lecturer.

(in addition to the three mentioned in the paragraph above), in a visual representation that would make case comparisons (within and cross-case) easier. Within-case analyses involved examining the relationship between each participant's mathematics profile and instructional behaviour. Participants were grouped together according to the similarity or differences in their mathematics profiles and cases compared before a broader cross-case analysis was carried out (Eisenhardt, 2002). The data reduction, display and verification process was therefore an iterative one involving both inductive and deductive coding techniques (Miles & Huberman, 1994; Creswell, 2003; Gay & Airasian, 2003) or what Tashakkori and Teddlie (1998) refer to respectively as latent and manifest content analysis.

For the purpose of the case comparisons I developed the format of the visual representation of the mathematics profiles and instructional behaviour profiles in consultation with a friend who is an architect who was able to assist me with the drawings. Using his technical and critical input and the conceptual framework I constructed the four categories and visual representations for each of the components of the mathematics profile. It was important to me that the visual representation is simple yet symbolic of the data it represents. While engaging with the literature in order to develop a suitable framework for the instructional behaviour construct, I decided that the most appropriate way to represent it in the visual presentation would be on a Cartesian plane. The Cartesian plane allowed me to position the instructional behaviour of participants on two axes rather than in one linear dimension. The two axes I chose to make up the Cartesian plane are denoted by continuums: on the *x*-axis is the traditional to reform (see section 2.3.5) continuum and on the *y*-axis the endpoints are authoritarian versus democratic (see section 2.3.6). This is further discussed in chapter 6.

3.6 Methodological norms

In qualitative research it has become acceptable to use alternative terms for validation standards of research (Creswell, 2007) such as credibility, transferability, dependability, confirmability and authenticity (Lincoln & Guba, 1985).

In my opinion the credibility and dependability of the study are the two most important features in validating the accuracy of the study (Creswell, 2007). *Credibility* is usually equated

in quantitative terms to internal validity and deals with whether the results are an accurate interpretation of the participants' meaning (Creswell, 2007). In this study an attempt to ensure high credibility was made through prolonged and sustained engagement with the participants (a year worth of data for each case), progressive subjectivity through a careful monitoring of the developing constructions (through an audit trail, as well as my continual iterative data reduction and display process) and triangulation of multiple data from the participants' portfolios (Guba & Lincoln, 1989). I also included the analytical process of compiling the data tables (see chapter 6) for each participant according to the conceptual framework. These tables guided the compilation of each participant's mathematics profile and instructional behaviour profile.

As the data was taken from what the students presented in their portfolios to the public, formal member checking was excluded as a validation process. This decision was taken as some of the participants compiled their portfolios three years before the narratives and profiles were compiled. With most of the participants already being in the field of teaching, it seemed futile to ask them to read through it now three years later to see if it represented what they then believed (and was in any case written in their portfolios). However, as there was another lecturer who assisted me at times with the mathematics specialisation module, I sent my analyses of the mathematics profiles and instructional behaviour to her as a form of member checking.

The four data displays alluded to in the data analysis section were also intentionally included as a means of increasing the credibility of the study. These varying data displays also allow for a more explicit *dependability* trail showing the progressive analysis of each step of the process and providing some chain of evidence (Yin, 2003). According to Whittemore, Chase and Mandle (2001), by including the data of how the participants present themselves in their portfolios (through their personal reflections) as well as how others assessed them (reports from mentors, peers and lecturers) the *authenticity* of the report is also enhanced as "different voices are heard" (p. 206).

While *transferability* has been considered through the use of multiple case studies and including a rich description of each case, the intention is not to generalize or directly transfer

the results of this study. Where a micro theory has been suggested, it is reserved for these participants in this context. This was intended as an exploratory study to understand any relationship between the mathematics profiles and practice-theories of the participants, but not to establish causal assertions (Yin, 2003).

3.7 Conclusion

This chapter has outlined the research methodology used in this study. A retrospective or post-hoc case study involving seven single cases was used. The study is situated within a social constructivist worldview. The context of the study, namely that of the Post Graduate Certificate of Education course was described as a backdrop for the reader for the chapters that follow. The participants were introduced as they depict themselves in the portfolios that they handed in at the end of their PGCE year. The data collection, analyses and quality control procedures were also discussed. The following chapter presents the participant reflections written in the voices of the participants.

CHAPTER FOUR PARTICIPANT REFLECTIONS

4.1 Introduction

This chapter presents reflections in the voice of each of the participants. Data were all collected during the PGCE year of the participants and selected from their final professional portfolios. Each participant reflection here is a compilation (in chronological order) of portfolio entries I selected from their final portfolios. These are narrated by the participants [18]and the entries included were chosen as representative of the full extent of entries appearing in the participant's portfolio. These reflections are intended to highlight information, experiences and beliefs of the participants relating to their mathematics profiles and instructional behaviour profiles.

After completing the initial literature review, I decided that the four most important components that I would focus on in depicting and analysing the *mathematics profiles* of the participants would be: subject matter knowledge, pedagogical content knowledge, conceptions of mathematics and beliefs about the teaching and learning of mathematics. In terms of *instructional behaviour*, I differentiated between traditional and reform practices on one continuum and authoritarian versus democratic experiences of teaching and learning mathematics on the other continuum. Each of these components was defined and described in chapter 2.

For the participant reflections in this chapter I have opted not to explicitly demarcate between the various components of the mathematics or instructional behaviour profiles, although they strongly guided my selection of what data to include from the portfolios. A more analytical view, drawing on these reflections and distinguishing between the components within each construct is provided in the researcher reflections in chapter 5. The basic outline of these

[18] Grammatical corrections to these reflections were only made when meaning was adversely affected. Respondents were not first language English speakers.

participant reflections presents each participant's initial and subsequent views on education (at the beginning and then the end of the course), lesson reflections and notes from their Learning Task Designs (LTD's) and experiences during the PGCE course. Although the dates of the portfolio entries are not always included, I have worked these entries into the participant reflections in chronological order and chosen at least one learning task from each of the two school-based experiences that each participant experienced. The changed font in the text is intended to mark the participants' own voices.

4.2 Marge

After a period of more than 20 years during which I often and intensely hankered to study further, I could finally do it at the start of 2006. Although I was very positive and excited about studying, I was not at all prepared for what facilitating of learning implies. My portfolio describes the self-examination that I went through. I was freed from a number of "bravade" on which my self-image and self-confidence was based at that stage. This is also explained in my portfolio.

At the start of the course, I had strong convictions about what mathematics and mathematics teaching are. I held fast to what Ernst describes as an instrumentalist view which could perhaps bend towards a plaTonic nature. I saw mathematics as a rigid body of facts, rules, laws and skills and myself as the authority and source of knowledge. I viewed mathematics teaching as the process within which solutions are explained with the single goal of being imitated.

From the moment I was confronted with having to follow a problem-centred approach in mathematics specialisation, I was sceptical and tense about it. I could not imagine how learners can construct their own mathematics. I could also not see how the greatest part of the curriculum could be presented in a problem-centred manner.

I had two strong convictions that were not in line with constructivism. I could not see how a learner could be confronted with errors. I went as far as to state that a learner should rather not do mathematics at all, rather than make mistakes. I could also not believe that learners could construct their own mathematics. In my opinion mathematics was a rigid body that must be meaningful.

After this morning's session, I know that, like I admitted the day before yesterday, I am guilty of a suffocating love in an inappropriate manner. I assume the responsibility for others. I am inclined to nurture dependence. I now realise that I denied my own children and learners the opportunity to develop their intra-personal skills. … I will have to believe in learners' potential….I really want to change but I do not know how to. I cannot see, but first I have to believe. … I will have to renew my thoughts and get advice about how to develop my right brain. I will also have to believe in my own potential…

I understand my role in the classroom still in terms of transmission and transaction paradigms. In those terms I understand my role as being to motivate learners to have a passion for mathematics, to build self-confidence in learners, to explain concepts in mathematics to learners…and to prepare learners for the examination. I see my role as making mathematics accessible and logical; to always convey everything with reasons.

I doubt very much whether negative learners taking a compulsory subject like mathematical literacy, are capable of constructing their own, CORRECT knowledge….I am always under pressure not to waste too much time. I feel concerned about letting them [learners] construct wrong ideas and then have it demolished again. I have always thought that it is more harmful to construct wrong ideas than no ideas at all. My idea has always been to show the way with clear explanations, embedded in theory and have the learners exploring with those examples as analogy.

I am shocked at how I totally missed the point with the planning of my specialisation presentation (learning task design). I commenced with theory and disciplined knowledge and ended with the application of problem-solving: exactly back to front!! The choice was further hopeless in the sense that the content did not form part of the new lesson plan. It has only been presented for the last two years and has no place in the reality of the real-world. It was impossible to use the transcendental paradigm for this content.

At Hoerskool [Highschool] Gold I was confronted with a lack of discipline, respect and motivation in the learners. My mentor also reacted at times negatively to a problem-centred approach by, for example, making the comment that everything takes twice as long. I was under pressure to teach conventionally and the first time I was assessed by Hayley, I got a very bad report. This coincides with lesson planning 3. This was a painful blow for me as I have always boasted of an excellent academic prestige.

At Hoerskool [Highschool] Gold, it started going better with me. A turning point was the operationalising of a combined self-study exercise of lesson 6, 7 and 8. I generated this problem myself. The learners had previously learnt the social knowledge and heuristic for this. The learners could solve the problem graphically with very little sophisticated mathematics, therefore on the horizontal level as described by the theory of Realistic Mathematics Education. To get the learners working self-actively was a personal victory for me. I cannot claim that this was facilitating learning, but the learners and I went through a learning curve and growth process. I can describe the nature of the learning experience as a type of tutorial class within which the learners were self-active. There was very little to no formal teaching.

My second SBE was at a high school only for girls. I can compare it to Paul's experience in Athens which he describes as: Athens was naturally a city of new

things. All inhabitants and visitors to the city wanted to know what the newest philosophy was. I had expectations of the learners. I was under the impression that this the one school where a problem-centred learner-centred approach would be welcomed with open arms. While I developed learning tasks for this SBE, I included the concept of solving or deduction in my personal practice-theory as an end-product outcome. Out of the nature of my learning area, I developed a need for this concept.

As part of the learning task design, I also began to reflect on how the lesson of an operationalised learning task might pan out and using that I planned questions that I could use during the learning task comments to effect reflection and meta-learning. It was also clear that the classroom culture that I wanted at Gold was focussed on discipline. Meantime I began to realise that it includes more than discipline. I discuss this in more detail in the following reflections.

I wrote a list of core concepts on the board and gave co-operative groups an opportunity use these to consolidate the concepts. Some of these concepts were new, but the learners could understand them in context and shape because it was constructed knowledge. This was a successful example of the heuristic of horizontal mathematics which then gets formalised vertically.

After the successful operationalising of LTD 1 and 2, my mentor was openly positively surprised…I could apply my personal practice-theory during the operationalising of LTD 2. … In LTD 2…the problem was not really high. The problem was a story. In retrospect I also know that I did not effectively facilitate co-operative learning effectively. I am, however, of the opinion that the operationalising of this problem still contributed to the learning quality of the learners. Meaningful and comprehensive content was generated during the process of solving. In the classroom culture this was a meaningful breakthrough. Learners have been conditioned through transmission and here had valuable experience with meta-learning strategies.

During learning task 5 I encountered the hurdle of incomplete social knowledge that Murray, Olivier and Human refer to. The learners were not confident with function notation. At this stage I worked social knowledge and heuristic into my personal practice-theory….This problem can be done in Grade 12 with sophisticated mathematics at a vertical level. It also lent itself though to a less sophisticated solution on the horizontal level. It was a meaningful way to let the learners construct knowledge and then to teach the quadratic function in a more "naked" way through transmission teaching.

I feel positive about the extent to which I succeeded in holding myself back from teaching learners and thereby robbing them of an opportunity to what they are able to do. Still I feel under pressure to finish the learning task in the shortest possible time. This makes me sometimes change over to transmission too quickly. I believe they feel unhelped and confused about this strange experience.

It was difficult for me to handle more than 30 learners at a time on my own: to let them go outside; to let them take the measurements and to facilitate. Many learners were helpless and did not have a good grasp. Many of them, for example, did the diagrammatic representation correctly. They struggled a lot to understand that the problem can be solved in two ways. An atmosphere of dependence was present. Learners do not read the written presentation. They are accustomed to not thinking for themselves. Claxton's description of a lack of common sense could clearly be seen here. The phases that Bruner describes, do not apply to these learners at all. They are used to fragmentation and struggle to integrate.

There were two more learning tasks that I operationalised at [the second school] that made learners excited and interested during the learning task presentation. The one was a problem about saving options and the other was a game with a prize. I chose LTD 16 as my most successful learning task presentation. I attribute the girls' involvement to the fact that everyone can identify with crime. When I told them that

my car had been broken into twice, some of the learners wanted to immediately know if this was the truth, and it was. There was definitely less resistance toward problem-solving. The learners all tried to solve the problem and the general atmosphere favoured meta-learning.

The operationalisation of learning task 16 was successful. To avoid conversations and subsequent dependence and to keep the atmosphere one favouring meta-learning, I included another concept in my personal practice-theory: that of Vygotskian scaffolding or hints in the form of questions that would force learners towards reflection and meta-learning. The girls wrote cards to bid me farewell and the report from the mentor was very positive.

4.3 Lena

At the start of this course I thought of teaching as being a job like any other. Now I know that to become a teacher is a calling, you need to have passion for teaching and for children. I thought that the aim of education is to give learners the knowledge that they need to be successful. I have learnt that that is not the only aim of teaching, but that you also need to give the learners the life skills they need.

In the classroom itself it is always important to earn the respect of the learners by showing them respect and treating them in a fair way. It is also important to build good relationships with your learners so that they will feel relaxed and confident in your classroom. Every learning task will have a different order. In some you will first give/explain the new work and in others you will first let the learners explore and try on their own. It is a good idea to start the LT [learning task] by getting the learners attention with something unusual or interesting. Then give a quick recap of the work done in the previous period and determine the learners' prior knowledge. In mathematics it is important to never use words like: difficult, stupid, wrong. Always motivate and encourage the learners and try to understand the reasoning of the learners

On the 23rd April I presented my first learning task to a Gr. 10 class at Höerskool [Highschool] F. This was my poorest learning task of the year. It had a lot that I could improve on. Firstly the Learning Task Design (LTD) did not contain the theme of the learning task. This makes it difficult for someone else to use/read my LTD. I presented this learning task in a totally teacher-centred manner. The whole period was direct teaching where I explained the new information and then did an example.

In my reflection on this learning task I wrote that the learners did not understand the concepts immediately. I was not prepared enough to explain it to them in a different way because I didn't think about that when I prepared the learning task. I also prepared too much work for one period and was not able to finish all the work. This caused me to rush through the work and not giving the learners time to discover the work on their own. This learning task made me realize how much work still lay ahead of me. I felt like I was back at square one. As stated in the article "Freedom versus Control" by Steven Wolk, it is important to let the learners be active in their own learning. In my next learning task I should try to involve the learners more and make the presentation learner-centred. I should prepare better by thinking of different ways in which the same concept or problem can be explained. This is because the learners do not always understand straight away and I need to be able to take a different approach. In my next preparation I will also prepare a little less work for a period so that I will not need to rush through everything.

At the end of the learning period I had no proof that the learners achieved the Learning outcomes I had set for that period. This is portrayed in my second Practice-theory – it does not contain anything about Learning outcomes or Assessment standards. When I designed my third Practice-theory I put both Learning outcomes and Assessment standards in. This helped me to think about the certain outcomes when I design a learning task.

After a slippery start, I took my newly designed practice-theory and tried to design a better learning task. On the 2nd of May I put a learning task into action which brought about both a snake *and a* ladder*. In this learning task I asked the learners to see if they can find a pattern in the different examples. This was my way of involving the learners more and making the learning task more learner-centred. At the end of the learning period I asked the learners to do a quick journal entry about the work that we had done in that period. This was to determine if the set learning outcomes were achieved (showing how I used my new practice-theory).*

Although this learning task was presented in a more learner-centred manner, I could still have involved the learners more by asking specific learners to explain how they understood a concept or problem or by leading them to discover the work on their own. This learning task was not exciting enough. After this learning task I moved up a few blocks, but my learning task still had aspects that brought me down.

I still need to make my learning tasks more learner-centred. In the article 'Toward meaningful learning' by Steven Wolk, he says that significant learning takes place when the subject is perceived by the student as having relevance to his/her own life. That is why I will design my next learning tasks around something that is relevant to the learners' own lives, something they will be interested in. I will also concentrate on the learning task presentation because if I can get the learners' attention straight away they will be more interested in what we are doing.

By asking the learners if they can find a pattern in the examples I forced them to use higher order of thinking skills. I added this in my fourth Practice-theory because it is important to develop the higher order thinking skills of the learners as much as possible. I also added that the learners need to discover the work on their own to make the learning tasks more learner centred and to improve the quality of learning

*By the end of my first School-based Education I felt that I got the hang of things. Then I started with my second School-based Education at Höerskool [Highschool] G and did my first learning task that was based on a real life problem (*ladder*). Unfortunately I also stumbled over another* snake. *In this learning task the learners had to do cooperative learning in pairs. This did not work as well as it could have if I divided them into groups of 3 or 4 (which according to* Cooperative learning in the classroom *is the optimal group size for cooperative learning). They did not have enough ideas and opinions to ensure optimal quality. In this learning task I focused on making the work relevant to the learners' everyday lives. I concentrated on the learning task presentation by giving them a problem that they want to solve immediately and discover the work on their own, instead of direct teaching. I also improved the learning task feedback (LTF) by thinking of questions I could ask the learners to lead them to discover the work on their own, in my preparation. This worked well and the learners were able to come to the correct conclusion after cooperative learning. This learning task proved that I was on the right track to becoming a real facilitator of learning, using everyday life situations in mathematics.*

As stated in Cooperative learning in the classroom *the optimal group size for cooperative learning is 3 / 4 learners per group. In my next learning task I will divide the learners into groups of 3 and see whether the outcome of the cooperative learning is a higher quality of learning. I need to think about my learning task feedback when I am preparing my learning task. As stated in* Facilitating learning*:* what is it really? *'feedback is inevitable for flow, growth and the improvement'. That is why it is important to me to prepare questions I can ask the learners to lead them to discovering the work on their own.*

As I moved on through my game of Snakes and Ladders I kept on improving as facilitator of learning. On the 6th of August I presented my best designed learning task in the transcendental paradigm. Firstly I asked the learners if they have ever thought of an idea to change our world. I got a few ideas from the learners and then

I showed them clips from the movie 'Pay it forward". This immediately got their attention because they knew the movie and wanted to work out whether the boy's idea could really work.

In this learning task I divided the learners into cooperative learning groups of 3. Even though this gave a better result than working in pairs the cooperative learning still didn't go as well as I wanted it to. This was because I divided the learners into their groups and they had to immediately move into those groups. The class was restless and everyone was moving around. In the future I will divide them into their groups beforehand.

In my preparation I concentrated on the learning task feedback. I anticipated how I think the learners will react to the learning task and also prepared questions I could ask them to help them discover the work on their own. At the end of the learning period the learners formulated the formula in their groups and realized that they can do it own their own. This became clear in the learning task consolidation showing that the quality of learning was very high. Even though this learning task did bring forth a snake *that I need to improve on, it showed a lot of aspects of my facilitation of learning that has improved tremendously.*

A part of my vision at the beginning of the year was 'to foster a love for mathematics in all my learners' and 'to change the negativity/hostility most learners have toward mathematics'. In the first week of second School-based Education at Hoërskool [Highschool] G I asked my whole class to write down what their mark for mathematics was at the end of the previous term and then also the mark they would like to get for mathematics (target mark). Throughout the 2 months that I worked with the learners I constantly reminded them about their target marks and motivated them to work harder. In my final week at the school they wrote a term test on the work that they had done. In the class of 35 learners there were 9 learners who reached their target mark and 8 learners who improved with 10% or more from the

previous term. When I asked the learner who improved with 35%, why she thinks she has improved, she said it is because she started to enjoy mathematics more and because I motivated her to study and figure the work out on her own. On the day I handed out the learners tests, I gave a chocolate as reward to the ten learners who improved most (and not the ten learners with the highest marks). The learners who had improved felt good because they were acknowledged. I believe this will motivate them to work even harder and it will also help them to enjoy mathematics more because they understand it.

4.4 Peta

I think that to educate someone is almost like informed consent, you give the person all the information and make sure he/she understands it so that he will make informed decisions in his life from this point in time onwards. Education is like drawing a picture; you have to start on nice clean page - usually the people you teach/educate don't know about the specific subject; so you start drawing the trees, the clouds, the sun, the house, the flowers etc. At the end they can see the "bigger" picture and understand.

In the beginning I was very scared and unsure. When I stood in front of the class I was afraid to perhaps be wrong or to make a mistake or that I could not do the calculation. I was very stressed and I know that when I feel stressed I cannot think. I was worried about almost everything, if I would be able to write the calculations on the board, and I stood with the book in my hand the whole time to see if I was still correct. I did not facilitate learning at all and did not even teach. It felt like I was holding a debate. Sometimes I could see on the faces of the learners that they did not understand what I was saying or that I was speaking too fast. When I spoke to them, the communication was not what I wanted it to be, it felt like we totally did not understand each other.

Discipline in my class was ok. I again just struggled with pedagogical knowledge. Some of the children frowned while I was explaining content and I got so frustrated with myself because I could not explain the work in such a way that they could grab on to this knowledge. I will work on this problem with Miss Barnes to ensure that by the time I come back @ 18 April 2007 that I will have improved in such a way that I can confidently say I think the children/learner understand. Every time I have to give a class, I am very confident and enthusiastic. The moment someone asks me why or they do not understand, I am confused and struggle to answer them in a pedagogical way = steps so they can follow.

On the 11 May I did a transcendental learning task with Grade 10 learners. I first gave learners an activity that introduced them to multiplication and division of algebraic fractions in terms of the number zero. Learners were busy for the whole period with this activity. I planned another learning task for the learners to also complete. I did the "senseless value" activity because I realised that most of the learners do not understand the concept of multiplication and division of algebraic fractions in terms of the number zero. I was very frustrated during this learning task. The learners controlled me. The learners determined what should happen when in the class and with what tempo we work. In a certain part of the class, I ask learners if we can go on with other work.

This learning task is representative of my whole first SBE. I was frustrated, unhappy and always behind with the work. During a certain time I went to see Prof S to tell him that I was behind in my reflections, that I don't know what I am doing and that I am struggling!! Prof S suggested I write a reflection about why I think I feel like I felt at that moment. I never even worked out myself the process that learners should follow to solve a problem and did not establish or plan the end product. I mentioned in my reflection that I do not carry over quality information to learners and that I do not know if they achieved the learning outcomes. I think the above-mentioned was my biggest problem, If I knew what I wanted the learners to achieve and if I planned

how they should get there, I would have been much more in control of the classes and less frustrated.

During my second SBE in a lesson on 31 July Grade 10 learners are shown the task in which they are asked to graphically represent data about a vegetable garden. Learners are offered the formulae and calculations that must be used to get to the end product. Learners needed a lot of guidance to get to the end product. The facilitator of learning had to help a lot to get the process of learning to start and to keep it going. After I had explained what to do, learners just looked at me and said they do not understand. I would really have liked to leave them so that they could think about it, but time is an important factor, especially because the learning task needs to be completed by the end of the double period. I am already behind with the Grade 10 planning. Learners must work together well and support each other. Learners drew the graph through the origin and we discussed why they should not do this. Learners derived the definition of domain and range and symmetrical axis from the parabolas that they drew themselves. In the future I will try to make the authentic real life problem easier so that I as the facilitator of learning need give less guidance, so that learners can work independently.

Learners benefited from having to think for themselves for the first time and trying to get the solution. This was the start of them learning a new thinking process because they are accustomed to only transmission learning. Many of the learners really enjoyed the challenge and some came and thanked me later for all the trouble I had taken. I think learners enjoy mathematics more because it is a challenge. I think it was a good learning experience for the learners but I could perhaps have asked more questions and said less so that they could think more. Sometimes I still feel "forced" to help them get the answer, rather than calmly leaving them to struggle a bit themselves. It is still difficult for me to not show learners how. I wish I had said less because I felt at the end as if I had spoilt the "moment". Next time I will try to say

less and be ready with better questions so that learners can struggle a bit themselves and wonder about how to get going. I definitely want to improve my questioning.

Today in class [8 August] I asked the [Grade 11] learners how a person works out the x *and* y *intercepts. One of the learners mentioned that you use the dual intercept method. I forgot that it is the same and asked them really honestly what the dual intercept method is. One of the learners shouted to me: "Oh no. Get out of the class. Just get out." I was very upset. I have already had trouble with this learner before and I don't know how to handle the situation. The learner makes no secret of the fact that he thinks that as the student teacher I am absolutely not competent to teach him. Overall I also have discipline, concentration and respect problems with the learners. I am well aware that respect gets earned. It is also bad for me that the relationship between myself and the learners is like this, because the Grade 10 class and I have an excellent relationship, where a conversation like this would never have taken place.*

Grade 11 learners have a transcendental task [11 – 25 August] in which they have to plot their cinema ticket cost against the number of sales. Learners were finished very quickly because I had to help them a lot. I wish I hadn't. I then began to explain the hyperbola to the Grade 11 learners. First I explained the part of the work where the hyperbola does not translate at all. Only then did I explain horizontal and vertical translation. Learners are very lazy to read. Learners blame the fact that they do not understand on the teacher. SO…on Friday I spoke to them about their poor cooperation and that it is difficult for me to help them to understand the mathematics if they will not cooperate. They must also work a bit from their side. Learners then began to cooperate.

I wish I could get learners in some way to do more themselves. They expect the facilitator to perform miracles. I get the feeling that they think the facilitator should enable them to understand what is going on in the syllabus rather than that they

should try themselves. I am going to give them a worksheet on Monday to work through with problems as well as all the answers and tell them that it is self-study. I want to just test and see what happens.

They [learners] came with the attitude that when a student teacher teaches them, they never do well or understand…I closed the door and told the class that if they would prefer that Mrs Coertze give them class, that they must please say so now. It is my choice to teach them, and I don't have to teach them if I don't want to. I also told them that it is difficult for me to effectively convey the mathematics to them if someone walks out the class ever so often or if no-one is prepared to give their cooperation. I asked the learners what they expect from each day's mathematics lesson. I also asked them if they were going to start giving their cooperation, otherwise I refuse to help them any further. I told them that I am prepared to give them my best, they are prepared to do it for themselves. I hope that my little sermon helped and that I will see how effective it was in the next class.

My final learning task was with Grade 10 learners. I started this learning task by asking learners to take a deep breath and to calm down and to close their eyes. I started by telling the learners the tale of a very rich Chinese king who had a beautiful daughter. Then I told learners that they should depict what I told them graphically and try to determine a general formula. I think that by first giving them an oral presentation and then the written presentation helped the learners in that they had more clarity about what was expected from them. During this learning task I gave a lot of attention to the end product/solution of the problem. I think I am starting to better understand the thought processes of learners and to appreciate them although there is still a lot of room for improvement. Having knowledge of the final product/solution and the thought processes of learners makes it easier to facilitate. My learning task design was therefore an good improvement on any of my previous learning tasks.

The learning task execution existing of an oral and a written learning task was better because I differentiated between them as two different concepts. My spes lecturer (Marge) noted in her feedback that she experienced that I created a favoured learning environment. During this learning task I asked questions like: "Why do you think this is the answer? Or "How can you do it differently?" These are definitely more higher order thought process questions and I would very much like to still improve on this, because I think learners benefit from it.

From my first SBE I have definitely learnt to not be so conservative in my thoughts with regard to learning task design. I experienced first hand that learners definitely understand more if they solve the problems themselves and that it is important that the problem is well-organised and must be worked out so that learners can optimally solve problems in the shortest possible time. Horizontal mathematisation should definitely precede vertical mathematisation.

At the end of the PGCE I think that the aim of education according to the article 'Facilitating learning what is it really?' is to maximize and fully utilize human potential towards a safe, sustainable and prosperous universe for all. 'Umuntu Ungumuntu Ngabantu' is a Zulu proverb meaning 'A human being becomes human through other human beings'. If these above-mentioned concepts are taken into account, in reference to education the most important is not for me to ensure that learners understand mathematical concepts but that I handle learners as valued adult people and behave and facilitate learning as such so that above all the learners will learn important life skills.

4.5 Kapinda

In January 2008 I believed that education lays a foundation of general knowledge, basic manners, academic literacy and qualities. Learners absorb information. Education is the transfer of knowledge and wisdom. Education is important to enrich

people, and the community. It promotes development of civilization. Therefore the aim of education is to lay building blocks to build a stable strong house.
Graphs were my first learning task which I designed but not presented or executed. The learning task design is disorganized and too lengthy. I should also have been divided into micro learning tasks instead of all types of graphs included in the same learning task (which spreads over six periods). I was unfamiliar with the correct terminology, I referred to lesson *instead of* learning task, *and did not understand what is requested in the Product Outcome. The learning task does not contain a real life challenge.*

Assessment was not effective. No assessment rubrics or memorandums included in learning task package. Methods of assessment included educator assessment (marking of worksheets) and self-assessment (marking of homework).

The learning task on volume was my worst learning task which has been executed. The real life challenge was neither urgent nor was it a realistic challenge since none of the learners work in fabric where ham jars are made. I did not plan media well (posters was written too small). I did not understand the terms of assessment standards and learning content. No assessment rubrics or memorandum included. The following was not included in the learning task design:
1. learning task sequence number
2. number of learning tasks presented in each paradigm
3. integration with other learning areas
4. supportive resources
5. learning task categories
6. learning product (homework assignment)

The history of volumes is irrelevant to learners. Presentation was unclear and disorganised, there was no chronological flow during the learning task presentation. Learning was not authentic since no real meta-learning took place. Learners

immediately worked in cooperative learning groups. It was ineffective since learners could not individually contribute to the group. Interaction between facilitator and learners was poor; tables were moved too far to the back. Facilitator also did not give enough chance for learners to answer questions and to interact. All the learners did not participate since meta-learning did not take place, therefore not all learners attempted to contribute. Only the stronger mathematical learners did the work.

Learning task feedback was not at all effective. I did give acknowledgement to learners by my presence and interest on how they solved the problem of discovering which cylinder had biggest volume. I did not give any resilience because I did not really encourage anyone who seemed to be disappointed for not finding a solution. I did ask clarifying questions to determine where the learners are, but did not use the information I gained to encourage meta-learning actions. When I saw that learners were on the wrong track (for example not knowing what the radius means), I did not guide the learner in realizing he was on the wrong track. I did not require resourcefulness since I did not suggest to any learner to find resources or advise auto-education. I provided edutainment only after the learning task was completed. No consolidation took place at the end of the learning period: therefore I did not evaluate the rate of progress *or* quality of learning, *and although I gave homework, I did not really provide an effective* continued challenge.

The real life challenge of my first LTD at Hoerskool [Highschool] G was realistic and urgent. The week before the learning task was presented, all the busses were on strike and since a large amount of learners travel with bus to school it affected them and they did not have transport to school. Although the learning task was presented in the transcendental paradigm, I think the learning task guided the learners more than necessary regarding the procedures learners should follow. I did give learning task feedback when I moved between the tables during cooperative learning. I did give acknowledgement and recognition to learners who were on the right track. I provided resilience where needed and tried to answer learner's questions with self-

answering questions. I do however feel that I tend to lead the learners more than what is necessary, and I become the resource in stead of encouraging the learners to consult other resources.

I think the second last learning task at [Highschool] G was successful. I should just work on discipline in terms of not allowing the learners to be in control of the time. We lost a lot of time because I did not stick to the time limit. I let learners be in control of the time. I will also expand the rubric to assess learners' body language, facing the audience, eye contact, and communication skills. When the learners reported back to the other groups, the rest of the class did not always understand the solution (although the proof was correct), since the learners did not communicate clearly.

The challenge was to discover why certain theorems in Mathematics are true. Often teachers give theorems to learners who memorise it without understanding it. the learners enjoyed the challenge and found it interesting. A few learners had an "aha" moment.

The learners enjoyed the video clip of Casper de Vries. In a humouristic way Casper de Vries revealed some truth about the paradigm in which learners only learn through rote learning, and memorise theorems without understanding it. The learning task presentation wakened the question WHY inside learners heads. This is important since one should never stop asking questions. By asking questions one learns.

Learners firstly learned through meta-learning. Learners completed individual worksheets in which they applied many theorems. The aim of this worksheet was to remind them of what the theorems were and to solve problems by using these theorems. This made the climax bigger regarding the fact that learners would be more eager to understand it once they realize that they do use it without knowing WHY. After meta-learning was completed learners worked in heterogeneous

cooperative groups. Each cooperative group had a different theorem to prove. Learners were allowed to use their solutions from the meta-learning worksheet to contribute to the discovery.

At the end of the learning period a representative from each group reported their discoveries to the rest of the class. Other groups assessed the representative and the whole group received the mark. It was therefore very important for the group members to ensure everyone understands the discovery. This encourages learners to support each other and prevents learners from copying work.

My most successful learning task concerning a real life challenge was LTD 8 on kites. The challenge was clear and the learners understood what was request from them. The learners were interested and put a lot of effort into this project. Kites are fund and everyone from young and old can be captured by a kite. The learning task presentation had clear instructions on the procedures of making a kite. Learners also needed to calculate the cost of the kite as well as the surface area. Learners firstly learned through meta-learning where they individually completed worksheets. It was crucial to first learn through meta-learning, to discover the characteristics of a kite. Without knowing the characteristics of a kite (the lengths of the sides, angles, etc.) one will not be able to make a kite. After meta-learning, learners divided into cooperative learning groups to discuss the project. Learners had a week to make the kite at home. Learners were very creative. Some learners even worked out a motto for their kite. Their interpersonal skills were most definitely developed.

During the week learners asked me questions if they had any uncertainty. The kites were assessed on the rugby field. I did give acknowledgement to learners by complementing their effort and creativity they put into the making of the kites. I showed interested in their discoveries and inventions. I provided resilience where needed during the week, and when learners came to ask me questions about the design of the kite I tried to answer learner's questions with self-answering questions.

I encouraged learners to think about what they are doing. I guided some learners in telling them they should consult their discoveries from the meta-learning worksheet in order to find remember what the characteristics of a kite is, but not give the characteristics on a spoon to them.

Learning task consolidation was done at the end of the learning period by interviewing learners, finding more out about their kites, what they struggled with, their feelings or any uncertainties. I asked learners how they divided the work between themselves.

At Garsfontein, my main "challenges/downs" was finding real life challenges in Mathematics. At Pro Arte, it was easier since the Mathematics Literacy curriculum is already in a real life context. [Highschool] G is very competitive and performance orientated. I experienced some pressure to perform. The teachers were not very welcoming towards the students and we were never treated as part of the teacher team. During staff meetings we sat against the wall and were not allowed to sit around the tables with the rest of the teachers.

My greatest "success/up" at [Highschool] G was the Grade 9 learners! It was a privilege to journey with them and to invest in their lives. I have also learned a lot from them. It was amazing to every day get to know the learners personally. The second SBL period gave me the opportunity of a new start compared to Pro Arte. I experienced that is easier to establish class principles (for example the way I treat disciplinary situations in the class, launching group projects), when one starts with a group than to try and establish it after teaching for a period. It is good to be consequent throughout a period. Therefore it is difficult to create a classroom culture halfway through the term. At Pro Arte I still focused on finding my feet therefore did not immediately focus on creating classroom culture. At [Highschool] G I had much more confidence therefore could focus on classroom culture and principles from day one. One day I dressed as Spongebob Squarepants. The learners really enjoyed the

Maths class and I think it motivated them to do their work. I had freedom to do what I want. Every week I played motivational video clips, including Facing the Giants and teachings of Rob Bell. I also gave the learners Brain Teasers which they really enjoyed and captured their attention. Another highlight was a three week "Romans project". Cooperative learning groups competed against each other when completing projects, doing extra work, and attending extra class.

Every single day was a confirmation that I am on the walking on the road to my own purpose, because I went to school in a bad mood and got home in a good mood. I did not know it is possible to experience that level of job satisfaction. Every day I was even more passionate. it was such a privilege to spend time with the learners each day (especially the grade 9s).

During the year my views on the education system and teaching paradigms shifted. I realised that we are dealing with learners who have a post-modern mindset, and should meet them at the place where they are. This is why we cannot teach in the transmission paradigm any longer and should encourage discovery learning in the transcendental paradigm.

4.6 Anabella

The aim of teaching I believe is successful education of children to adults. We play a very important role in every child's development and growth, so that we have mature South African citizens in the end who can add value to our country on various domains. Teaching helps the child to form their perceptions of the world as well as their personality and interests. How to work with people and how to successfully integrate into the society. Education is like a garden. A garden consists of different types of plants just like teaching consists of different aspects: learners, teachers, to learn, to teach, using teaching tools etc.

In one of our first classes in spes [specialisation] we got a certain concept that we had to teach for the group and we got half an hour to prepare. I had a very simple concept, and when I stood in front of that group I realized that I don't have a clue how to explain the concept in the correct way. I was struggling to find the right words, and to talk and write, through me of my point the whole time. When I walked back to my seat, I felt stupid, humiliated and just dumb, and then Haley also gave us a test to do where she tested our mathematical thinking and background. She then called me in and said that my maths is not where it is supposed to be and that I must work on exponents etc. We also got our brain profiles back, and there it also states that my mathematical, analytical left brain is the least developed.

I knew then that I needed a lot of work and that my maths background must be sharper and clearer. I know I want to become a maths teacher, but when I got home that day I started doubting if I will be able to do this or was I just kidding myself. I sat with that thought in my head for quite a while but then I decided to change my mindset. It was only my first time and experience that I had in teaching and I made peace with the fact that I can't always do everything 100% right the first time and that this is a learning experience where I can better myself everyday. ***I will be a maths teacher, and I will be good at what I do,*** *and even if I get critique now I can get go and work on it, and I will prepare and teach in the best way possible for me.*

And I know that a right brain person makes wonderful teachers and with my right brain I can make class interesting. Although I'm not so strong in my left brain I will do everything in my power to develop that area and to get the best out of myself to really know my subject and the end and to one day also be called a professional in my field.

With my first attempts in teaching, I started educating in the transmission and in the transaction paradigm. With my first class I went through in incident where the

children said that they don't understand the way I was explaining the work. This was a low point for me and I decided to take this low point and change it into a positive experience. That night I planned my lesson very carefully and after practicing my verbal presentation in front of the mirror and with my friends I went in with a lot more self confidence the next morning. I decided that I will show them, and I could see the difference in their faces and they even started asking questions. This was a good sign and after class a girl came up to me and said that, for the first time she actually understood was going on in class. THIS WAS AN EXLARATED FEELING!

I did my first Learning task at [Highschool] C and it went well, although originality and creativity still lacked. I didn't really yet understood how to correctly give Learning task feedback and what my role was in the classroom. This was a high point because for my first attempt I felt confident that this was a good start and it was in this learning task that it actually dawned on me that facilitating learning can work. I also started to "play my individual notes randomly", meaning that I thought of various ideas that could work for my second LT [learning task] and eventually I came up with an idea that I really thought would work and I was excited to operationalize the LT. My SPEC lecturers came to assess me and ***the LT was a total disaster!!***

My learning task was definitely unsuccessful and I didn't even come near to reaching my specific outcomes. My original plan was to give each learner a different graph to investigate and find consequences of the q and a changes in the different graphs. I wanted all the learners who had the same graph to group and decide on an effect. Then all the different graphs will be drawn on the board with the effects of a and q under each graph and a summary could then be seen on the board. It was seen as only an introduction and a revision exercise or them to refresh their memories of grade 10.

My learning task failed completely because I overestimated their knowledge on graphs. I didn't realize that they still couldn't plot graphs and that most of them didn't

even know how to use the table method to plot points and draw the graphs. It took them 2 whole periods and they weren't even finished after that. I realized that in the future I must first determine what they know, even if it is just one easy graph, I could have tested if they do know how to plot. I also could have given them the drawn graphs without them having to plot it, because my main aim was actually for them to see what a and q does, plotting will only take unnecessary time where they could have already worked and concentrated on the outcome.

I also know that transcendental means for them to be challenged with a realistic life problem. I could have presented my learning task much better, through making it urgent for them and for them to get excited to see whet the effect is and if they can find the reason for something happening. Overall the report that I received was mostly remarks made on my mathematical language use. I know that I still don't talk perfectly and that my words can give misconceptions but that is just the consequences that I'm willing too accept because I know that my mathematical English won't be perfect in a year's time and that it takes experience to teach in another language than my own.

I also did a bit research on the concepts of horizontal, vertical and realistic mathematics, and came to the conclusion that the focal point should not be on mathematics as a closed system but on the activity, on the process of mathematization. Looking at horizontal mathematics, the learners should come up with mathematical tools which can help to organize and solve a problem located in real life situations. Furthermore I deduced that vertical mathematics can be deemed a re-organizational tool within the mathematical system itself for finding shortcuts and discovering connections between concepts and strategies and then applying these discoveries themselves.

Facilitators should give the learners the opportunity to re-invent mathematics by practicing it. It allows them to develop informal strategies for dealing with

mathematical problems under the assumption that with guidance these informal strategies can progress to more formal applications without limiting them to a certain set of rules.

I will also concentrate on making mathematics a real world mathematics education. Through this I hope to make learners perceive mathematics as an authentic and real experience within their minds. For the problems to be presented to the learners, this means that the context can be a real world context, but this is not always necessary. The fantasy world of fairy-tales and the formal world of mathematics can be suitable for a problem, as long as they are regarded as real I the learners' minds, context problems and real life situations can be used to constitute and to apply mathematical concepts.

In my learning task 2.2 I made a mistake with my calculations with the final end product outcome. All the learners struggled to find the right answer and it was because of me that they didn't reach the correct end product outcome. I felt incompetent, dumb and stupid! I went home and worked the problem out thoroughly and asked colleagues to check my answers. I had to go back to class and apologise for my mistake and I immediately handed them a copy of all the right answers. I learned that I must make sure of answers before I go into class and before operationalising an LT, to also ask for advice/help from colleagues to check that my work is liable and correct. I

My last LT operationalised at my second SBE was my best learning task. They [the learners] stepped in class greeted me and sat down. I handed out their already worked out homework problems which they had to do for today and then I also gave out their written presentation of my learning task. I told them they should keep quiet, sit back and enjoy! I then showed them a clip of Mission impossible, where the guy worked out the math and physics behind a jump that he was going to attempt from the one building to the other and he made it and was alive. After I showed them the

video clip, I told them they are now going to use this clip and find the answers and calculations for him to successfully have made the jump. I gave them all the info on the written presentation. I told them that they can ask me questions but that they were not allowed to talk with the others around them. I also told them that they only have 20 minutes whereafter I am going to take in their worksheets for marks.

What was very interesting is that the kids that always do very well academically were the kids that are hands went up first. They couldn't handle it that I don't tell them exactly what to do. There was one girl that got so frustrated that she almost started crying because she didn't catch the problem at all. They are so used to be told exactly what to do that this freaked them out completely.

I told them that the challenge is to actually solve the problem on their own without asking the whole time what to do. They would ask me the silliest questions, and then I would read the info on the written presentation with them and they would immediately catch it. I came to the conclusion that these kids are lazy and that they don't ever make efforts to read questions or interpret info given in the word form.

The kids that never really shined in class actually came up and took the lead with this learning task. Although there was no cooperative learning planned, the kids that got really frustrated began to seek for clarity and started asking the less clever kids who were on the right path on what to do. I could see that confidence their confidence was really boosted and I was proud to see that they could figure the problem out without anyone's help.

I felt great! It was exciting learning task and I could see that the video really inspired them to start working. The learning task was successfully operationalised, and the quality of leaning was constantly on a high level. I felt confident and in control. The learning task worked well and finally I could see the implications and consequences of the transcendental paradigm work positively for them.

With this learning task I tried to incorporate both scaffolding skills as well as learning task feedback strategies. It worked well and I could see that the kids really got terribly frustrated with how I was applying the theory and just these reactions told me that I was on the right path. This was actually my last LT operationalized at my second school-based learning period and after this LT I finally mastered the paradigm and theory. I know that I will never be perfect and that I can still grow at all levels but at least now I know exactly what to build on in future and how to think and design LT that can work.

Although my initial views of education are not wrong, I definitely came to a deeper insight, that education is not just a teacher telling kids what to do, or transferring knowledge like a computer, but it's about a lot more than that. It is about directing the child to take control of their own learning by motivating and inspiring them to eventually take responsibility for their own quality of learning and to at the end develop self-directive, independent life long learners that can not only adapt to the real world out there but make noticeable differences in society where ever they may find themselves. Maximise their potential on a continuous basis!!!

4.7 Sophie

I see teaching as the manner, way and technique that information (new information) and content is explained to people (learners), shown and how examples or experiments are visualised for them to make it understandable and clear and to make them wise with their new knowledge.

I began as an unexperienced, unmotivated, unconfident student. My first 3 weeks were the most difficult, because it felt I didn't do so well as the other student were doing. Also because in our student group at the school, I felt I were less experienced with senior learners in High School. I struggled with the work and getting through to the learners, because my mentor teacher were present in all my classes and the

learners preferred to ask her questions, instead of asking me. After my spec teacher visited me for the first time, I was obliged to ask my mentor teacher for some space and I asked her for a class that I can do anything with, on my own. She gave me her Grade 10 [mathematical] literacy classes and her Grade 9 class. Some days I facilitated 5 of the 6 periods. I had 90% of her classes and the work load were quiet a bit. After my spec teacher's 2nd visit, I had an accident the following day. After my accident my mentor teacher thought it was better to just give me the maths lit classes. She also wrote me a "personal report" and said how much I improved. Now I am more organised, motivated, confident and I make better choices. I also know now that I need to be more organised and I musn't postpone my work until later…

I didn't have enough confidence in my class while my mentor teacher were there. She observed every class of mine and I felt that the learners don't bound [bond] with me. During break I, Diane and Kimberly talked about it. Kimberly called Mrs J and started to talk to her and told her about the problems I were experiencing. Looking back, I were first really uncomfortable in my classes and had a lack of confidence. After I talked to Mrs J, I felt better and in the first class I suddenly had confidence and I talked to the learners and facilitated the way I want to. The other PGCE students really helped me and they also felt good by helping me solve the problem. I didn't have enough confidence and were uncomfortable in my classes because Mrs J watched the whole time and when the learners struggled with some of the questions they didn't ask me and they couldn't get used to me teaching them, because they asked her the answers they didn't know. The learners also felt uncomfortable with me at first, because I look maybe 2 – 5 years older than them and also because they were used to Mrs J way of teaching and handling things.

My weakest learning task was at my first SBE at [Highschool] W. My outcomes were: I wanted to make the learners understand the work they need to know for the exams. I also wanted to see if they can remember they work I did with them, and whether my practice on them improved their maths skills. My outcomes for the

learners: I wanted them to renew their knowledge of number and number relationships (substitution and factorization) and data handling and space, shape and measurement (the last activities I did with them). I also motivated them to use their knowledge of data handling with their own problems and to help them to learn about each other. Unfortunately the work I did with them that day – I didn't do with them while I was practicing at [Highschool W] – It was the work their teacher did with them just before I arrived. The learners handed in assignments that I marked for their Portfolios, about the activities and lessons I did with them 26 and 27 May. So I know my outcomes were reached.

These are some decisions that I think didn't work during that lesson. I first did the work the teacher gave me with the Grade 9 and 10's. I didn't facilitate the learners – I TAUGHT them. It didn't work, because I couldn't accommodate my own personality and own style of teaching in the classroom. It also caused confusion, because the learners were used to their own teacher's way and style of teaching. I weren't organized in my crit lesson, which I will always regret. I really improved, and I know I have, but the last lesson I had to show it – I didn't and couldn't because I weren't prepared enough.

These are the decisions that I thought did work during this lesson. I talked to my mentor teacher about having my own class for a while without her observing the whole time. I didn't give attention to any comments in the class. I handled all the problems of the learners in the same way. I started to give my learning tasks to the other PGCE students and asked them if my spelling were correct and whether or not they themselves understand the learning task. Before I designed my learning task, I asked my mentor teacher for some ideas and after I produced the learning task I talked to her about it. I divided the learners in to Cooperative Learning groups and I divided them so that all the "groups" like friends, the smart learners and races were mingled. It really worked. I asked the learners during my practice to help me to

explain to the person next to them, because I can't go to each one individually. I can personally say that this was my worst lesson ever and I really made a mess out it.

We discussed the discipline in the classroom and talked about what I as facilitator need to do to establish it. Today I was even more unsure about myself as facilitator than yesterday. But I know that one day I will be the best facilitator ever. I was told by people that I am not a good facilitator and that I cannot apply my learning theory, instead of that I recognised myself, it made me feel inferior about myself and as a facilitator. I was unsure about how I would apply consolidation in the class and what must be done to ensure that the end product outcomes are achieved. I can show people that they are not always right. I can just get better and better everyday and prepare my work and consult many people and lecturers about my whole learning task and practice-theory and how I must consolidate, as much as possible. As facilitator I am going to prove people wrong. I am going to give learners recognition, motivate them and explain my reaction to learners. Will ensure a continuation and give them another question/problem. I will maintain the level of discipline and continually give them a challenge and ensure that it is interesting and make sure that they do not get other things to busy themselves with in class. I will establish a relationship of trust and recognise them as people and motivate them through telling them everyone is in a position to do good things. I will reward them for the problems that they must solve. I will ensure that my attitude is constant so that learners know my norms. I will ensure that I know the rules and the consequences and that I am part of the interaction. I will warn learners if they continually do something wrong and I will react on the action that is taken. I will execute rules, the learners must know what these are and that they must pay attention in my class. The others also have a right to learn.

In my lesson on the 28th August, the learners were excited and worked hard. It was something different and especially because I changed the groups again, it made a huge difference. The learners encouraged EACH OTHER which elicited a big reaction.

The video camera naturally also played a big role. Because it was something different and some learners do not have a feeling of acceptance/love, the groups co-operation worked very well. The stickers and sweets also brought a lot of joy.

These were the things that I changed about myself during the second SBE. I planned my lessons each time and asked my mentor for help, if I was unsure about what to do. I filed all my work and began to get organised. I treated all the learners the same, as difficult as this was. I changed the whole classroom atmosphere, when I implemented the sticker system. According to this the learners got stickers if they did their homework and when they got full marks for a test. The classes and groups in each class also competed against each other. The learners started looking up to me, started listening and keeping quiet in the class. Their view of me as a role model (action research) began to take place and I am proud to say that I also presented 5 transcendental learning tasks, the last 4 were very good and consolidation showed that the learners learnt a lot and that the quality thereof was deep and good. I gained more self confidence, I began to know the names of the learners and I did my reflections regularly. I also made time for an extra mural activity, where I got to know some of the learners well. I acted professionally in all of my classes and I established rules in my class (no cellphones), that the learners listened to. The assessments that were done by my mentor and my lecturer, showed my improvement….

I now see education as the facilitation of learning. It is the way we help learners to optimise their potential to become active, interdependent lifelong learners. I as the facilitator help them to shape the future. I have to let learners experience, in order for them to learn. I have to ensure that the organisation of the subject proceeds smoothly. I have to facilitate the chosen subject with maximum effectiveness. In education I have to ensure a successful learning product and outcome and I have to facilitate learners in that way to maximise their potential as humans.

4.8 Toni

The aim of teaching is to successfully prepare the learner for challenges in the future. Through teaching the learner should develop skills to identify and successfully conquer these challenges. Teaching is also a method to stimulate the development of the learner on an emotional, intellectual and social level.

I confronted peer students of the PGCE programme with the firs learning task I designed. The real life problem was to calculate the perimeter of a chicken farm in the Lichtenburg area. For this they will need to develop the distance formula used in analytical geometry. This was supposed to be a learning curve for me as facilitator, providing me an idea of the possible responses that I can get from the learners in my classroom. The students quickly got involved in the learning process. It felt like they forgot it was only a trial learning task and actively tried to solve the problem. It was as if they were in a real classroom situation.

I did not use the scaffolding as successfully as I did in this learning task during the rest of the year. I still believe that the scaffolding used in this example was of critical importance and I want to use similar scaffolding in my practice one day. This learning task required learners to construct their own knowledge. I classify the method of instruction used in this learning task as dialectical constructivist approach as discussed in the Good strategy instructors article (number 1 in the bibliography). I tried an endogenous constructivist approach in learning task number 4. I feel most comfortable with the dialectical constructivist approach (tried in this learning task and learning task number 7) and believe that when I facilitate learning with the approach the learners achieve the best quality of learning at the optimal rate of progress.

The worst learning task I believe I implemented was with Grade 10's with the critical outcomes that I aimed to achieve being problem solving, team work and effective communication. The learners were divided into five rows each containing five learners. A paper with five word sums was handed to each row. Row 1 to five

received paper one while row 4 and five received paper 2. The desks were number 1 to 5 from front to back. Each learner received a word sum to try and solve. I thought 15 minutes would be enough for this, after this they will try discussing their solution/ attempt with the other learners who had the same problem, then they will return to their base group and discuss the solution of all 5 questions.

I believe that students should be autonomous. They should be able to discover solutions individually and share this with their peers. This is associated with a natural process of meta-learning and cooperative learning. I did not give any guidance to the learners on how to solve the problem. I thought the lesson erupted into chaos and trying to establish control again I reverted back to traditional methods of teaching. My anticipation of what was going to happen was wrong. The learners are still dependant on the educator as source of information. This should have been expected taking the current education and classroom culture into account. The learners had a lot of questions. This is supposed to be a good thing since questioning is where learning starts. I tried to answer or meet all questions of learners. I started to spin because I could not listen to all the learner's questions at the same time and while they were waiting for me to provide feedback on their questions no learning was taking part on their behalf. I should take the time to listen to a learner's question thoroughly without trying to run to the next learner.

I know that I possess a great skill for mathematics and that I have a wide knowledge of the subject. I am confident that I can solve any problem in the current curriculum. This resulted in me not completing the end product outcome myself and when I reverted back to traditional methods I made a mistake on the board. What I can learn from constructing the end product in myself is:

- *Possible misconceptions*
- *The though process needed to sole the problem*
- *Possible questions that will be asked by the learners*

- *Questions that should be asked by the facilitator to improve the quality of learning*
- *Prior exercises needed and ideas for scaffolding*

The important lesson for me is to identify the skills we use without noticing that the learners may not yet have acquired these skills. An example is the translation of words into equations. I believe this is where assessment of prior knowledge and scaffolding will be useful. The scaffolding will also aid in dealing with multiple questions at the same time.

I also approached this learning task from an endogenous constructive viewpoint. Since I was not successful I did not want to use this approach again although it seems that the facilitation of learning paradigm is built on this approach. In learning task number 9 I again tried the endogenous constructive approach and achieved tremendous success with it. It gave me the opportunity to view the approach of the learners and thus establish the knowledge that they have and what still needs to be learned.

The greatest lesson that is to be learned from this learning task is that there should be a thorough analysis of all the aspects of a learning task whether it is successful or not. I should not think that everything is a failure when I am not successful.

My best learning task put into operation was the last learning period I met with the grade 10 learners during my second school-based learning. During this learning period we started with a new topic. I tried something new for this period. Learners had already identified and constructed graphs of:
$y = a\sin\theta + q$; $y = a\cos\theta + q$ *and* $y = a\tan\theta + q$
$y = c/x + q$
$y = ax^2 + q$

They are able to state and interpret the effect that the parameters a and q have on the graphs. They are also able to determine the expression of an equation from a given graph with the coordinates of certain points given. They have not seen an exceptional graph together with equation y = ab..+ q. What I expected from them was to determine the genera shape of an exponential graph and the effect that the parameters a and q have on the graph through the construction of multiple graphs. This is the exact same procedure they followed for the previous graphs with the exception that they were guided step by step. I did not give them any specifics.

Each learner received a written instruction with the problem. I did not read the problem to them. They had to identify what needed to be done themselves. After learners read the question some started to work while others asked questions and did not now what to do. After a while I asked some of the learners who started working on the problem to explain to the class what needed to be done. Some learners spontaneously started to work together. At the end of the period most learners only finished one graph. During the consolidation I asked a learner to present his work on the board to the entire class. The class then had the opportunity to question him.

The learners used the table method to construct the graph of the exponential function. This is the same method that they initially use to draw all other graphs. The first problem was that there were only unknown values in the equation. The concept if variables (x and y) and parameters had to be discussed first. After this most learners chose a value for the parameter b (2 was the popular choice). The learners then constructed a table for the equation y = 2x, thus b = 2; a = 1 and q = 0.

Usually learners will choose positive and negative integers for the independent variable. For this table they only used natural numbers. This was a surprise for me. It might be because x is the exponent. I realized that exponents is a difficult topic for grade 10 learners. They may not all be comfortable with a negative exponent and

questions usually ask them to give answers with positive exponents. This is a clear demonstration of how prior knowledge influences the learning experience.

Some of the learners constructed a table with values for the independent and dependant variable of the equation y = 2x, I asked them what the values of the parameters a, b and q are. They stated that the value of b is 2 but many different answers for the values of a and q were given. For example was when a learner identified that the value of q is 0 since it is not present in the equation, he automatically assumed that the value of a is 0 as well because it is not present in the equation. This is a lack of understanding of the notation that is used. I try to help learners overcome this difficulty by having them describe an equation verbally to me. I encourage them to use the correct terminology and to distinguish between constants and coefficients. They need to explain the effect of coefficient (multiplying a value) and a constant (increasing/decreasing a value by a constant amount),

At the end of the learning period learners only identified the shape of the graph of an exponential function. They did not draw enough graphs to determine the influence of the parameters a and q.

I enjoyed this learning period very much. At the start learners were uncertain of how to approach the problem. Once they identified a strategy of solving the problem they started to work vigorously on their own and in groups. The need to solve the problem was substituted with desire to solve the problem. This was the first time I really experienced this.

When learners are not given specific instructions the mathematics they use can be observed more clearly. They do not just mimic the example of the educator but rely on their own mathematical ability. I believe this is the best way to identify flaws in the conceptual understanding of mathematics of the learners. It is also possible to

observe the understanding of a variety of themes and not just the topic that the class is busy with during the learning period.

I was surprised by a specific learner in the class. He is a weaker learner in the math classroom. He took leadership of a group in the class and explained to them how the problem will be solved. he also demonstrated a good understanding of what values should be chosen for the parameters to solve the problem. After the learning period he asked me for a copy of the written instruction because he wanted to complete the entire problem at home. This was significant for me because it was my last period, he did not have to submit anything to me, and it was a Friday. He is not a strong mathematics learner but wants to do a mathematics problem during the weekend.

This was the final task that designed for my school-based education. I implemented this learning task on the last day of my school-based education. I was frustrated with the way things were during my second school-based education. My mentor was a person an educator who believed that the educator should provide the learners with an exhaustive example of the problems and the way in which it should be approached by the learners. This is contradictory to my view of education. This learning task was a form of rebellion. I deliberately moved into an endogenous approach. Learners were confronted with a problem that was not divided into any smaller parts. They had to identify for themselves how they would approach and solve the problem. An amazing experience for me was when the class moved into cooperative learning spontaneously and I only facilitated this process.

The consolidation I did during this learning task was also a breakthrough for me. I made use of an individual learner to present his solution on the board to the entire class. I gave other learners the opportunity to question his approach although they did not make full use of this opportunity. The consolidation provided learners with an idea of what is expected from them during the next learning period to establish the influence of the parameters in the

My view of education changed greatly during this year. I previously held the opinion that the teacher is the most important factor for learning to take place and that the teacher's action will influence the quality of learning. This is not true. The focus should be on the actions of the learner and how these actions will improve their quality of learning and how learners will crave further knowledge.

The main aim of education is develop learners who will become citizens that can be responsible for their own learning. This is done through facilitating meta-learning which creates active, effective, collaborative, independent life long learners and facilitating cooperative learning which creates active, effective collaborative inter dependant lifelong learners. Focusing on the highest level of cognitive skills identified in Bloom's taxonomy will create the opportunities for learners to develop and improve their own learning experience. This can be associated with real life challenge.

4.9 Conclusion

This chapter has presented the reflections of each participant narrated through their own voice. The compiling of each reflection was done by using entries in chronological order, taken from their final professional portfolios. As the researcher, I chose the entries to include those which were most representative and descriptive of the participant's progress and experience during the course of the year relating specifically to their mathematics profiles and instructional behaviour. Chapter 5 now presents my researcher reflections on each of the participants with regard to the two constructs being studied in this investigation.