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INTRODUCTION

The Numeracy Inquiry Community of Leader Educators (NICLE) will form the empirical field to this study. The NICLE initiative will focus on numeracy teacher development within the foundation and intermediate phases in 15 primary schools in the Grahamstown greater area. This numeracy teachers' professional development programme was developed by the South African Numeracy Chair, Rhodes and is aimed at improving the quality of primary maths teaching and learning. The Numeracy Inquiry Community of Leader Educators is articulated and conceptualised as a long term partnership between in-service teachers and the Chair and partners of the Chair. It currently has 56 Foundation and Intermediate phase teachers who attend NICLE fortnightly seminars and inquiry sessions. The numeracy teacher development programme by its intentions is explicitly designed as both a Community of Practice and a Community of Inquiry teacher development approach and is framed by Wenger's Communities of Practice perspective (Wenger, 1998, Lave and Wenger, 1991, 1999) and by Jaworski's (2005, 2006) concept of mathematics Communities of Inquiry which brings more of a critical perspective. Having briefly outlined the empirical field of this research I will provide a précis overview of the contents of this proposal.

At this proposal stage I will outline my preliminary understanding of the broader context within which my study is situated. I will therefore focus on South African numeracy teaching and learning challenges and how these influences teacher identity, discuss local curriculum changes and current curriculum reforms before explaining national teacher professional development initiatives and related policies.

Wenger's notion of (1998) Communities of Practice and Jaworski's (2005) concept of Communities of Inquiry provides the key theoretical framework to this study. Central to this research will be identity, which is one of the four components of Wenger's (1998) social learning theory. Whilst borrowing originally the notion of identity from Wenger it will be supplemented by insights and positions argued for by Sfard and Prusak (2005) and Gee (1985, 1989, 2001). These conceptual orientations will provide a theoretical lens to gaze into how numeracy teachers learn and how their practices and identity evolves within NICLE.

The third section of this proposal engages with literature on teacher professional development. The literature informed discussion will explain the features, challenges, contents, promises and emerging trends in new staff development initiatives and the implications of such changes to maths teacher education. I will relate Shulman's (1986, 1987) concept of content and pedagogical content knowledge to numeracy teaching practice and explain what this entails to numeracy professional development.

The last part of the research proposal focuses on the research methodology to be used in this study. I will explain the data collection methods, the sampling strategies, ethical considerations and how validity and reliability of data will be ensured in this research. Finally a brief discussion on how data analysis will unfold in the study concludes this research proposal.

Research Questions

Overarching Question

What is the nature of numeracy teacher learning within an in-service community of practice-inquiry context?

Research Questions

- 1.** How do numeracy teachers professional identities evolve in relation to participation in an in-service community of practice-inquiry? What are the processes through which numeracy teacher identities evolve?
- 2.** How do numeracy teacher practices and their forms of participation in those practices evolve (if at all) in the in-service Community of Practice-Inquiry as well as in other overlapping communities of practice?
- 3.** What activities, relations and forms of participation within the Community of Practice enable or constrain evolving teacher numeracy identities and practices? How do these enable or constrain? What contextual factors (internal and external to the CoP) enable or constrain teacher evolving identities and practices?

Problem Statement

South Africa faces acute Maths problems (commonly called the Maths crisis) and attempts are being harnessed to provide for professional development models that improve and result in quality and effective teaching and learning of numeracy. One example of such an attempt is the First Rand Foundation Mathematics Education Chairs and the South African Numeracy Chairs initiatives that provides for longitudinal research and development work with teachers. The teacher development Numeracy Inquiry Community of Leader Educators (NICLE) of the South African Numeracy Chair, Rhodes University will form the empirical field for this study. Literature suggests that short-term traditional formal and mandatory professional development interventions are disempowering and have little impact on teaching and learner performance (OECD, 2008, Wineburg and Grossman, 1998, Smylie, 1989, Wilson and Berne, 1999, Abdal-Haqq, 1999). Locally the cascade model of implementation used for the introduction of Curriculum 2005 particularly highlighted the need for alternative forms of in-service teacher development (Chisholm, 2005).

There is an increasing international body of knowledge that points towards collaborative, on-going teacher learning through participation in professional communities of inquiry as a means for successful and empowering teacher learning. Such success has been evident in USA, European and Asian countries (Wilson & Berne, 1999, Abdal-Haqq, 1996, Jaworski, 2004, 2006, Ma, 2010, Kilpatrick, Swafford & Findell, 2001, Askew, Brown, Rhodes, William & Johnson, 1997a, Rosebery & Warren, 1998, Grossman, Wineburg & Woolworth, 2001, Farmer, Gerretson and Lassak, 2003, Fennema, Carpenter, Franke, Levi, Jacobs & Empson, 1996, Heaton & Mickelson, 2002). Research into teacher learning within professional community of practice development models and the nature of knowledge

transmitted therein is limited in South Africa (save for Graven 2002, Breen, 2004 and Huillet 2007 studies). These studies focused on the Senior phase and FET phase teachers and postgraduate university students, yet teaching primary mathematics differs significantly from teaching mathematics in the Secondary classes or in university settings. There are no Southern African studies available on the nature of foundation phase teacher learning within such a teacher professional development community of practice based context.

There is increasing local (Carrim, 2003, Jansen, 2002, Graven, 2003, 2005a, Parker, 2006, Samuel, 2008, Samuel & Stephens, 2002), and international literature (Morgan, 2005, Wood and Jeffrey, 2002, Lasky, 2005, Marsh, 2002a, 2002b, Zemblays, 2005, Beck and Young, 2005) on teacher identity. However there is dearth of South African literature on how numeracy teacher identity and practices forms and evolves within new collaborative and inquiry driven professional development communities. Thus a study of the nature of evolving identities and evolving practices of numeracy teachers (and the mechanisms that enable or constrain such learning) would contribute to growing knowledge in this identified gap in the literature. Lave and Wenger's theory of Communities of Practice (Wenger, 1998, Lave & Wenger 1991, 1999, Lave, 1996), Jaworski's theory of Mathematics Critical Learning Inquiry Communities (Jaworski, 2005, 2006) and theories of identity (Gee, 1985, 1989, 2000; Wenger, 1998; Sfard & Prusak 2005; Juzwik 2007) have gained increasing popularity among the international community of mathematics educators and in particular in the field of mathematics teacher education (Jaworski, 2003, Graven, 2005a, Marsh, 2002a). I will draw on these works in order to develop a theoretical framework for this study.

Purpose Statement

The purpose of this study is to explore and explain the nature of teacher learning with a particular focus on how numeracy teacher professional identity evolves within a Community of Practice-Inquiry professional development setting and the implications of such educators development models towards effective numeracy teacher learning.

Rationale

1. The study can contribute to policy and practice in the field of in-service numeracy teacher professional development.
2. The study can be viewed as a case of numeracy practice and inquiry informed professional teacher development with a focus on numeracy teacher identity and can contribute to the growing body of literature that highlights learning as changing identity.
3. The research seeks to investigate towards numeracy teacher learning mechanisms within communities of practice and inquiry context.

SECTION 1: CONTEXT OF THE STUDY

South African context

The South African Maths Crisis

South Africa currently faces what has been termed the “Maths crisis”. The maths crisis is not unique to South Africa and has also been noticed in Britain and in the United States (Schoenfeld, 2004). However the nature and extent of the South African maths crisis has been much more pronounced and in some ways multiplex. Locally the Maths problem is evident in the poor and lower grades attained by most Grade 12 maths learners. The dismal performance of learners at the Matriculation level in maths is evident in the last three years’ national examinations (2008, 2009 and 2010) where the maths percentage pass rate has been between 46% and 47% (Taylor, 2010). It is important to note that the Department of Education regards a 30% attainment at Matric as a subject pass. If we were to calculate the Matric maths scores at a 50% pass rate, which is the grade required by most universities for entry into the “sciences” then even fewer matriculants would make the grade.

The local learners’ performance in maths and numeracy in regional, sub-regional, national and international tests is indeed pathetic and reveals the maths dire strait situation South Africa currently faces. I will explain the implications of such weak maths learner performance to primary maths education.

Firstly evidence from national, regional and international tests reveal that local primary learners cannot do maths or execute tasks at the appropriate grade levels or at the minimum expected competence levels (OECD, 2008; Schollar, 2008). The SACMEQ II dataset indicates that half of Grade 6 mathematics learners perform at the Grade 3 level or lower (Schollar, 2008, van der Berg and Louw, 2007). In the 2004 Western Cape Grade 6 numeracy tests it was found that only 15,6% were performing at the appropriate grade level with a disappointing 40% operating at the Grade 3 level (Fleisch, 2008). This has led some scholars to conclude that 80% of the South African learners are below the minimum expected standards for their grade (Schollar, 2008).

Secondly the learner performance tests also show that most South African primary scholars have a poor grasp of elementary foundational mathematical concepts as reflected by the 30% average scores for both the 2001 Grade 3 numeracy national tests and the 1999 MLA Grade 4 numeracy project in which South Africa had the lowest score amongst the 12 African participating countries (OECD, 2008). In the three International and highly regarded TIMSS tests the local Grades 7, 8 and 9 maths scores were at the bottom of the maths league tables (Reddy, 2006b, Howie, 2001). Schollar (2008) clearly illustrates this and pinpoints that the majority of South African learners do not have an understanding and knowledge of the basic number bonds (algorithms), place value in the base-10 number system and cannot readily understand the meaning of multiplication and division. Results from the TIMSS 2002 Grade 8 tests also highlight that the South African curriculum emphasises a lot on applying mathematics to real-life situations and multicultural approaches at the expense of understanding and mastering basic fundamental mathematics concepts and skills (Reddy,

2006b, Howie, 2001). Such a criticism is warranted given the fact that the official curriculum (Curriculum 2005) in early 2000 was characterised by under-specification of basic knowledge and skills (Reddy, 2006b).

The third implication arising from the learners' poor performance in numeracy tests highlights the need to widen interventions to primary levels. According to Reddy (2006a, p. 413) solutions to the local maths and science problems lies in "interventions . . . aimed at the entire system and not only at the secondary level". Whilst in the past, national efforts and concern has been on mathematics learner performance at the final grades it is also equally important to focus on mathematics at the primary school levels. Primary level elementary mathematics is important and "fundamental" as it contains the rudiments of many key concepts in more advanced branches of the discipline", which must be built from the early stages (Ma, 2010, p. 116, Reddy, 2000a). The SACMEQ data and the national learner evaluation tests show that the weak performance in matric originates much earlier (van der Berg and Louw, 2006), probably in the foundation and or intermediate phases. For example in the SACMEQ II and III sub-regional tests the local Grade 6 maths scores were below the regional mean scores (van der Berg and Louw, 2006). Thus one can argue that the maths problem is also pronounced and extends in the primary grades where local learners maths scores are consistently amongst the World's worst, with far poorer countries achieving better than South Africa and learner achievement scores far below what is expected at all levels of the schooling system (Bloch, 2007, Muller 2004, OECD, 2008). South African learners have also performed badly mostly in Science and English (Literacy) and even in some cases in Life skills tests.

South African Numeracy classroom challenges

In this part of the research proposal I will discuss the complex challenges faced both by the South African education system and maths classrooms as presented in the local literature. Such a literature informed discussion will help in the understanding of the extent of the difficulties and challenges facing local numeracy classes and how this hinders the effective teaching and learning of primary mathematics. Furthermore it would also be important in this study to investigate how the activities in NICLE address such challenges.

In the South African context the concept, Opportunity-to-learn (OTL) implies the time, coverage, exposure, the sequencing and pacing of curriculum content made available to learners (Reeves and Muller, 2005, Fleisch, 2005). Reeves and Muller's (2005) study on the dimension of OTL in the grades 5 and 6 mathematics curriculum found out that Grade 6 teachers covered content, skills and concepts that were supposed to have been covered in Grade 4 and 5 levels. Content "reteaching" has been found to consume 21% of South African maths classroom time (Howie, 2001). The Khanyisa study carried in Grade 3 maths classes in 24 schools indicate that only a paltry 10% of the sample were on track to complete the intended curriculum for the year (Taylor, 2008). Taylor (2008) and Taylor and Vinjevold's (1999) argue that South African Maths classrooms exposes learners to low OTL when a teacher spends a whole lesson doing two or three maths problems or exposing learners to low cognitive mathematical tasks. One important aspect of the OTL is time, yet

local research has shown widespread teacher and learner absenteeism and late coming (Taylor, 2008, van der Berg & Louw, 2007, Taylor and Vinjevold, 1999). The three TIMSS reports state that school and class attendance is a major problem that shortens South African students' classroom learning time (Howie, 1997, Howie, 2001, Reddy 2006b). One major challenge facing South African maths and numeracy classes is the low levels of OTL that learners are exposed to. This has a detrimental effect for the effective teaching and learning of maths and alongside a negative maths learner attitude this clearly indicates a poor (maths) learning and teaching culture.

South African classrooms are generally characterised by vast inequalities that indicate social class and economic gaps (Reddy 2006a). Across the different social and economic groups educational material and human resources are unequally distributed (Adler and Reed, 2003). This "higher degree of segmentation in the South African schooling system" (van der Berg & Louw, 2006, p. 13) led Fleisch (2008, p. 1) to metaphorically assert that South Africa has "two education systems" – the first system comprises of well-resourced former White and Indian schools and the second system enrolls the majority of African working-class poor children (van der Berg & Louw, 2006, Reddy, 2006a). Translated to primary school maths and science performance this leads to a "bimodal distribution" and a wide variation and massive disparities in learning achievement with poor working class children doing worse on academic performance tests (such as MLA and SACMEQ) as compared to the privileged (Taylor, 2008, Fleisch, 2008, van der Berg & Louw, 2006). Hoadley's (2008) study illuminates how the inequalities mentioned above have infiltrated into South African grade 3 numeracy classrooms resulting in middle-class learners acquiring the specialised knowledge of mathematical principles whilst working-class students have been exposed to local everyday knowledge, meanings and practices.

Another educational research gap and problem existing in maths and numeracy classes is on the language of instruction. Advocates of bi/multilingual maths classes which is similar to the government's "additive bilingual model" (Taylor and Vinjevold, 1999, p. 211) argue that such a practice enables learners to understand and explore mathematical concepts and ideas, supports classroom communication, learners peer discussion and allow for teachers to provide learner support needed to develop proficiency in the language of learning and teaching (eg English) (Setati, 1998, 2005, Howie, 1997). The government's additive bilingual model has been criticised for making an early exit from the mother tongue at Grade 4 instead of having pursued more years of first language education (Howie, Venter, van Staden, Zimmerman, Long, du Toit, Scherman and Archer, 2008). Those who prefer Anglophone maths classes including some non-English speaking parents argue that English initiates learners into maths ways of talking, it is the language from which the learners will be assessed and is a higher status, international and universal language for communication and commerce that gives privilege to socio-economic advancement (Setati, 1998, Adler and Reed, 2003, Taylor and Vinjevold, 1999). Having sketched the different language positions it is important to note that learners using additional languages in maths tests mostly attain low scores, however Reddy (2006b, p. 90) hastily warns that "the effect of language proficiency and achievement scores is not straight forward". The South African classroom language

situation is more than complex and still to be resolved. There is constantly shifting school learner demography, children born through inter-marriage are fluent in a number of languages and this makes it difficult to identify the class' home language, some teachers lack competence in the learner's mother tongue and also the problem of the "dilemma of code-switching" which indicates insufficient classroom informing high quality studies on this matter (Adler and Reed, 2003, p. 135, Fleisch, 2008, Taylor and Vinjevold, 1999).

Local literature and researchers point to low levels or weak maths teacher content/conceptual knowledge (Fleisch, 2008, Adler and Reed, 2007, Taylor, 2008, Taylor and Vinjevold, 2008). The Southern African regional study by Spreen and Fancsali's (2005) and the TIMSS-R report (Howie, 2001) has noticed a positive correlation between teacher subject knowledge and learner achievement. Teachers with a poor grasp of fundamental concepts deprive learners of higher order challenging tasks and subordinate learners to low level concepts, unchallenging tasks and poor learning outcomes (Taylor and Vinjevold, 1999). However disturbing is the Khanyisa Programme Grade 3 teacher numeracy tests in which the educators' average scores of items taken from Grade 6 maths learners tests was 67% with 3 of the 25 teachers scoring below 50% (Taylor, 2008). In the Integrated Education Project the numeracy minimum score of 14% attained by some teachers is below what the primary school curriculum expects from the average learner (Magobane and Pereira 2008, in Taylor 2008). It's traditionally acknowledged and logically follows that teachers with a good grasp of mathematical knowledge impact positively on learners, exposing them to varied, cognitively challenging maths tasks and adventurous maths encounters. On the other hand teachers with weak concept knowledge are limited for they "cannot teach what they do not know" (Taylor, 2008, p. 24) and are "therefore constrained by this in the classroom" (Howie, 2001, p. 155).

Whilst content knowledge is important it however is not sufficient, for there is need for what is commonly called pedagogical content knowledge which is the "subject knowledge for teaching" (Adler and Reed, 2003, p. 135) and is about how "teachers . . . enable the learners to understand the concepts they were meant to teach" (Lotz-Sisitika, 2007, p. 4). The South African pedagogical project encourages empowering and democratic learner centred methods and activities that engage learners in high-level conceptual thinking and disregards classrooms characterised by teacher talk, rote-learning, learner chorusing and closed questioning techniques (Taylor and Vinjevold, 1999, Fleisch 2008, Adler and Reed, 2003). Some teachers have accepted superficially the informing principles of the local pedagogical reforms (Adler and Reed, 2003). Harley and Wedekind (2004), agrees with this, arguing that the envisioned transformational pedagogical orientation has in some instance had the opposite effect, which has led to the reproducing of social class divisions that affect historically disadvantaged learners especially in schools with limited resources. Another South African study relevant to this research, involving 6 numeracy foundation phase teachers has shown that local teachers have a limited understanding of how children learn numbers therefore suggesting that teachers lack the knowledge of strategies involved in teaching and learning numbers (Kuhne, van den Heuvel-Panhuizen & Ensor, 2005). However the most suitable pedagogical mix or teaching practice in primary mathematics is perhaps one

that maintains a balancing act and meanders between learner engagement and the discipline, leading ultimately to the effective teaching and learning of numeracy.

Linking local primary maths classroom challenges to teacher identity

Having discussed the main challenges facing South African primary classrooms I would like to link and explain how the aforementioned difficulties impact and affect local teachers' (numeracy) professional identity. In the ensuing discussion on teacher identity I will mainly draw from local maths and teacher identity literature. Identity is central to this study as captured both in the provisional title of this proposal as well in research questions 1 and 3.

The social class disparities in the local schooling system (Reddy 2006a, van der Berg & Louw, 2006, Fleisch, 2008) are also evident in the teaching fraternity. Generally in the local teaching profession white teachers stationed in well-resourced schools are regarded as "professionals" whilst black teachers who practice in working-class schools have "worker teacher identities" (Carrim, 2003, p. 133). The notion of teacher identity is also closely related to bilingual (maths) classes. In South Africa there has been no studies specifically focusing on the relationship between teacher language competencies and teacher identity, however Pavlenko (2003) has argued that bilingual teachers have multilingual speaker identities. It would be important for this study to investigate the notion of mathematical-linguistic identities conceived by foundation phase educators who teach in bilingual maths classes. The local numeracy literature depicts primary maths teachers as exposing learners to low OTL (Reeves and Muller, 2005, Howie, 2001, Taylor, 2008) and having weak maths conceptual and pedagogical content knowledge (Fleisch, 2008, Adler and Reed, 2007, Taylor and Vinjevold, 2008). Such a portrayal of the local primary maths teachers' limited mathematical knowledge affect numeracy teacher professional identity. According to Jansen (2001) one's subject matter competence levels is the professional basis for teacher identity. It would be relevant therefore in this study to investigate and explain the relationship between numeracy teacher identity and teacher content (and pedagogical) knowledge as well as the other factors enlisted herein.

South African curriculum changes

The South African education landscape has constantly experienced curriculum changes and is currently facing curriculum reforms which have had and will have effect on knowledge positions, (maths) practice and consequently (numeracy) teacher professional identity. Curriculum policy documents and other policy texts contain the official projections of the ideal teacher (Jansen, 2001), which is mostly conceptualised in functionalist terms (Carrim, 2002). It follows therefore that each wave of curriculum change experienced in South Africa has had ripple effect on teacher identity. Thus historically the National Christian Education practised in the apartheid era which was characterised by fundamental pedagogics, rote-learning and teacher centredness, projected teachers as liberators (Jansen, 2001).

The advent of democracy in 1994 signalled major political and social reforms that impacted heavily on the South African education ideology. In 1997 the Department of Education officially launched Curriculum 2005 (OBE), which was introduced in Grade 1 classrooms in

1998 (Jansen, 1999, OECD, 2008). OBE was necessitated by the legacy of apartheid education and was a response to global competitiveness challenge with education geared for the promotion of democracy, social justice, equity and economic growth and high-level skills knowledge (Jansen, 1999, DOE 2000b, Chisholm, 2005). The new curriculum had three design features; it was outcomes-based, learner centred and had an integrated knowledge approach and was structured into eight “learning areas” with the Foundation Phase Learning Programmes being literacy, numeracy and life skills (OECD, 2008). The new curriculum therefore outlined and specified new knowledge positions and teaching practices. Also enshrined in the new curriculum was a particular teacher identity; the teacher was projected as facilitator, educator and reproducer of a democratic South Africa (Jansen, 2001, Carrim, 2002).

However the new curriculum had its epistemological weaknesses. SAQA (South African Qualifications Authority) guided by the NQF (National Qualifications Framework) defined the critical outcomes to be developed in all students across the entire education and training system (OECD, 2008). According to Taylor and Vinjevoold (1999), if the SAQA critical outcomes are viewed within the framework of Bernstein’s curriculum models they embrace elements of progressive and radical competence models which recognise both cognitive and political empowerment. Such epistemological positions however emphasises everyday world knowledge which obscures formal systemic conceptual development (Adler and Reed, 2003, Taylor and Vinjevoold, 1999). This concurs with the findings of the Review Committee which argued that C2005 neglected systematic conceptual progression and understanding particularly in maths (DOE, 2000b). This has been one of the weak areas of C2005 especially in mathematics, which prompted curriculum revisions and resulted in the creation of the RNCS (NCS) in 2002 (Chisholm, 2005, DOE, 2000b, Schollar, 2008). The South African education system in the post-independence era has therefore been characterised by curriculum flux and overload and this trend is likely to continue given the impending curriculum reforms. Each curriculum reform thrust articulates particular knowledge positions and practices and this has directly and indirectly shaped teacher identity.

Current educational reforms

Current curriculum reforms have been informed by learner achievement tests, which in most instances are meant to expose a country’s education’s strengths and weaknesses, provide feedback (evaluation) on the impact and quality of its education system (from an input, process and outcome perspective) and the targeted interventions that can be taken to improve teaching and learning (Reddy, 2006, Chinapah, 2003, Murimba 2005, Muller, 2004). South Africa’s Foundation for Learning Campaign is one such a targeted intervention which draws from the learner assessment tests to inform and enrich its literacy and numeracy Foundation Phase learning. The Foundation for Learning Campaign aims to promote Numeracy learner performance to no less than 60% by 2014 (DOE, 2008, Grahamstown’s District DOE meeting 27/01/2011). This strategy outlines the numeracy teaching and learning methods, time allocation, resources, activities and assessment tasks that ensure the effective teaching and learning of numeracy (DOE, 2008, OECD, 2008). This strategy is similar to Britain’s National Numeracy Strategy which aims to improve numeracy standards and was provoked

by the low scores attained by British primary mathematic learners (Askew and Brown, 2004, Department of Education and Employment (DfEE), 1999).

In line with the Foundation for Learning Campaign all primary school learners have to undergo “annual national assessments” (ANA) in Literacy and Numeracy using standardised tests to measure progress towards achievement of set targets” (DOE, 2008, p. 7). These tests have been carried out in Maths (Numeracy) and Language (Literacy) in the Foundation and intermediate phases for all learners from Grade 2 up to Grade 7 and will continue up to 2014 (Grahamstown District DOE meeting, 27/01/2011). South Africa is currently awaiting a new Curriculum and Assessment Policy (CAPS) (DOE, 2010). Copies of the final draft of the CAPS document have been sent out to the public for comments, after which they will be revised, published and distributed to all schools. This newly developed policy will replace the NCS and is likely to be out any time this year. We expect that the new impending curriculum policy, like prior curriculum statements conceptualise local professional teacher identity. The study will therefore need to investigate how the new curriculum policy projects South African teacher identity and specifically numeracy teacher identity. It would be relevant as well to discuss how the new national assessment reform standards (ANA) affect numeracy teaching practice as well as teacher professional identity.

In-service teacher professional development in South Africa.

In 1996 the Presidential Education Initiative (PEI) was set up, leading to the establishment of the Teacher Development Centre in the Department of Education with one of its prime intentions being the “upgrading and reskilling of serving teachers in science, mathematics and technology” (Taylor and Vinjevold, 1999, p. 3). During the same time a variety of NGOs delivered sporadic, haphazard and uncoordinated in-service teacher development programmes for science, language and maths, however these were criticised for not making direct impact on improving learner knowledge and skills and were of poor quality (OECD, 2008, Reddy, 2006b, Jansen, 1996). In South Africa the need for professional training in maths and science was felt especially given the fact that there was a high shortage of qualified maths and science teacher and one third of teachers who taught those subjects were either underqualified or unqualified (Reddy, 2006b, OECD, 2008).

Given the poor quality of prior in-service training, experts and researchers have given various suggestions to improve on the-job teacher training. Any suggestions made should note that teacher development initiatives’ ultimate goal is to impact significantly and improve on the quality of teaching and learning and improve learner performance (Reddy, 2006b, Taylor and Vinjevold, 1999). Reddy (2006b) argues that mathematics educators have to continually update their knowledge in addition to the formal training acquired at colleges or universities. Effective and future professional development initiatives must be of high quality, over a period of time, subject specific, more intensive, school-based and must be offered in flexible ways (Reddy, 2006b, Taylor, 2008, Jansen, 1996, Graven, 2005b, Adler and Reed, 2003). The success of teacher professional development courses heavily depends on the extent of teacher professional agency (Taylor, 2008). Another important question posed on teacher development concern the contents, activities, tasks, skills and knowledge that should be

translated in the professional development initiatives. Many teacher educator researchers agree that INSET programmes must have both subject knowledge and pedagogy-focused components as this results in confidence in teachers' knowledge of the subject they are teaching (Adler and Reed, 2003, Taylor, 2008, Jansen, 1996). Jansen (1996) concurs with Reddy (2006b) that prior professional development courses in maths and science in South Africa tended to focus on content and less on teaching strategies. Other components essential for teacher development include the need for teachers to know how learners come to acquire their subject knowledge, reflection on actual classroom practice, utilisation of resources in the classroom including textbooks and addressing the issue of the languages of instruction especially in primary level (Adler and Reed, 2003, Taylor and Vinjevold, 1999, Kuhne, van den Heuvel-Panhuizen & Ensor, 2005). The teacher development suggestions discussed herein are important to numeracy and maths teacher education.

However teacher development initiatives are faced with many challenges. Whilst longer intensive, school-based and subject-focused professional development initiatives are effective, there are resource and cost implications and time-tensions (Graven, 2005b, Alder and Reed, 2003). Reflecting on the aspect of cost, Reddy (2006b) argues for acceptable returns on teacher development investment, simply put, the cost of teacher development can only be justified in the light of high-student performance. However dependency on learner performance tests only as an indicator of teacher knowledge gains in any INSET programme is problematic (Adler and Reed, 2003). The effectiveness of professional teacher development must therefore be understood more broadly rather than simply linking it to learners' performance. Given such challenges Jansen (1996, p. 15) called for the "reconceptualization of teacher development". In the light of such comments this study entails to investigate the effect of such reconceptualised teacher development models (such as NICLE) to teacher learning and practice.

South African policies related to teacher professional development.

This part of the research proposal will discuss policies formulated in South Africa that have impact and effect on continuous professional teacher development. These policies also articulate the teacher professional identity envisaged by the government. Generally the RNCS (2002) outlines the importances of teachers in education and envisions teachers who are qualified, competent, dedicated and caring (DOE, 2002b). The national visions and guidelines for initial teacher education training programmes, for practising professionals and those engaged in continuous professional development are clearly outlined in the Norms and Standards for Educators (NSE) (DOE, 2000a). The NSE provides the different teacher competences and roles expected of the educators and these are: learning mediator; interpreter and designer of learning programmes and materials; leaders, administrator and manager; scholar, researchers and lifelong learner; community, citizenship and pastoral role; assessor and learning area/phase specialists (DOE, 2000a, p. 7-8). The teacher competences and responsibilities outlined in the NSE circumscribe teaching practices and professional teacher identity attributes expected of South African classroom practitioners. The NSE allow for teacher autonomy and professionalism which regards educators as highly skilled and

accountable, (thus capturing a particular notion of teacher identity), however some experts regard this policy as over-ambitious and suited for contexts with independent highly qualified and professionalised teachers (EPU, 2005).

The Development Appraisal System (DAS) which is one of the three components of the Integrated Quality Management Systems (IQMS) policy introduced in 2003 aims to support and develop teachers (OECD, 2008, EPU, 2005). SACE has been mandated to spearhead and coordinate teacher support and development. Under the envisaged and the soon to be implemented Continuous Professional Teacher Development (CPTD) policy teachers will engage in approved and endorsed professional development activities (totalling 80 hours per annum) for which they will earn professional development points over a stipulated period (SACE, 2010, OECD, 2008). Amongst the key purposes of the CPTD system is to improve schooling and the quality of learner achievement and to facilitate and support the effective participation of teachers in professional development activities in areas of great need (SACE, 2010). There is no doubt that on improving maths and numeracy teaching practices the CPTD idea is a step in the right direction, however how it should best be put into practice is unclear and requires widespread research into a range of innovative models of maths teacher education.

The Numeracy Inquiry Community of Leader Educators

One of the positive outcomes of the Foundation for Learning strategy is its call for teacher development initiatives that improve and enhance teaching strategies and the quality of primary mathematics education (OECD, 2008). Such envisaged teacher development initiatives are supplemented have been mooted by the South African Numeracy Chair national initiative aimed at improving both the quality of maths in-service teachers and maths learner performance at primary level. The South African Numeracy Chair, Rhodes has developed a numeracy teachers' professional development programme, called the Numeracy Inquiry Community of Leader Educators (NICLE) which is articulated and conceptualised as a long term partnership between in-service teachers and the Chair and partners of the Chair. The NICLE initiative will focus on numeracy teacher development within the foundation and intermediate phases in 15 primary schools in the Grahamstown greater area. It currently has close to 50 Foundation and Intermediate phase teachers who attend NICLE fortnightly sessions. The numeracy teacher development programme is framed by Wenger's Communities of Practice perspective (Wenger, 1998, Lave and Wenger, 1991, 1999) and supplemented by Jaworski's (2005, 2006) concept of mathematics communities of inquiry which brings more of a critical perspective. As a working guideline and informed by Askew, Rhodes, Brown, William and Johnson (1997a) and Kilpatrick, Swafford and Findell (2001), the Chair has defined numeracy as the ability to process, communicate and interpret numerical information in a variety of contexts. This definition extends to the interwoven strands of numeracy important for the effective teaching and learning of numeracy which include an understanding, fluent computation, logical reasoning, and applying numeracy concepts to solve problems and having a productive disposition and passion for maths (Graven & Schafer, 2011).

The NICLE teacher development initiative is seeking, through this partnership with teachers, possible way forwards to the South Africa maths crisis. The Numeracy Inquiry Community of Leaders Educators will form the empirical field of this study with the unit of research analysis being “the numeracy teacher” in NICLE. This study will be carried over a period of 2 years which is the initial intended duration of NICLE and will focus on how teachers learn within the context of community of numeracy inquiry and how their identity and practices evolves within such a setting.

SECTION 2: THEORETICAL FRAMEWORK

Learning as participation (Sfard, 1999) will be the driving learning theory metaphor for this research. Within this broad frame two closely related theoretical perspectives on the nature of learning will inform the conceptual framework to this study.

Firstly, learning as participation within a community of practice with four learning components namely: identity, practice, meaning and community (Wenger's, 1998). This work draws primarily from Wenger's (1998) seminal study following on from his earlier influential work with Lave (1993; 1996) and Lave and Wenger (1991).

Secondly learning as critically reflective participation within a community of inquiry. This work coheres closely with the community of practice perspective but places inquiry at the centre of the practice and raises the need for 'critical alignment' (Jaworski, 2003a, 2003b, 2004, 2006). While some might interpret communities of inquiry as an extension of Communities of Practice theory others have argued that it provides a theoretical framework in its own right (Jaworski, 2003a). For this I will primarily draw on Jaworski (2003a, 2003b, 2004, 2006) and Wells (1999) work on Dialogic Inquiry.

The research will place identity as the central component of Wenger's four component theory of learning. Indeed Wenger (1998) notes that any one component can be placed as the central focus and then one can view learning through participation in the components of practice, meaning and community through their interrelationship with identity (learning as becoming). However literature on learning as changing identity is becoming increasingly popular in the field of both mathematics education and for teacher development and to draw only on Wenger, Lave and Wenger's and Jaworski's work on identity in Communities of Practice and Communities of Inquiry would miss out on some key theoretical extensions of this work. Sfard and Prusak (2005), Sfard (2006) and Gee (1985, 1989, 2001) have theorised learning in relation to identity and have provided useful theoretical opportunities not provided in Lave and Wenger's or Jaworski's work. I will thus draw on these as well and elaborate on them later. At the end of this section I will present my own understanding and conception of teacher identity captured under the rubric Professional Numeracy Teacher identity.

The Social Turn

Traditionally educational research and learning has realised "the acquisition metaphor", however the "social turn" experienced towards the late 1980s influenced research and learning and saw the emergence of the "participationist metaphor" under which "meaning, thinking and reasoning" were regarded "as products of the social activity" (Lerman, 2000, p. 23, Sfard, 1998). This paradigm shift towards participationists' perspectives has been acknowledged in maths circles and has

influenced both maths classroom practices and maths professional development approaches. The participationist metaphor and the social turn which occurred during the same period saw Lave and Wenger's social learning theory influencing education research, teaching and learning and mathematics education. The orientation towards Lave and Wenger's learning theory has been invoked by the criticisms levelled against traditional learning theories. The conventional theories which explain learning as transmission, acquisition and assimilation (internalisation) of knowledge have been seen as problematic, concerned with individual differences and comparisons, privileging decontextualized abstract knowledge and the transmitter's point of view and ignoring the process of active participation in sociocultural communities (Brown, Collins & Duguid, 1989, Lave 1993a, Ernest, 1998, Wenger, 1998, Lave and Wenger, 1991, Sfard, 1998, Lave 1996). When compared to the traditional learning approaches, situated learning theory offered a "fresh look at learning" which proposes a frame that lends itself to more participation approaches that focuses on learner participation in authentic (practice) activities (Lave, 1993a, p. 7, Lave and Wenger, 1991, p. 39, Sfard, 1998, Brown, Collins & Duguid, 1989, Matos, 2009). From a curriculum perspective another major difference between situated learning and conventional teaching approach is that the former theory is driven by a learning curriculum which foregrounds learners' perspectives and consists of situated opportunities that enhance engagement in practice whilst traditional approaches and schools use the teaching curriculum in which knowledge is mediated through an instructor (Lave and Wenger, 1991). The limitations in conventional methods consequently implied an increase of education research and maths education informed by the social learning theory.

Wenger's Communities of Practice

Lave and Wenger's social learning theory and the concept of Communities of Practice focuses on learning as "participation in socially situated practices/activity" (Lave, 1996, p. 150, Lave, 1993a, p. 4). Underpinning this approach according to Lave and Wenger (1991, p. 33) is "the view that agent, activity and the world mutually constitute each other" and through this integrative enterprise "co-produce knowledge" (Brown, Collins and Duguid, 1989, p. 32). Rogoff (1994a) agrees with such a reconceptualization of learning. Under this perspective learning implies socially negotiated meaning, active participation in the practices of social communities and constructing identities in relation to these communities (Wenger, 1998, Lave and Wenger, 1991). This synthesised definition of social learning captures the four key components of Wenger's Communities of Practice theory, that is, community, meaning, practice and identity, the last aspect of identity will be central to this study as indicated by its focus in the first and third research questions. Situated learning has therefore been captured as legitimate peripheral participation in communities of practice and this notion entails how learners (new comers) participate in and become (full participants) part of a community of practice. Both Lave and Wenger (Lave & Wenger, 1991, Lave 1993b) highlight the importance of legitimate peripheral

participation which results in the development of knowledgeable skills, the construction of identities which leads to the promotion of persons and the production, reproduction and transformation of communities of practice. In this research therefore I will employ the aspects of identity with the intention of observing and noting how numeracy teachers participate in NICLE and develop and construct their numeracy professional identities and how their participation in NICLE influence their practices (knowledgeable skills) and experiences of numeracy teaching.

The emergence of the Communities of Practice Theory

The situated learning theory or the concept of legitimate peripheral participation in Communities of Practice arose from Lave and Wenger earlier anthropological research on Vai and Gola tailors' apprenticeship in Liberia (Lave and Wenger, 1991, Lave, 1996, Wenger, 1998). Other ethnographic studies of Yucatec Mayan midwifery, butchers apprentices, nondrinking alcoholics, navy quartermasters, Egyptian Muslim law practitioners and Insurance claim processors have provided Lave and Wenger with insightful perspectives of how learning is situated in social practices (Lave, 1993b, Wenger, 1998, Lave, 1996). Since the emergence of Communities of Practices as "sites of learning" (Lave, 1993, p. 72) the concept has been used to illuminate, amongst others, studies and practices in physical therapy programmes (Rose, 1999), literacy elementary classrooms (Brown and Campione, 1990), girl scout sales (Rogoff, 1994b), Guatemalan Mayan toddlers and caregivers and in a United States public elementary school (Rogoff, 1994a). However of relevance to this study is how the theory of situated learning and in particular Wenger's Communities of Practice has been connected to maths classrooms and most importantly to maths teacher development.

Application of the Communities of Practice theory in Maths education

The concept of community of practices has been used to study and illuminate mathematics classroom experiences. Such situated learning mirrored primary and secondary maths classrooms have been reported in the United States (Boaler, 1998, McClain and Cobb, 2001), in Britain (Winbourne and Watson, 1998, Hughes & Greenhough, 1998) and in Portugal (dos Santos & Matos, 1998). An influential study in primary mathematics in Britain undertaken by Askew, Denvir, Rhodes and Brown (2000), also argue for participation of learners in numeracy communities of practice classes as they claim this leads to the effective learning of maths. It is important to note that in all maths classes that were seen as replicating communities of practices, writers noticed improved learner understanding and successful learning of maths. There has been a surge in mathematics professional development models employing the situated learning theory to create maths communities of practice from which teacher participate in and learn through active participation (Bohl and Van Zoest, 2003, Little, Gerhat, Curry and Kafka, 2003, Graven, 2004, Huillet, 2007). Besides the maths field there have been teacher communities of practice professional development models in other school taught subjects (Grossman, Wineburg &

Woolworth, 2001, Little, 2002). Lesson studies, video case studies, narrative classroom records, examining student's work, use of textbooks, virtual interaction, conceptual knowledge, packaged programme toolkits and open-ended problem solving maths situations have been enlisted as tasks, artefacts, tools, resources and activities structuring and fostering most maths communities of practice professional development initiatives (Matos, 2009, Fernandez, 2005, Brown, Collins & Duguid, 1989, Kuhne, van den Heuvel-Panhuizen, & Ensor, 2005, Ponte, 2009, Silver, 2009, Balls & Evens, 2009, Adler, 1989). On content, most practice-based professional development approaches treat "maths content, maths pedagogy and student thinking in an integrated nature" (Silver, 2009, p. 246). The emergence of maths practice-based models of professional development approaches, their nature and structures and how educators learn in and from practice is central to this study.

Limitations of Wenger's Communities of Practice theory's application in education

However the use of Communities of Practice theories for explaining learning in teacher professional development has challenges. One disadvantage emanates from the informing theory of Communities of Practices which regard teaching as not necessary to produce learning (Lave and Wenger, 1991, Lave, 1996, Wenger, 1998). Such a position undermines explicit teaching in communities of practice, this is practically difficult and problematic both for the Communities of Practice informed maths classes and professional education development. Lerman and Graven (2003) indeed take issue with the undermining of the role of teaching, even while arguing its potential for analysing teacher learning, similarly Adler (1998) argues that the social practice theory is inapplicable to maths classrooms yet powerfully illuminates mathematics teacher development. Another weakness raised at the theoretical level is the fact that the situated learning approach does not offer a learning mechanism or an explanation of how knowledge transfers within communities (Lerman, 2000) and attempts to do so have not been convincing (see for example Rogoff, 1994b). The study will therefore try to address such a theoretical challenge and offer a possible illumination as to the learning mechanisms for teacher knowledge growth within Communities of practice, as has been outlined on the Rationale's point number 3.

Jaworski's Mathematics Communities of Inquiry

Another theory that has influenced maths teacher development is Jaworski's notion of critical inquiry communities (Jaworski 2006, 2005, 2004, 2003a, 2003b). This approach which is proving to be internationally popular and influential in maths professional development will theoretically inform this study and will be part of the conceptual framework to this research. This new emerging theory has been motivated by UK inquiry and action research movements, the Cockcroft Report and the USA researchers' call for investigative/inquiry maths classrooms (Jaworski 2003a, 2003b, 2006). At a theoretical level the maths education community of inquiry development

model has drawn from Wells' (1999) notion of "Dialogic Inquiry" and Lave and Wenger's Communities of Practice theory (Jaworski, 2006, 2003a, 2003b). Just as Lave and Wenger's (1991) Communities of Practice has illuminated maths classroom and maths professional development practices the Community of Inquiry has also influenced research of classroom and teacher education experiences. An outstanding vivid description of a "community of inquiry" is found in Schoenfeld's (1996) maths education research students' problem solving approaches at a university. Other notable examples of Communities of Inquiry in maths education are reported in a pre-service elementary maths teachers' statistical investigations (Heaton & Mickelson, 2002), in the grandstanding Norwegian's Learning Communities in Mathematics research project (Jaworski, 2004, 2006) and in one South African university's post-graduate maths education research courses (Breen, 2004). Goos (2009) also allude to the growing number of studies in mathematics teacher educator development using the notion of reflective inquiry. The Numeracy Chair in its articulated intentions aims to create a Numeracy teachers Community of Inquiry and it is from and within such a community that this study's research will be grounded.

Communities of Inquiry are distinct from Communities of practice because of the element of "inquiry" which is regarded as the linchpin and the vital driving cog of this theoretical perspective. The Communities of Inquiry aims to collaboratively promote inquiry amongst maths teachers, didacticians (teacher educators) and learners so as to critically engage with key questions and issues in maths practice (Jaworski 2006, 2005). Under these special forms of communities of practice, existing maths teaching and learning practices are questioned and alternative practices explored-thus inquiry becomes "a tool for developing practice" and is "a way of being in practice" (Jaworski, 2006, p. 103, 2005). Under maths professional development Communities of Inquiry, teachers and teacher educators question, explore and critically engage with key issues concerning maths teaching and learning. Borrowing from Wenger's (1998) three modes of belonging (alignment, engagement and imagination), Jaworski (2003a, 2006, 2005) argues that Communities of inquiry require "critical alignment" under which participants in the process of aligning with aspects of practice critically question the status quo, existing social norms and classroom practice. "Critical alignment" results in "critical reflection" a process which ultimately leads to "meta-knowing" – a form of critical awareness engendered in inquiry (Jaworski, 2006, 2003a, 2003b, 2004). It would be important in this study therefore to employ Jaworski's theory to identify and discuss instances of maths inquiry within NICLE and how such activities provoke or lead to critical alignment and critical reflective practices both in NICLE and in participating teachers' numeracy classes (if at all). To foster inquiry practices, teachers and teacher educators are regarded as co-learners who create partnerships which collaboratively design tasks and approaches for workshops and classrooms (Jaworski, 2003a, 2003b, 2004, 2006). According to Jaworski (2003a, 2003b, 2006) investigative methods in mathematics teaching stimulate mathematical thinking and create opportunities for critical reflection on mathematical understanding and also leads to knowledge growth in teaching - thus

empowering teachers to develop conceptual, relational and principled understanding of teaching mathematics. The elements of inquiry, critical alignment and critical reflection are fundamental tenets of Jaworski's theory and I will use these aspects as lens for research in NICLE to investigate numeracy teacher identities and the educators' inquiry practices within NICLE and in foundation phase classrooms. Documents stating design intentions of NICLE clearly locate NICLE within a Community of Practice and Community of Inquiry frame. The extent to which these intentions are realised and the evolution of the inquiry practice within NICLE will be investigated.

Lave & Wenger's notion of Identity and Wenger's Modes of Belonging

Identity is central to this study. Identity according to Lave and Wenger is formed through participation (as well as reification) in communities of practice; simply put, identity is a "process of becoming . . . a certain person" (Wenger, 1998, p. 215) or "becoming knowledgeably skilful" (Lave, 1993b, p. 65) thus "learning involves the construction of identities" (Lave and Wenger, 1991, p. 53). Participation in Communities of Practice is therefore a simultaneous and intertwined process of learning and identity formation. However important in understanding the processes of identity formation and learning within Communities of Practice are Wenger's (1998) three distinct modes of belonging namely, imagination, engagement and alignment. This research will use the modes as conceptual lens and analytical tools to explore the nature of teacher learning and how numeracy teachers identities and practices evolve in the numeracy communities of practice in-service programme and in other related and overlapping Communities of Practice. Whilst NICLE is my empirical field of research it also serves as a replica of a Community of Practice and from this community of numeracy teachers I want to gaze into the teachers' practices and identities and how educators through participation engage, imagine and align their activities in this primary mathematic professional teacher development enterprise.

Sfard & Prusak and Gee's conceptions of Identity

Lave and Wenger (1991) highlighted the importance of stories in fashioning identity, however their weakness according to Sfard & Prusak (2005, p. 14) is their failure "to operationalize the notion of identity". To operationalize identity and make it a tool for educational research Sfard and Prusak (2005, p. 14 & 16, Sfard, 2006) "equated identities with stories (narratives) about persons which are reifying, endorsable and significant". These stories they argued come from various sources and they distinguish between actual identity and designated identity (Sfard and Prusak, 2005). Cain (1991), Gee (1985, 1989) and Clandinin and Connelly (1996) have been influential in drawing links between stories and identity. Gee (2000) like Sfard and Prusak (2005) made the notion of identity to be useable as an analytic tool for studying important issues in education by distinguishing between Nature, Institution, Discourse and Affinity forms of identity. I intend therefore in this research to be

guided by Lave and Wenger's (1991) notion of identity, Wenger's (1998) extension of identity, supplemented by insights from Sfard and Prusak (2005) and Gee (2005), to study the professional numeracy teacher identities of educators in NICLE (captured in educator stories) and how these identities as well as practices evolve through participation in NICLE.

There have been numerous studies employing the concept of identity to explain learners mathematical identities (Watson and Winbourne, 1998, Anderson, 2007, Sfard and Prusak, 2005, Anderson, 2007, Walls, 2009), maths teacher identities within reform contexts (Morgan, 2005, Wood and Jeffrey, 2002, Lasky, 2005, Graven (in press), mathematics teacher identity formation during professional development (Jaworski, 2003, Graven, 2005a, Graven, 2003) or in pre-service training (Marsh, 2002a), practising teacher identities (Zemblays, 2005, Marsh, 2002b) and in higher education (Beck and Young, 2005). Following in this trend will be this study which is interested in researching evolving numeracy teacher identity within a teacher professional development context. This study intends also to investigate how numeracy teacher identity and practice is affected by reforms especially given the fact that South Africa is expecting a new curriculum (CAPS) this year which is likely to impact on the teaching and learning of numeracy.

Professional Numeracy Teacher Identity

My conception of teacher identity will be streamlined and will zoom in to what will be termed throughout this study as professional numeracy teacher identity. Such an identity perspective is different and diverges from the broader, common, laymen and personal use of the term. I intend therefore to specifically use the term to refer to primary numeracy professional teacher identities. Professional numeracy identity entails and involves being an effective teacher of numeracy who "aligns, imagines and engages" in professional activities relevant to numeracy teaching. My notion of numeracy professional teacher identity will be guided and illuminated by the South African curriculum policy, NSE roles and competences and key international and influential numeracy research initiatives which argue for the effective teaching and learning of numeracy (Askew et al, 1997a) that leads to learner mathematical proficiency (Kilpatrick, Swafford & Findell, 2001). Furthermore my understanding of Identity is that it is dynamic and constantly evolving (whether positively or negatively). Thus through participation in NICLE the teachers' numeracy professional identities and practices will be evolving. Though they might be instances of negatively evolving teacher identity, NICLE intends to foster a positive Numeracy teacher identity of effective teachers of numeracy whose practices ensures learner mathematical proficiency. Whilst the study primarily focuses on teachers' evolving identities within NICLE I will not neglect the broader contextual forces that shape the numeracy teacher's professional identity. Such factors like the broader school context, the school maths department, classroom practice, overlapping communities of

practice (such as the District Office, AMESA conferences) and curriculum change influence and sculpture the primary maths teacher's identity.

Having formulated the parameters of what Professional Numeracy Teacher Identity entails I must be cautious of the fact that this study will involve foundation phase teachers. Foundation phase numeracy educators unlike Intermediate, Senior or FET phase teachers do not have subject specialisation which is an influential indicator of one's professional teacher identity. Foundation phase teachers in addition to numeracy also teach Literacy and Life skills thus from a subject specialisation perspective their professional teacher identity is fragmented. In other words Foundation phase teachers have multiple identities when we factor in their teaching subject or Learning area specialisation.

In summary this study is therefore guided and driven by Wenger's (1998) four component social learning theory, with a particular focus on identity; Wenger's (1998) three modes of belonging namely imagination, engagement and alignment; Jaworski's (2006) theory of Critical inquiry communities (and critical engagement and alignment). In addition Wenger's notion of identity is complimented by Sfard and Prusak (2005) and Gee's (1985, 1989, 2001) operationalized identity conceptions. These sociocultural-participationist theoretical approaches will formulate my conceptual framework and will illuminate this study and provide lens to gaze into how teachers participate in NICLE and how their participation in this inquiry and practice informed teacher development initiative transforms their identities and practices. The theoretical orientations will also assists this study to analyse data as some of the theoretical elements will formulate templates upon which to present data.

SECTION 3: LITERATURE REVIEW

Having reviewed a wide range of literature in relation to my choice of the theoretical framework and my contextual background in this part of the research proposal I will initially discuss how literature on teacher education has called for a shift from the “fatally flawed” (Grossman & Wineburg, 1998, p. 353) traditional in-service teacher training models to more effective teacher professional development approaches. In the purview of literature on in-service teacher education I will discuss the features, challenges, contents, promises and emerging trends in new envisaged staff development orientations and the implications of such innovations to maths teacher education and practice. A literature informed discussion on current forms of teacher training models will enlighten me on how teachers learn within such teacher development initiatives (some of which are similar to NICLE) as well as understand the factors, features and activities that might enable or constrain teacher learning. The proposal will explain Shulman’s (1986, 1987) concept of content and pedagogical content knowledge and how numeracy teachers draw from such domains of knowledge to effectively teach foundational mathematics and what this implies on the content and activities supposed to be conveyed and afforded in numeracy professional teacher development.

Forms of Professional Development

Conventional forms of teacher professional development have been under attack by teachers, educational researchers and teacher educators who regard them as irrelevant and ineffective and have instead argued for collaborative approaches of educators in-service training. Many studies have heavily criticised traditional formal mandatory one-shot “workshops” sponsored by the school districts as being unproductive, fragmented, unrelated to practice-too theoretical, the least effective source of teacher learning, lacking in intensity, content and follow up and having little effect on teacher practice (Wineburg and Grossman, 1998, Smylie, 1989, Wilson and Berne, 1999, Abdal-Haqq, 1999, Askew et al, 1997a, 1997b). Besides the criticisms levelled against traditional forms of professional teacher development these remain the most prevalent and widely used approach to staff development (Cochran-Smith & Lytle, 1999, Garet, Porter, Desimone, Birman & Yoon, 2001). Under the traditional “training-model” of professional development teachers are presumed to learn from training and coaching provided by officially certified trainers or outside experts (Matos, 2009, p. 167, Cochran-Smith and Lytle, 1999). This model fits within Sfard’s (1998) acquisition metaphor of learning and is similar to the “knowledge-for-practice” conception of teacher learning (Cochran-Smith and Lytle’s, 1999, p. 250) which conveys “propositional knowledge” (Shulman, 1986) or foundational and applied domains of knowledge needed by teachers for classroom instruction and organisation. Conventional professional development models’ shortcomings and limited impact on influencing teacher practices have resulted in the call for more effective in-service teacher training approaches.

There seems to be consensus in teacher education literature on the features and characteristics of successful teacher professional development approaches and what this entails. By discussing features that characterise effective approaches to staff development I will relate these factors to NICLE and how these may enable teacher learning within this empirical field of research. Effective professional development models are supposed to be on going/longer-term, (Abdal-Haqq, 1996, Graven, 2005b, Hill, Blunk, Charalambos, Lewis, Phelps, Sleep & Ball, 2008, Garet et al, 2001, Grossman and Wineburg, 1998), with volunteering participants (Borko, 2004, Hill, 2004, Kennedy, 1998, Graven 2005b), connect with classroom practices or student learning, (Smylie, 1998, Kennedy, 2008, Borko, 2004, Hill, 2004, Hill et al, 2008), emphasises teacher collaboration, (Abdal-Haqq, 1996, Garet et al, 2001, Hill, 2004, Hill et al, 2008, Adler, Ball, Krainer, Lin & Novotna, 2005, Ma, 2010, Brodie & Long, 2004), regards teachers as professionals active life-long learners, (Garet et al, 2001, Hill, 2004, Abdal-Haqq, 1996, Graven, 2005b), are school-based and support teacher initiatives, needs and goals, (Abdal-Haqq, 1996, Kennedy, 1998, Askew, Rhodes, Brown, William & Johnson, 1997a, 1997b), provide adequate time and follow-up support (Abdal-Haqq, 1996) and offer opportunities for individual reflection and inquiry into practice (Farmer, Garretson & Lassak, 2003, Abdal-Haqq, 1996, Jaworski, 2006). Key distinguished numeracy teacher educators and researchers agree that such features afford teachers opportunities for mathematical learning and understanding and have powerful effect on raising standards and are highly influential in developing teaching practices (Hill et al, 2008, Ma, 2010, Askew et al, 2007a, 2007b).

Most successful professional development approaches privileges strategic knowledge which naturally tends to be embedded in teacher practice and reflection on practice mostly within inquiry communities (Cochran-Smith & Lytle, 1999, Smylie, 1998). Such emerging epistemological perspectives in current professional development approaches are captured under the rubric of ‘teacher learning communities’ which regard teacher learning as “knowledge-in practice” and “knowledge-of practice” (Cochran-Smith & Lytle, 1999, p. 250). This notion of teacher learning communities is illuminating many mathematics professional development initiatives. Such waves of change have been influenced by the “social turn” experienced in the field of mathematics education under which mathematics education researchers and teacher educators have been drawing on sociocultural conceptual frameworks especially situative and subjectivity perspectives (Lerman, 2000, Borko, 2004). These new forms of professional development aim at creating a supportive teacher learning community, which socially constructs knowledge and meaning through inquiry processes and metacognitive reflective critical practices on their teaching, resulting in improved instructional practices (Farmer, Gerretson & Lassak, 2003, Wilson and Berne, 1999, Grossman, Shulman and Shulman, 2004). Such forms of teacher community professional development approaches have been reported in maths staff development initiatives (Jaworski, 2004, 2006, Graven, 2004, Shulman and Shulman, 2004,) in numeracy professional development projects (Farmer, Gerretson and Lassak, 2003,

Fennema, Carpenter, Franke, Levi, Jacobs & Empson, 1996, Heaton & Mickelson, 2002) and in other school taught subjects staff development programmes (Rosebery & Warren, 1998, Wineburg & Grossman, 1995, Grossman Wineburg & Woolworth, 2001). Teacher communities of learning professional developments have great potential and many benefits. They are democratic sites that create opportunities for teacher learning, teacher growth and allow teachers to mutually support each other whilst giving attention to issues of subject matter, teaching practice and student learning which ultimately enables educators to improve the quality of learning experiences for pupils (Grossman Wineburg & Woolworth, 2001, Little, et al, 2003, Matos et al, 2009, Adler, 1997).

Challenges facing teacher professional development

Both traditional and current forms of teacher professional development are susceptible to an array of challenges which are discussed in teacher education literature. A literature discussion on problems in in-service teacher education will assist me in linking and comparing constrains facing other international teacher professional developments and that of the empirical field of research, NICLE. The greatest challenge to successful staff development programmes is the unavailability of time to engage in professional work (Farmer et al, 2003, Abdal-Haqq, 1996, Graven, 2005b, Adler and Reed, 2003). The most affected are USA teachers who have limited time for collegial interaction when compared to Chinese, Japanese and Germany teachers (Abdal-Haqq, 1996, Ma, 2010). Abdal-Haqq (1996) provides practical feasible solutions to this challenge. Another dilemma pertains to the site from which staff development can take place- whether it can be district, university or school-based (Garet et al, 2002, Graven, 2005b, Adler and Reed, 2005), with school-based programmes being convenient and most preferable for numeracy professional development initiatives (Askew et al, 2007a, 2007b, Ma, 2010). Garet et al (2001) concurs with Graven (2005b) that another impediment to providing high quality professional development experiences is financial cost and the related issue of resources. However Kennedy (1998, p. 25) is of the opinion that the above enlisted challenges have little effect on in-service teacher education and on student learning than the dimension of the “content of the program”.

I will therefore now turn to the challenges in professional staff development that concern the content supposed to be relayed to teachers in in-service programmes. A discussion on content will inform me on the knowledge dimensions and activities cited in literature that promote teacher knowledge growth and how these are evident in the activities which teachers partake in NICLE. The tension has been should maths professional development experiences appropriate content or specific pedagogical techniques (Farmer et al, 2003, Borko, 2004, Graven, 2005b, Garet, 2001, Grossman et al, 2001, Adler & Reed, 2003, Brodie & Long, 2004). A third knowledge dimension that has become the focus of high-quality professional developments has been the need to afford teachers opportunities to focus on student learning and

thinking (Wilson & Berne, 1999). One exceptional study that has had higher effect on students outcomes undertaken by the Cognitively Guided Instruction researchers, (Fennema, Carpenter, Franke, Levi, Jacobs & Empson, 1996), found that offering teacher opportunities to explore student's thinking and knowledge enable teachers to develop more advanced mathematical ideas, improves teachers' mathematical practices and is helpful for instruction designed to improve student conceptual understanding (Garet et al, 2010, Kennedy, 1999, Fennema et al, 1996). Deducing from the literature there have been those writers who prefer that professional development programmes focus mainly on subject matter which they argue is more likely to produce understanding, enhanced knowledge and skills (Garet et al, 2001, Borko, 2004, Kennedy, 1998, Grossman et al, 2001); others prefer a focus on both content and subject matter knowledge (Wood, 2009, Brodie & Long, 2004, Graven, 2005b) and those who prefer professional development programmes with a combination of the three knowledge dimensions (Wilson & Berne, 1999, Hill, 2004, Hill and Ball, 2004, Hill, Ball & Base, 2008, Askew et al, 2007b). The district-based in-service training on the other hand focuses exclusively on pedagogical techniques (Grossman et al, 2001). However at primary level and in many countries it has been found that elementary teachers have learned limited mathematics in school when compared to secondary maths teachers or have limited content relevant to elementary instruction (Adler et al, 2005, Ma, 2010). It is also important to take heed of the fact that many practising teachers have not learned the content they are now required to teach (Adler et al, 2005). Given such a scenario this must justify the need for primary professional development programmes to focus mainly on content aspects but without disregarding other equally essential teacher knowledge dimensions. It is of importance for this research therefore to identify the knowledge privileged in NICLE and how this affects participating teachers' numeracy teaching practices.

Another contentious issue in teacher learning concern the lack of valid and reliable approximations to measure teachers' learning, knowledge growth or teachers' acquired knowledge after attending staff professional development (Ball & Even, 2004, Hill and Ball, 2004, Wilson and Berne, 1999, Rowan, Correnti & Miller, 2002, Kennedy, 1999). Whilst other researchers focus their attention on the teachers and assess teachers' knowledge with tests (Hill and Ball, 2004, Askew et al, 1997a, Ma, 2010), through classroom observations (Adler and Reed, 2003, Ma, 2010), teacher reflections (Ball and Even, 2009) or teacher testimonials about the influence of particular programmes on their practice (Kennedy, 1999), other education researches link measures of teacher learning to student learning gains or value added by employing learner tests (Askew et al, 1997a, Hill & Ball, 2001, Fennema et al, 1996, Rowan et al, 2002, Kennedy, 1999), analysing learners exercise and test books (Adler & Reed, 2003) and through learners reflections (Ball & Even, 2009). The use of teacher knowledge tests, learners' tests and classroom observations to measure professional development outcomes is getting prominence in numeracy education (Hill and Ball, 2004, Ma, 2010, Askew et al, 1997a). The NICLE staff development initiative will utilise learner tests, analyse learners' exercise books and classroom

observations as approximations to measure participating teachers' numeracy knowledge growth.

Shulman's concept of content and pedagogical content knowledge

I will explore Shulman's (1986, 1987) concept of content and pedagogical content knowledge and how numeracy teacher education literature interpret the importance of such "knowledge base for teaching". Such knowledge base for teaching enables teachers to be competent and to skilfully perform powerful pedagogical acts which enable learners to understand subject matter concepts (Shulman, 1987). Many writers have argued on the importance of maths teachers' content and pedagogical content knowledge as being influential to providing quality instruction and learning and affording learners opportunities to engage in high-level conceptual thinking (Adler et al, 2005, Hill and Ball, 2004, Adler & Reed, 2003, Wood et al, 2009, Berliner, 1986, Ball and Bass, 2005). Numeracy teacher educators and researchers also regard mathematical subject knowledge as important (Rowan, Correnti & Miller, 2002, Hill & Ball, 2004, Ball, 1993, Ball, Hill & Bass, 2005). However research in primary education has shown that higher qualifications in mathematics do not imply teachers competence in teaching numeracy as higher levels of mathematics are unconnected or unrelated to primary maths content (Rowland, Martyn, Barber & Head, 1999, Askew et al, 1997a, 1997b, Rowan, Correnti & Miller, 2002, Hill & Bass, 2002, Ball, 1993, Hill et al 2008). Secondly highly qualified teacher need to simplify and clarify (compress) their understanding of mathematics for elementary school students (Rowan et al, 2002, Ball and Bass, 2002).

In refining the "numeracy knowledge base for teaching" distinguished primary mathematics researchers have differently labelled this unique kind of teaching ability that leads to a holistic understanding of foundational mathematics as "mathematical knowledge for teaching" (Hill & Ball, 2004, p. 335, Ball, Hill and Bass, 2005, p. 17, Hill et al, 2008, p.431), "profound understanding of fundamental mathematics" (Ma, 2010, p. 120), or numeracy "teachers' pedagogic content knowledge" (Askew et al, 1997a, p. 24). The concept of "mathematical knowledge for teaching" or "profound understanding of fundamental maths" primarily consists of content knowledge and the specialised knowledge for teaching mathematics. Askew et al's (1997a & 1997b) notion of numeracy "teachers' pedagogic content knowledge" adds a third dimension of knowledge of how pupils learn numeracy. Such primary teaching skills and knowledge results in quality effective teaching of numeracy which makes learners to be mathematically proficient is turning out to be the concern of both preparation and continuing teacher professional development (Adler et al, 2005, Wood, 2009). It logically follows that in instances where such knowledge was not conveyed during initial teacher training, numeracy professional development programmes are being called upon to impart such important numeracy teaching skills. Askew et al (1997a, p. 69) clearly argues that primary school teachers need to "develop a fuller deeper understanding of the number system in order to effectively teach numeracy" and this

is likely to be afforded in professional development programmes (Hill & Ball, 2004, Ball, Hill & Bass, 2005, Askew et al 1997a, 1997b) rather than during initial training.

In this part of the research proposal I have surveyed relevant key literature on maths teacher education and explained on how I intend to use this literature in this study. In the light of literature on in-service teacher education I have enlisted the shortcomings of traditional professional development models and explained the promises, features as well as the challenges and tensions in current staff development programmes. I have discussed Shulman's (1986, 1987) concept of content and pedagogical content knowledge and the implication of such knowledge dimensions to numeracy educators, primary maths classroom practices and professional development initiatives.

SECTION 4: RESEARCH METHODOLOGY AND METHODS

The Empirical field of Study-NICLE

The Numeracy Inquiry Community of Leader Educators (NICLE) professional development programme forms the empirical field of research to this study. The NICLE initiative will focus on numeracy teacher development within the foundation and intermediate phases in 15 primary schools in the Grahamstown greater area. This numeracy teachers' professional development programme was developed by the South African Numeracy Chair, Rhodes and is articulated and conceptualised as a long term partnership between in-service teachers and the Chair and partners of the Chair. It currently has 57 Foundation and Intermediate phase teachers who attend NICLE fortnightly seminars and inquiry sessions. The numeracy teacher development programme by its intentions is explicitly designed as both a Community of Practice and a Community of Inquiry teacher development approach and is framed by Wenger's Communities of Practice perspective (Wenger, 1998, Lave and Wenger, 1991, 1999) and by Jaworski's (2005, 2006) concept of mathematics Communities of Inquiry.

Research Study Sample

A combination of sampling strategies will be employed to select 8 Numeracy Educators who will be part of this study, these will be drawn from, targeted primary schools in the Grahamstown urban area and are in-service teachers participating in NICLE. The overall selection of the participating schools was done by the Chair who invited primary teachers from schools that were "functional" by which she loosely implied schools with a timetable that had a maths slot in which classes were held during school time. The choice of schools was further negotiated with Department of Education and key partners who worked in primary schools in the Grahamstown district. Following a meeting with Principals and visits to schools by the Chair, volunteering grade 3 and 4 (Foundation and Intermediate phase) teachers were invited to participate in NICLE's professional development exercise. Secondly the selected primary schools were feeders to High schools that had some FET Maths teachers' participating in the FRF Maths in-service professional development, an initiative similar to NICLE. The fact that the programme set specific criteria to identify 15 participating primary schools and teachers is characteristic of the purposive sampling strategy. Purposive sampling also studies a few cases in depth so as to yield many insights about the research problem (McMillian & Schumacher, 2001). I will select teachers who actively participate and frequently attend NICLE sessions. To enable easy access to teachers' classrooms I will sample 8 Foundation phase teachers who teach in six primary schools in the Grahamstown urban area, this is a convenience sample in the sense that I can easily contact and access these teachers. These teachers will be invited to participate in my research. The six primary schools from which the participants teachers will be drawn from are: Ntaba Maria, George Dickerson, St Marys, Oatlands Preparatory, Grahamstown and Good Shepherd. However the

numeracy, Foundation and Intermediate phase teachers had to volunteer for professional development, such a sampling strategy Cohen, Manion, and Morrison (2010, p. 116) call “volunteer sampling”. This research therefore will combine purposive, convenience and volunteering sampling strategies to identify the 8 participants to be involved in this study.

Ethnographic research methodology

In carrying out my research I will use a qualitative ethnographic approach. I have borrowed the ethnographic methodology from cultural anthropology and will apply it in this educational research study. As with other educational researchers who have borrowed from cultural anthropology my ethnographic interpretation does not involve living among the teachers or being fully integrated into their professional activities. A synthesised definition of ethnography is that it is an art, science or process of describing, understanding and interpreting in-depthly a group’s experiences from the subject’s point of view (Fetterman, 1997, Erickson, 1986, Bell, 1989, Cohen, Manion & Morrison, 2010). By employing the ethnographic methodology this study will aim to provide a rich thick description on the participation of numeracy teachers in NICLE. The ethnographic research methodology will therefore enable me to observe the patterns of action and interaction (verbal and non-verbal) (Best & Kahn, 1998), between members and key partners of the NICLE community. I intend therefore to understand and describe precisely and unbiased the NICLE group’s experiences and how this impacts and affects the numeracy teacher identity and teacher learning. In doing so I will address the overarching question and the three research questions thus investigate: the nature of numeracy teacher learning and how identities and practices evolve through participation in NICLE? In this study my unit of research analysis will be the “numeracy teacher” in NICLE.

In ethnography the subjects’ point of view is paramount (Fetterman, 1997). The teachers’ point of view and their voices will therefore be central in this research study. In carrying out this research and to enrichen my description of activities in NICLE and how teachers learn (both in NICLE and in the broader context) this research will foreground the experiences of the teachers, whose voices will be key to this inquiry.

This ethnographic approach, according to McMillan and Schumacher (2001), involves prolonged fieldwork and employs a variety of field methods with the primary strategies for gathering data being observation, interviewing and document collection in the context of a single study. To bring the voices of the teachers at the forefront of this study I intent to use “interactive interviews” and “reflective journals”. In addition to these I will use observations and document collections to gather data across the two year period of the programme, which is from July 2011 up to December 2012.

Data Collection Methods: Observation

One of my data collection methods will be observations. Observations, according to Best and Kahn (1998), consist of detailed notations of behaviour and events, and the

contexts surrounding the events and behaviour. Both McMillan and Schumacher (2001) and Bell (1987) agree that observations reveal characteristics and elicit data that is nearly impossible with other means or approaches.

As a full time doctoral fellow in the Chair I participate in the activities of the Chair including NICLE. In the NICLE in-service initiative I will be a participant observer, what Cohen, Manion & Morrison (2010, p. 404) call “complete participant” and I will be taking part and contributing in some of the activities to be observed. Firstly and most importantly my observations will focus primarily on how teachers are engaging in maths activities, maths inquiry practices and their use of maths language. Furthermore I will investigate communication patterns, that is how teachers interact and relate to each other and how they relate with the Chair/Co-ordinator or invited presenters of the programme, the nature of their listening, questioning, engagement, contributions and explanations. By investigating the interaction patterns and mathematical activities I will be in a position to understand the nature of numeracy teacher learning and how identity and practices evolve within NICLE thus gathering data to answer the question central to this study and all the three research questions. In the initial stages of the research I will observe and compile field notes and as time progresses on, teacher development activities will be audio-taped with the possibility of video-recording some of the sessions with the teachers’ permission. The observations will be throughout the 2 year intended life-span of NICLE and this according to Fetterman (1997, p. 480) helps the researcher “internalise the basic beliefs, fears, hopes and expectations of the people under study”. Participating in NICLE will also help me to establish relationships with teachers who will be in the NICLE Community of Practice.

Document collection

One of the four methods I will use in my fieldwork data gathering exercise will be document collection. Document collection is an extremely valuable alternative source of data used to supplement information obtained, in this particular research from observations, interviews and questionnaires (Bell, 1989). According to McMillan and Schumacher (2001) document collection provides an internal perspective as well as the values of the organisation (the NICLE community in this case). In my 24 months research within NICLE I intend to collect copies of minutes, attendance registers, hand-outs, notes, files, letters, teaching or curriculum guides, readings, articles or any pamphlets that will be given to the participating teachers. I will also collect Chair documents provided to funders, the advisory board, the NRF as well as all publications of members or the Chair. All these documents will be subjected to ‘internal criticisms’, general guidelines for such analysis are outlined by Bell (1989) and Cohen, Manion & Morrison (2010). Also to be collected are curriculum documents, such as the new CAPS guidelines, Department of Education policy and official documents and these will help me in compiling the background to the study. These documents also spell out the teacher professional identities and practices as perceived and intended by the government. Most of the documents that I will collect

and review fall under the category of primary sources of educational data and are official documents in Bell's (1989), McMillan and Schumacher's (2001) and Best and Kahn's (1998) categorisation of documents.

Interactive Interviewing

The third data collection technique that I will use are, interactive interviews and these are closely related to ethnographic studies. Generally interviews have been used as a research tool for obtaining/eliciting specific information from the respondent that allows the interviewer to access the perspective of the person being interviewed (Neuman, 2006, Best & Kahn, 1998). Such notions of interviews give prominence to the Interviewer who dominates the interview process and downplays the voice of the interviewee. Interactive interviews reverse such hierarchical interviewing relations with participants retaining considerable control over the course of the interview (Corbin & Morse, 2003). Interactive interviews are defined as "shared experiences in which researchers and interviewees come together to create a context of conversational intimacy in which participants feel comfortable telling their story" (Corbin & Morse, 2003, p. 338). I will use interactive interviews so as to afford the teachers' voice in the research and to reduce my influence over the interviewing process. I will ask the teachers to tell their story as they see it, feel it and experience it (Corbin & Morse, 2003). As the teachers tell their stories, I intend to glean from these narratives, information about the teachers' numeracy teaching identities and how they learn and what they enlist as enabling or hindering their learning in NICLE and in the broader educational context. I will therefore use interactive interviews for it privileges the teachers' voice in the research process.

I will use the semi-structured interviews with open-ended questions to enable interview conversations and in the process hear the stories of the 8 selected Foundation phase teachers participating in NICLE. Whilst topics and issues to be covered will be selected in advance through a semi-structured interview schedule, I will always give room to the participants to narrate what he/she might feel is important and relevant to the study. Questions will be worded in an open-ended format (Best & Kahn, 1998). Open-ended items suit interactive interviews as they encourage co-operation, help establish rapport and this gives opportunities for participants to construct their stories (Manion, Cohen & Morrison, 2010, Corbin & Morse, 2003). In instances where the interviewee is not clear I will probe and ask for clarification from the participant. All the interviews will be conducted at the respondents' schools outside teaching time and will be audio-recorded and transcribed for analysis. During the interactive interview sessions the interviewer will note any non-verbal actions or expressions. Each participating teacher will be interviewed four times during the quarterly phases of the NICLE programme. I intent also to make regular visits to the participating teachers' schools and hold informal discussions with teachers and in the process compile field notes.

Reflective Journals

I will use reflective journals as a way of accommodating the teachers' voices in the research. Reflective journals have been commonly used in psychotherapy and in the broader medical and health field and are gaining popularity in educational research. I will give the 8 participating Foundation phase teachers journals, which will be in the form of a special bound notebook, in which I would request them to write and clarify their experiences, opinions, thought and feelings and reflect upon these (Ortlipp, 2008, Janesick, 1999). Chirema (2006) and Cunliffe (2004) explain that journal writing is a useful tool for promoting critical reflection of experiences, is a means by which teachers engage in learning and allows teachers to discuss the link between theory and practice and through this explore new possibilities for being and acting. To differentiate educational research reflective journals from personal diaries (journals) I will explain and give specific guidelines to each and every participating teacher that their thought and feelings will be centred on topics related to key research questions posed by this study.

I would request teachers to write and reflect upon their experiences in NICLE, in their numeracy classrooms, in maths departments, in schools and in overlapping communities of practice that are related to how they learn as teachers and how their numeracy professional identity and practices evolves within such contexts. At the end of the professional development project I will photocopy the contents of the journals and return the original journals to the teachers. Whilst journal writing is a powerful research tool it has two main challenges, firstly some participants find writing difficult and is a time-consuming activity (Chirema, 2006). To overcome such challenges and encourage journal writing I will constantly remind the teachers to update their journals when paying visits to schools or when teachers attend NICLE sessions. I will also give teachers the option of "journaling" by voice recorder should they be opposed to writing.

Ethical Considerations

Ethical issues in research concern beliefs about what is wrong and what is right from a moral perspective in the conduct of research (McMillan & Schumacher, 2001). Research ethics therefore imply compliance with acceptable research norms, morals, standards and principles. To conform and comply with the University's research ethical codes, guidelines, protocols and practices, this research proposal will be forwarded for approval to the Ethics and the Higher Degrees Committees. I will also seek authorisation to conduct my research from the Grahamstown Education District Office. Before entry into the research sites (primary school classrooms) I will seek permission to carry out my research from the School Heads and teachers.

In line with the principle of "informed consent" I will explain honestly and openly to all participants about the nature, aims, purpose and educational benefits of my study and further elaborate to participants that participation in this research is voluntary and

that participants can withdraw from the study at any time. The teacher participants will sign the Participant Information and Informed Consent, the Interview Consent and the Recording Consent forms. All these forms will be translated into the appropriate languages of the participants. The forms will have my 24 hour contact telephone numbers as well as those of my Supervisor. I will secure prior voluntary consent before audio recording and interviewing the participants.

In this study I also need to comply with ethical issues of confidentiality, anonymity and privacy. To ensure confidentiality, names of the interviewees will not be disclosed, the name of the schools, teachers, learners, principals (heads) will remain anonymous and will not appear in the thesis. Instead, fictitious names will be used throughout the study. The data gathered in this exercise will be solely and strictly used for the purpose of this research project. During and after completion of the study the raw research data will be appropriately stored by the researcher under lock and key. Such confidentiality initiatives and data storage measures are all in the interest of ensuring and protecting the privacy and anonymity of participants. McMillan and Schumacher (2001) and Neuman (2006) agree that guaranteeing privacy, anonymity and confidentiality means that access to participants' responses, behaviour and information is restricted to the researcher and kept secret from the public. I will make all the necessary effort and commitments to ensure and uphold both the informants' privacy and research ethics principles during the fieldwork and in the compilation of my thesis.

Validity and Reliability of data

This research will employ multiple strategies to ensure and enhance validity and reliability of data. The fieldwork research will be over a period of 24 months. Prolonged engagement that also entails persistent observation in the field will support the validity of findings and participant reality (Cohen, Manion & Morrison, 2010; McMillan and Schumacher, 2001). A common method used to ensure "agreement" between different sources and methods of information is triangulation. To seek corroboration of the information gathered I will compare and cross-check data from observations, interactive interviews, documents and reflective journals. In NICLE my Supervisor and I will both be observing and independently collecting data within the Community of Practice-Inquiry setting, we will compare notes and check for agreement on the data that would have been gathered. This strategy of enhancing data validity and reliability has been called "Investigator triangulation" (Cohen, Manion & Morrison, 2010, p. 142), or "Multiple researchers" (McMillan and Schumacher, 2001, p. 408). Another way that will be used to ensure information dependability is through Participant reviews/Member checks or Respondent validation under which the participants (numeracy teachers in this case) will review and check my synthesised information that I would have collected during observations and from interactive interviews. So as to provide readers with possibility of assess validity of my interpretation of data, information collected from the research will be presented in direct quotes and also as vignettes.

All the above enlisted strategies outlined will be continuously used during the data gathering and data analysis exercises to ensure valid and reliable data. It is typical of ethnographic studies to employ a host of strategies to critically assess, verify, check, curtail bias and examine the reliability and validity of information gathered.

Data Analysis

I will use the deductive data analysis strategy to synthesise and make sense of massive raw data and information (Best & Kahn, 1998), to be obtained from NICLE observations, interactive interviews, reflective journals and documents. Basically this method involves coding, categorising (grouping) and interpreting of data through provisionally preconceived categories (Bell, 1989; McMillan and Schumacher, 2001). Under this approach the data codes and categories are to be decided in advance and these will aide me in analysing the data. Thus when I begin my analysis and exploration of data I will be guided and illuminated by the research questions, the research problem and the theoretical framework (Best and Kahn, 1998). The categories will result in patterns of meanings to emerge and these will be related to the conceptual framework selected for the inquiry, the research questions and the research problem (McMillan and Schumacher, 2001; Neuman, 2006; Best and Kahn, 1998).

The overarching research question, questions (1-3), the research problem outlined in the introduction and the theoretical framework will be key to structuring the analysis of data. In some instances both the theory and the research questions will assist in organising gathered data, for example Wenger's Communities of Practice theory which regards learning as (social participation) becoming, doing, belonging and experience relates to the main research question and the second research question-both of these can therefore collaboratively illuminate data analysis and presentation. Wenger's notion of identity and modes of Belonging (Imagination, Alignment and Engagement) in relation to identity, Sfard and Prusak's concept of identity as "stories" and Gee's categories of identity (Natural, Institutional, Discourse, Affinity) and his distinction of identity (Actual and Designated) will help to organise and structure the data. Such structuring of data places identity at the centre and assist in answering research questions 1 and 3. Jaworski's concept of Communities of Inquiry and related elements of reflective inquiry, critical alignment and critical engagement will also guide the organisation and presentation of data for this study. The above mentioned categories will form templates upon which the gathered data can be presented. However these categories and information patterns if need arises can be further revised, recycled, readjusted, rephrased and modified through repeated iterations so that they fit the gathered evidence better, become meaningful and also so as to achieve a higher level of accuracy (Neuman, 2006; Le Compte, 2000). This will consequently result in modified and revised categories from which can emerge new patterns of meaning that are aligned and informed but not restricted by research questions, the research problem as well as the theoretical framework.

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TIME FRAME.

Research Activities and Writing	Time Scale
Developing Research Proposal	February -12 June 2011
Proposal Presentation	13 June 2011
Revising Proposal for submission to EHDC	15 June – 27 June 2011
NICLE Observations Document Collection Audio/video-recording fortnight sessions Compiling field notes	15 May 2011- December 2012
1 st Teacher interactive interviews for 8 sampled Grahamstown teachers, Giving out Reflective journals and explaining how they will be used in the study.	July 2011
2 nd Teacher interactive interviews, for 8 sampled Grahamstown teachers, encouraging Journal writing amongst teachers.	November 2011
3 rd Teacher interactive interviews, for 8 sampled Grahamstown teachers, encouraging Journal writing amongst teachers.	March 2012
4 th Teacher interactive interviews, for 8 sampled Grahamstown teachers, encouraging Journal writing amongst teachers.	August 2012
Draft Introduction Chapter	Aug- Oct 2011
Draft Literature Review Chapter	Nov 2011 - Jan 2012
Draft Research Methodology Chapter	Feb- April 2012
Data analysis	Sep - Nov 2012
Draft Findings Chapters	Nov- Feb 2013
Compiling 1 st Draft of the Dissertation	Feb – May 2013
Compiling 2 nd Dissertation Draft	May- June 2013
Compiling Final Dissertation Draft	June - July 2013
Revisions	July - Aug 2013
Submission, External examination, Corrections and Revisions	Aug- Oct 2013
Final Submission	Nov 2013