Rhodes University Education Department - Research proposal

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Field of research: Mathematics Education

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**Research topic**

**Exploring the nature of teacher learning through their participation in math clubs and a community of after school mathematics club facilitators.**

**ABSTRACT**

This study will explore the nature of mathematics teacher’s learning through their participation in running a math club and in a community of after school mathematics club facilitators. In Phase 1 of the South African Numeracy Chair (SANC) project, maths clubs were initiated as a learner intervention. Researchers such a Stott, Mofu and Ndongeni also ran clubs as part of their research. The research shows that the clubs are effective for learner learning and the SANC project’s report claimed that the running of clubs could also enable effective teacher learning. In clubs, teachers were able to try new pedagogical approaches, introduce new activities and games, and adapt their assessment from classroom to individual assessment. Teacher’s participation in clubs has built more confidence in mathematics teaching. The SANC project has developed its club programme into a more scalable club programme called “Pushing for Progression in number sense and fluency” (PfP), as literature points to the importance of developing learners’ number sense in the primary years. The PfP program will be coordinated by the SANC project and offered to groups of teachers in various districts as a learner and teacher development programme that runs over 16 weeks. Each participating teacher will run a weekly after school maths club and also participate fortnightly in support sessions and reflection sessions on the clubs with SANCP and other club facilitators. Thus over the 16 weeks teachers will be participating in a community of practice of math club facilitators focused on learning about mathematics teaching and learning through running after school mathematics clubs.

As a researcher I will research the nature of teacher learning through their participation in the PfP teacher development programme, their running of maths clubs and their participation in community of after school mathematics club facilitators. I will use an interpretive qualitative case study approach to examine the nature of teacher learning of 8 Foundation Phase teachers from the King Williams Town district who will be participating in the teacher development programme that overlaps with running their maths clubs and participation in community of after school mathematic club facilitators. During the research process I will be wearing two hats, firstly as a “participant observer” (Merriam, 1998) in my professional capacity as provincial mathematics planner I will be inviting teachers who have showed the willingness to participate in running the clubs, providing them with an opportunity to be part of development professional programme and a link between teachers and the PfP program coordinator. Secondly, as researcher in the process investigating the hypothesis by SANC that a clubs model is also useful tool for teacher learning and also can be a teacher development program investigating the nature of teacher learning.

## THE CONTEXT OF THE STUDY

South African learners’ poor performance in mathematics is well documented in both national and international studies, for example the annual national assessments (ANA) (DBE, 2014a) and the Trends in International Mathematics and Science Study (TIMSS) (Mullis, Martin & Fay, 2008). This poor learner performance in mathematics is mirrored in the performance of South African teachers in the comparative study conducted by Carnoy, Chisholm and colleagues (2008) as well as in the statistics from the latest SACMEQ III study (Moloi & Chetty, 2010). Morrison (2013) has cited from The National Commission on Teaching and America’s Future (NCTAF) (1996) the broader evidence that points to connections between mathematical content knowledge and mathematics teaching practices. Evidence also points to mathematical content knowledge being necessary for constructive classroom practice (Askew et al., 1997; Ball & Bass, 2003). Wietz (2014) in her research has pointed the need for supporting teachers in ways that model progression of learners. According to Schollar (2008) children are still relying on simple unit counting to solve problems and concrete counting strategies. In the Foundation Phase there is evidence of a lack of shift from concrete counting-based strategies to more abstract calculation-based strategies (Ensor et al., 2009) In the study conducted by Venkat & Naidoo (2012) highlighted that concrete counting based strategies in the Foundation Phase has resulted to low rates of task completion within and across lessons.

South Africa is currently embarking on achieving improvement in the quality of teaching and learning in schools for the children to be able to succeed in the 21st century society (DBE, 2015). South African Policy on Professional Learning Communities (DBE, 2015) has highlighted the importance of working together as a cornerstone for effective professional development. The establishment of Professional Learning Communities (PLCs) has been put forward in the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) in South Africa, 2011-2025 as an instrument to strengthen teacher professionalism. Research has shown that professional development activities are more effective when they involve educators in active learning that stimulate interaction and collaboration, teacher who promote ownership in learning (Brodie, 2014; Adler 1998; Lerman 1998; Graven 2004; 2005b; Pausigere and Graven, 2014). For my research I prefer not to use the term PLCs but rather the term ‘community of practice’ as it provides a theory of learning, which I will discuss later. It is then that I will be investigating teachers learning in their participation in the programme, in running the clubs and community of maths club facilitators. The issues I have mentioned above have led to the framing of my research questions as shown below.

## RESEARCH QUESTION

What is the nature of teacher learning through their participation in after school mathematics clubs and in a community of after school club facilitators?

SUB-QUESTIONS

1. What are teacher’s experiences of running after school maths clubs?
2. How do teachers’ learning experience in after school mathematics clubs influence their classroom practice?
3. How does participation in the community of practice, particularly as relates to reflecting on club experiences and club preparation support or enable teacher learning?
4. What are the enablers and constraints of teachers running after school maths clubs and participating in the club facilitator community of practice?

## RATIONALE OF THE STUDY

As a curriculum planner I shared my own experience of running of a club and learner progression from concrete to abstract in multiplicative thinking with teachers as part of my masters research. Teachers liked the idea of clubs and progression as it is evident in general that the learners are “stuck” in using concrete methods (Schollar, 2008). Teachers have indicated their willingness to participate in SANC project’s “Pushing for Progression (PfP) programme that will run for 16 weeks. This program focuses on teachers running maths clubs to understand how to progress the learners from concrete to more efficient strategies. PfP seems to be a logical fit for both the teachers and learners. For teachers they will be equipped with an understanding of how to progress and develop learners’ number sense. For learners in the club, the aim if for them to develop procedural fluency, conceptual understanding and number sense (Graven & Stott, 2016).

I will be partnering with a number of Foundation Phase teachers who will be participating in the PfP program by running clubs. Together we will create a community of maths club facilitators. During the research I will investigate the SANC project hypothesis that the club model is possibly a good development opportunity for teacher learning and for promoting shared practices. I will be exploring the nature of teacher learning through participation in this community of practice. The teachers will reflect on running the clubs, participating in PfP program and their participation in the community of practice. Such teacher learning through the running of maths club has not yet been researched, thus the community of maths club facilitators may be an opportunity to research this teacher learning. I will also be contributing to a limited studies in Southern African available on the nature of Foundation Phase (FP) teachers learning within community of practice that has been identified by Pausigere (2012). The study will would contribute to growing knowledge in this identified gap in the literature focusing in teacher learning by participating in a community of practice of math club facilitators focused on learning about mathematics teaching and learning through running after school mathematics clubs.

## THE OBJECTIVES OF THE STUDY

The study will explore the teacher’s learning when engaged participating in a community of practice of math club facilitators focused on learning about mathematics teaching and learning through running after school mathematics clubs and a structured teacher development programme. Learning according to Lave & Wenger (1991) is a process of becoming, of changing participation and changing identity. I will be researching the SANC project hypothesis that running the clubs can be an opportunity for teacher learning which has not yet been researched. I am working on the assumption that teacher learning may be enhanced by participation in such a community of practice.

## EMPERICAL FIELD OF STUDY

## The empirical field will be Foundation Phase teachers who have a joint enterprise of running the clubs, participating in the PfP program coordinated by the SANC project and in a community of after school mathematics club facilitators. The community of maths club facilitators will interact with each other in formal and informal settings to reflect on their learning and practice. During PfP program sessions I will be a “participant observer”, observing and taking field work notes on how teachers make sense of the concepts learnt and the activities to be done. All the teacher development programme sessions will be audio-recorded for further analysis to understand the nature of teacher learning. I also will observe a number of individual clubs session. During the community of maths club facilitators meetings teachers will reflect on their learning and sharing their practice on running the clubs. All club community of practice meeting sessions will be recorded and analysed.

## LITERATURE REVIEW

### Community of Practice

The South African Department of Basic Education (2011) has launched the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) in 2011 as a strategy to strengthen and address the challenges in improving teacher quality. One of the provisions in the ISPFTED was the establishment of Professional Learning Communities (PLCs) by 2017 to strengthen teacher professionalism that will promote collective participation in professional activities for professional development (DBE, 2015; Bolam, McMahon & Stoll, 2005; Brodie, 2013). Research has shown that PLCs enhance teacher quality in various way, help bridging the gap between education theory, policy and practice, creating spaces for addressing practical issues and connecting pedagogical practice with subject content knowledge (DBE, 2015). Although policy promotes the setting up of PLC’s, I choose to use the term ‘community of practice’ not PLCs, PLC’s has been loosely used as is the work of professionals where teachers will be discussing how to translate educational innovations into their practice (DBE, 2015) but the community of practice in terms of Wenger’s theory provide with the theoretical framework and an analytic framework which is rich and has been established.

According to Wenger (2000) Communities of Practices are groups of people who share a passion for something that they know, how to do and who interact regularly to learn how to do it better. Graven (2005), highlighted that supportive community of practice can be seen as a means of sustaining teacher learning that will be enhanced by stimulating participation within a community of practice where members of the community of practice would provide support for teacher learning. Brodie (2000), in her study supported peer interaction as providing a support for the construction of mathematical meaning by students and allowing more time for students talk and doing activities that develops teacher’s knowledge and practice. To understand the CoP concept we need to differentiate the community from learning community. Community generally describes groups of people connected by a common interest and who define their identities by the roles they play and the relationships they share in the group's activity. Communities provide a safe environment for individuals to engage in learning through observation and interaction with experts and through discussion with colleagues. A “learning community” develops a high level of trust among participants in order to be functional (Wenger, 1998, p. 214). A strong learning community fosters interactions and relationships based on mutual respect and in the process develop a sense of belonging and mutual commitment (Wenger, 2007).

A community of practice creates a social structure for individuals to share ideas and artefacts that support community activities and help individuals make sense of new knowledge. Newcomers can benefit from having access to the experience of others (Wenger, 1998, p. 13).

According to Wenger, McDermott & Snyder (2002, 27), in order for a community to be recognized as a CoP, a combination of three characteristics must be cultivated in parallel:

* + *The domain*: The domain is what “brings people together”, what members commonly experience and “guides their learning” (*Wenger et al (2002, p. 31)*. Members of a CoP domain may share a profession or discipline, have the same job or role and deal with the same clients. In the case of my study domain are the after-school clubs.
  + *The community*: A community according to Wenger et al (2002, p.34) is “a group of people who interact regularly build relationships and help with each other, have shared understanding of their domain and an approach to their practice by engaging in joint activities and discussions by sharing information”. The community is a social structure that facilitates learning through interactions and relationships with others. In my study, the community is made up of the Foundation Phase teachers running the clubs and myself.
  + *The practice:* Members of a CoP are practitioners. They develop a “shared repertoire of resources” (Wenger et al, 2002, p.34), such as experiences, stories, tools, and ways of addressing recurring problems, thus learn with and from each other. They, in essence, the practice is the specific knowledge the community shares, develops, and maintains. It should be noted that CoP was originally developed as a learning theory that promotes self-empowerment and professional development through sharing classroom experiences on teaching and learning. In my case, the practice is running the clubs based on the structure of the PfP development programme.

In the community of practice members engage in joint activities and discussions, help each other in developing the pedagogical skills to teach specific content, with strong positive effects on practice and share information by reflecting on their practices. Teachers build relationships that enable them to learn from each other and work collaboratively.

### Teacher learning

My study will focus on the teacher learning through participation clubs CoP which is based on the work of Lave & Wenger (1991). According to Lave & Wenger (1991), learning is a way of being in the social world and not a way of coming to know about it. Learning is a process of becoming, of changing participation and changing identity within a community of practice (Wenger, 2000). Wenger (2000) refers to community of practice as a learning partnership with capability that are anchored in a mutual recognition as potential learning partners. This view of learning resurrected a model work-related learning, that was developed as a social learning framework to include four components; community, identity, meaning and practice (Wenger, 1998). Lave and Wenger (1991 suggested that most of the learning for practitioners occurs in social relationships a concept known as 'situated learning'. The central themes of the book are the interactions between novices and experts, and the process by which newcomers create a professional identity. Through interaction process with each other identified gaps in the practice can be addressed as to improve practice. Lave and Wenger’s (1991) definition of situated learning suggests “learning as it normally occurs is a function of the activity, context and culture in which it occurs and its core principle, that adult learning starts with individual experience. Situated learning environments must support active engagement, discussion, evaluation and reflective thinking.

Lave and Wenger’s (1991) situated learning argued that learning as it usually occurs is a function of the activity, context and culture in which it takes place. Social interaction is a critical component of situated learning where learners become involved in a community of practice which embodies certain beliefs and behaviours that are to be acquired. The group of people share a concern or a passion for something they do and learn how to do it better as they interact with one another on a regular basis. Thus becoming a professional is not seen as an individual acquisition of knowledge, but rather as a process of social participation in a learning community. Lave and Wenger (1991) emphasize that novices begin learning by observing members of the community and then slowly move from the periphery of the community to fully participating members.

The construction of practitioners' identities is a collective enterprise. The construction of identity is also a way of speaking of the community's constitution of itself through the activity of its practitioners. This conception of learning activity draws attention to the complex ways in which persons and communities of practice constitute themselves and each other. Learning is recognized as a social phenomenon constituted in the experienced, lived-in world, through legitimate peripheral participation in ongoing social practice; the process of changing knowledgeable skill is subsumed in processes of changing identity. Learning emphasizes the inherently socially negotiated quality of meaning and the interested, concerned character of the thought and action of persons engaged in activity. This view also claims that learning, thinking, and knowing are relations among people engaged in activity in, with, and arising from the socially and culturally structured world. It is useful to distinguish between different modes of identification that position learning in the landscape (Wenger (1998, p. 173) :

* *Engagemen*t which refers to a practice, engaging in activities, doing things and talking, using and producing artifacts (Wenger, 1998, p. 184), Engagement gives a direct experience whether this experience is one of competence or incompetence and whether one develop an identity of participation or non-participation.
* *Imagination*: As engagement with the world and also constructing an image of the world that helps to understand how one belong or not. Imagination can create relations of identification that are as significant as those derived from engagement (Wenger (1998, p. 176).
* *Alignment*: Is an engagement in practice is rarely effective without some degree of alignment with the context by making sure that activities are coordinated (Wenger (1998, p. 181).

Learning can be viewed as a journey through landscapes of practices through engagement, imagination and alignment. Ones identities come to reflect the landscape in which one live and through the experience of it. Identities become personalized reflections of the landscape of practices.

### Learning as participation

The community of practice framework rest upon the metaphor of ‘learning as participation’ (Sfard, 1998). The ‘social turn’ in mathematics education experienced towards the late 1980s saw the emergence of the ‘participationists metaphor’ or theories that see “meaning, thinking and reasoning as products of the social activity” (Lerman, 2000 p.8). The participation metaphor views learning as community building, where a member becomes a participant. Learning takes place as a result of becoming a participant in a community and knowledge is an aspect of practice.

Wenger (2000) advocates that communities of practice form when people “engage in a process of collective learning. Collective learning is required where the acquired knowledge and skills are shared with colleagues through joint activities and discussions (Wenger, 2007). Meaningful learning in social contexts requires both participation and reification to be in interplay. Learning entails realignment. Learning as increasing participation in communities of practice concerns the whole person acting in the world. Learning happen as a result of the individual and team effort, and to reflect with others on the action of the whole system in order to learn how to improve practice (Boyle, Lamprianou, & Boyle, 2005; Dymoke & Harrison, 2006). This conception of learning activity draws attention to the complex ways in which persons and communities of practice constitute themselves and each other.

### Reflection on practice

Teacher learning communities develop through reflection on practice (Schön, 1983) where teachers are required to work together and help each other collaboratively together through inquiry, support one another, as well mentor future teachers. Teachers need time to think and reflect about classroom practices with each other. Schön (1983, 1987) in his idea about reflection highlighted by “reflection-on-action”, teachers recall on after teaching, “reflection-in-action”, teachers deal with the problems as they occur. This means that this reflection can be recalled and shared.

Reflection is effective when it leads the teacher to make meaning from the situation in ways that enhance understanding so that she or he comes to see and understand the practice setting from a variety of viewpoints (Loughran, 2002). Participating in these will be encompasses by learning from experience where teachers will be reflecting on their practices and that learning is most effective when it involves collaboration. Stones (1994) argued that reflection is the basis for learning. The professional development aspect of this design drew from the framework of communities of Practice (Lave & Wenger, 1991). Wenger’s (1998) approach of participation in the community of practise with learning as an integral part explores the intersection of the learning components of community, practice, meaning, identity and increased confidence (Graven, 2002).

My research will investigate the nature of teacher learning when they reflect on their own practice through participating in the PfP programme and community of maths club facilitators focusing on the joint enterprise (Wenger, 1998) of running the clubs that is intended to continue beyond the period of my research. The maths club community will meet once a month. Teachers will expected to talk about their learning as meaning, practice, identity, community and confidence on their experiences (Wenger,1998), practice for teaching, professional knowledge, professional practice, leadership in learning communities, and ongoing professional learning (Schön, 2013).

## Theoretical Framework

The study will draw from on Wenger’s social theory of learning”(Wenger 1998, p. 12) which regards learning as social participation within a community of practice which sees learning as participation in the social world emphasises the relational interdependency of individuals (Lave, 1993b, p. 67; Lave & Wenger, 1991, p. 50). This theory regards learning as social participation which broadly implies socially negotiated meaning, active participation in practices of communities and identity. Teacher’s participation in a collaborative community involved the combination of various components of learning, namely: meaning, practice, identity, community and confidence (Graven, 2002; Lave, 1996; Wenger, 1998 Wenger et al., 2002, Pausigere and Graven, 2014). Wenger’s theory (1998) explores the intersection of the learning components: community, practice, meaning and identity. In the research conducted by Graven (2002, pp. 303–304) another learning component - “confidence” emerged, as a product and a process of learning that enabled the teachers in the study to move ‘from being *teachers of mathematics* towards being and becoming competent and confident *mathematics teachers’*. Graven (2002) in her study began to see learning as an integral part of being a professional, irrespective of one’s level of formal education. Graven (2002, p. 203) argues that confidence is closely intertwined with all four of Wenger’s learning components as an overarching fifth component which explains individual teacher’s ways of learning through experiencing, doing, being, and belonging. Wenger (1998) identifies four components of learning namely: meaning, practice, community and identity.

All these components see learning as integral part of being a professional and will provide a conceptual framework for analysing learning as social participation as follows:

* *Meaning* (learning as experience) is a way of talking about ability to experience the world as meaningful learning that takes place through engagement in actions and interactions, and participation. Participation describes the social experience of living in the world in terms of membership in “social communities and active involvement in social enterprises” (Wenger, 1998, p. 55). The process of participation and reification form a duality that is fundamental to one’s experience of meaning and to the nature of practice.
* *Practice* (learning as doing) involves participation with the community through regular interaction of the members, is a way of talking about shared historical and social resources, frameworks and perspectives that sustain mutual engagement in action Where each member being lifelong learners in relation to mathematics teaching. Community of practice should be viewed as a unit that has a specific features mutual engagement, joint enterprise and shared repertoire (Wenger, 1998, p. 95).
* *Community* (learning as belonging) is a way of talking about the social configurations in which our enterprise is defined and our participation is recognisable as competence in knowledge. Communities of practice are a privileged locus for the creation of knowledge which is a ‘learning community’ (Wenger, 1998, p. 214).
* *Identity* (learning as becoming) is a way of talking about how learning changes a person, changes who we are. Wenger (1998) identifies identity as “learning trajectory” (p.149) as trajectories, our identities incorporate the past and the future (p 155).

A diagrammatic presentation of components of Wenger’s (1998) social theory of learning is given below.

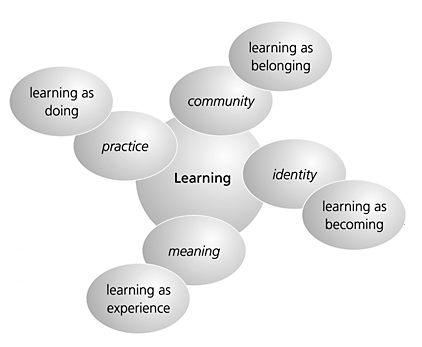


Figure : Components of a social theory of learning: an initial inventory (Wenger, 1998, p. 5)

Wenger (1998), relates communities of practice to the learning components of meaning, practice, community and identity as a joint enterprise which ‘requires a strong bond of communal competence along with a deep respect for the particularity of experience’ (p. 214). According to Lave and Wenger (1991), learning is located in the process of co-participation and increased access of learners to participation in an interactive process. Wenger (1998, 214) referred to community of practice as ‘a living context that can give newcomers access to competence and also can invite a personal experience of engagement by which to incorporate that competence into an identity of participation’.

Teacher learning is enhanced by stimulating participation where members support for each other’s teacher learning. Participation in this sense is the process of ‘being active participants in the practices of social communities and constructing identities in relation to these communities’ (Wenger, 1998, p.4). Graven (1998) indicated that teacher education should involve bringing teachers into supportive communities where reflection-in-practice is enabled. Learning will take place through our engagement in actions and interactions, learning reproduces and transforms the social structure in which it takes place within the context of participation within collaborative the community club maths of facilitators, which includes practice of running maths club in schools.

Wenger’s (1998, p. 4) work is based on four premises:

1. People are social beings which is a central aspect of learning
2. Knowledge is about competence with respect to ‘valued enterprises
3. Knowing is matter of participation about active engagement in the world;
4. 4. Meaning is ability to experience the world and engagement with it, ultimately what learning produces.

Wenger (1998) pointed out that communities of practice are a privileged locus for the creation of knowledge (p. 214). Wenger (1998) in his book highlighted the importance of reflection on learning.

Research Design

I will use an interpretive qualitative case study approach to examine the nature of teacher learning within participation in a club collaborative community of practice. From this perspective, research will be through the experiences of the people involved, it will recognise that people actively construct their social world I need to examine situations through the eyes of participants rather than the researcher (Cohen, Manion, & Morrison, 2010). By employing the qualitative educational interpretive methodology this study aimed to provide rich ‘thick descriptions’ (Cohen et al. , 2010, p. 169; Miles & Huberman, 1986, p. 10) on the nature of teacher learning. Qualitative studies provide exploratory and detailed narrative descriptions that use the context and setting to search for deeper understanding of the phenomenon being studied (McMillian & Schumacher, 2001). Lietz, Langer and Furman (2006) explain that the qualitative method focuses on the co-construction of meaning between the researcher and the participants. A case study uses a small group in order to learn more about social realities in a particular context. According to Cohen et al. (2010) a case study have a rich and vivid description of events relevant to the case which can be defined with reference to characteristics defined by individuals and groups involved. It allows the researcher to probe with the necessary depth and recognition of the context and hopes to find out knowledge that will be applied to address the social problem (Janse van Rensburg, 2001).

This chosen methodology coheres with the theoretical framework of social practice theory and the work of Lave & Wenger (1991) and Wenger (1998), the empirical field of research community of maths club facilitator’s views on learning and to explain how they perceive learning as they participate in communities of practice (Lave, 1996; Wenger, 1998; Lave & Wenger, 1991). To access such data will involve close interaction between the teachers and myself (as researcher) and I will be partnering with them. A meeting with the principals and teachers of the participating schools will be conducted to explain what participation in CoP and running the clubs will involve, as well as asking them to participate in the 16 week “Pushing for Progression programme”. I will explain that I wish to collect data for my doctoral research on the nature of teacher learning and how their participation in club CoP model as a teacher development programme influence their teaching and their students’ learning. I will explain to teachers that they can withdraw from the research at any point and that their ‘data’ will be withdrawn from the study.

I will adopt the dual role of both researcher and provincial Mathematics specialist who will be coordinating the Community of Practice of running Maths Clubs thus I will participant observer’ (Merriam, 1998) who will sit with the teachers observing and write in my field work notes and recording all PfP sessions and all maths club CoP session and taking the notes to inform further development PfP program. In my research I intend to explore teachers learning in their participation in learning collaborative community of practice as a form of teacher development programme and how their learning impacts classroom practice. In doing so I will be addressing my research questions which are as follows:

1. What are teacher’s experiences of running after school maths clubs?
2. How do teachers’ learning experience in after school mathematics clubs influence their classroom practice?
3. How does participation in the community of practice, particularly as relates to reflecting on club experiences and club preparation support or enable teacher learning?
4. What are the enablers and constraints of teachers running after school maths clubs and participating in the club facilitator community of practice?

### Sampling

As I am working in the provincial department I will ask permission from Education district to access the school and the research participants to ensure that the provision in the Departmental research policy is adhered to research in school Policy (DBE, 2007). A sample of 8 Foundation Phase teachers from King Williams Town who have expressed their interest and willingness will be selected to participate in community of maths club facilitators in this research. These participants will be easy to contact and access as they are in the close proximity. Participation in the research is entirely voluntarily. Teachers will be explained that they could withdraw at any point and that their ‘data’ will be withdrawn from the study.

### Methods of data collection

In qualitative research reality is constructed by individuals interacting in their social worlds and that meaning is embedded in individual’s experiences and is mediated by the researcher’s perceptions (Merriam, 1998). My chosen theoretical framework of social practice theory, the work of Lave and Wenger (1991) of learning in community of practice and the main research question have an influence on the choice of the methods to be used. Data collection methods will include unstructured interviews, stimulus recall interviews on recorded club sessions, teacher reflective questionnaires, workshop observations, individual club observations, teacher learning journals and researcher field notes. I discuss each of these in detail below.

Questionnaires

I will be administering a number of different questionnaires. The first questionnaire will be a pre questionnaire which will primarily involve gathering basic information related to teachers’ qualifications, teaching experience, reflecting on their current classroom practice in mathematics. Subsequent questionnaires will be used to following every club session, where teachers will be asked to reflect on the club session which will assist them when they meet at their community of practice meetings. These questionnaire will be collected during these CoP sessions. A reflection questionnaire will be filled by teacher after each PfP programme workshop to determine the teacher learning during the workshop.

Interviews

Interviews are used in qualitative interactive studies (Cohen et al. , 2010) to focus on the participant’s experience. Interviews will be administered, recorded and transcribed. I will be conducting a number of different interviews. I will use structured pre and post interviews, at the beginning and end of the research to ascertain the nature of learning as meaning, practice, community and identity (Wenger, 1998). At the start of each interview I will explain that the there is no right or wrong answer to questions and yes or no type questions will be avoided. Rather questions will be followed by prompts to dig for more information. All interviews will be conducted individually. After I have observed and recorded a teacher’s club session, un-structured, stimulus-recall interviews will be undertaken. A set of items and prompts will be used in order to stimulate recall. All interviews will be recorded and a research journal used to take some notes as a backup.

Observations

Observational data represent a first-hand encounter with the phenomenon under study which affords the investigator the opportunity to gather ‘live’ data from naturally occurring social situations (Cohen et al. , 2010, p. 397; Merriam, 2001). I will be a “Participant-as-observer” during all programme sessions aiming to capture the insider’s view to get a thick description data and for authenticity of the data (Henning, 2004) on teacher learning and on the activities that the teachers will be engaged with. As a researcher will also be observing one session for each club, which I will video record to provide insight about the nature of teacher learning in running the clubs. The video recorded observations will form the focus for the stimulus recall interviews mentioned above to allow the teachers to reflect on their practice and also a development tool for where the participants can identify any progression in learners.

Audio recordings

I will audio record the PfP programme workshops and CoP meeting sessions. It is hoped that in these spaces, teachers will be collectively reflecting and sharing their practices and provide ideas for running the clubs. All the recordings will be transcribed.

Journals

I will use two different types of journals as data collection tools: my own researcher’s journal and teacher reflective journals. As a researcher and “participant observer” I will maintain my own journal where I will be compiling the field notes taken during PfP programs sessions and immediately after interactions with teachers. As an observer I will be taking notes which will serve as a reflective device to analyse what will be happening in CoP and to consolidate and the record research ideas that will emerge out of reflections. These notes will then be used as triangulation for validity purposes.

I will give the 8 participating Foundation phase teachers journals. I will request them to reflect deeply by writing about their experiences on the PfP workshops, the practices of running the clubs and their interactions in the maths club CoP. I will explain that journal writing is a useful tool for promoting critical reflection of experiences, is a means by which teachers engage in learning and allowing them to discuss the link between theory and practice Clandinin and Connelly (1994, p. 421) explain that journal writing is a “powerful way for individuals to give accounts of their experience. As personal 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 will ask the teachers to bring their journals to the CoP meetings and 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 challenges, some participants find writing difficult and is a time-consuming activity (Chirema, 2006) they will be explained to update their journals at an inconvenient time to them for expressing their experiences.

A detailed data collection timeline, which dovetails with the 16-week PfP development programme is shown in Table 1 below.

Table : COP event and data collection time line guided by the SANC project development events

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Weeks | 0 | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | No. in total | |
| Development events (run by SANCP) |  | Workshop One |  |  | Workshop Two |  |  |  |  |  | Workshop Three |  |  |  |  |  |  |  | |  | |
| COP events | Establish COP |  |  | COP Meeting 1 |  |  |  |  |  | COP Meeting 2 |  |  |  | COP Meeting 3 |  |  |  | Final COP meeting | | 5 | |
| Club events |  | | Teachers run weekly clubs | | | | | | | | | | | | | | | |  | | 15 | |
| DATA COLLECTION SCHEDULE | | | | | | | | | | | | | | | | | | | | | | |
| Teacher Pre questionnaire | ✓ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | 8 | |
| Teacher Post questionnaire |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | ✓ | | 8 | |
| Workshop session reflections questionnaire |  | ✓ |  |  | ✓ |  |  |  |  |  | ✓ |  |  |  |  |  |  |  | | 24 | |
| Post club reflections questionnaire |  | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | | 120 | |
| Club CoP Reflections (Audio recording) |  | |  | ✓ |  |  |  |  |  | ✓ |  |  |  | ✓ |  |  |  | ✓ | |  | |
| Researcher club observations and unstructured interviews with teachers (Audio recording) |  | |  |  |  |  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  | | 8 | |
| Pre individual structured interviews with teachers  (Audio recording) | ✓ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | 8 | |
| Post individual structured interviews with teachers  (Audio recording |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | ✓ | | 8 | |
| Research journal and Reflective Journal | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |  | |
| Continuous data analysis | | | | | | | | | | | | | | | | | | | | | | |

## DATA ANALYSIS

### Unit of analysis

The unit of analysis for the study is teacher learning in running the clubs and participation in maths community of club facilitators and in PfP programme.The club CoP will be framed by Wenger’s Communities of Practice components of learning as meaning, practice, identity and community (Wenger, 1998, Lave & Wenger, 1991, 1999) to include interacting component of “confidence” embedded in Graven’s research, to describe and explain teacher learning that occurs within learning collaborative community of practice (Graven, 2002). In this way ‘communities of practice’ are one possible unit of analysis in relation to the theory of learning. Analysis of data on community of practice permeates the analysis of teacher learning on what the teacher say and their reflection on their learning in the participation in community of practice and running the clubs. However, unit of analysis for the study will be both the teacher- in- community and community - in- the teacher (Lerman, 1998). Data analysis will explain the nature of individual teacher learning in participating in community of mathematics club facilitators and running of clubs and the nature of the influence of community of mathematics club facilitators on individual participants.

Wenger’s (1998) four component ‘model’ of learning (*Meaning, Practice, Community, Identity)* as social participation, together with the component of ‘confidence’ will provide an interpretive framework for describing, analysing and explaining teacher learning.

The qualitative data analysis will be conducted concurrently with gathering of data collection processes (Creswell, 2009) Due to the quantity of data that will be collected, rather than leaving data analysis to the end, I anticipate at this stage, that data collection will be on-going and analysis will occur chronologically as the data is collected as suggested by (Merriam, 1998). This approach will allow me to maintain focus, identify coherent patterns and themes (McMillan & Schumacher, 2001) linked to the theoretical framework and will allow flexible revision of those emerging themes, if necessary, therefore that collection of data will be more interactive in practice to help answer the research questions on explaining the nature of teacher learning.

## ETHICS

Ethical considerations and procedures for this case study will conform to the University’s requirements, including seeking permission from the Department of Basic Education, principals, teachers and learners’ parents. Parental permission will be obtained for learner participation in the clubs and for the video recording of club sessions. Setati (2005) discussed critical issues that are often silenced in accounts of research on teaching and learning in school, and moves the debate from a dichotomy between doing research 'with' or 'on' to understanding research on teaching and learning in schools as a process that is both 'with' and 'on' teachers. She referred to this as a reciprocal power relationship. I examine ethical concerns relating to the rights of the researched, informed consent, access and acceptance, privacy, anonymity and confidentiality. I relate these to the ethical challenges faced in this research drawing particularly on the work of South African researchers (Setati, 2000).

An open and honest meeting will be arranged with principals and teachers about the nature of the research and the processes involved, further indicated that participation in the research is voluntary, and that participants could withdraw from the study at any time. To indicate their willingness to participate in the study, the teacher participants will be asked to sign the Participant Information and Informed Consent forms. To ensure confidentiality, names of the participants and their school names will be changed. I am aware of my positionality as Departmental curriculum planner. I will be wearing 2 hats: in the first instance I will be liaising with SANC project and bringing the development project to teachers. Good relations with teachers will be displayed by partnering with them with the aim exploring the nature of their learning. In the 2nd instance I will be acting as the researcher and “participant observer” I will be taking field notes and recording the sessions on teacher reflection on the nature of learning in running the clubs and their participation in community of mathematics club facilitators.

## VALIDITY, THREATS AND RELIABILITY

Using different data collection strategies enhances both the internal validity of data through triangulation and the generalisability of the research findings by providing in-depth and rich data (Merriam, 2001; Cohen et al. , 2010; McMillan & Schumacher, 2001). To ensure validity, participants will do member checks (McMillan & Schumacher, 2001; Merriam, 2001), where they will review, check and sign their stimulus-interview transcriptions. I will also use triangulation that will allow me to compare and cross-check data from different sets of data which include written questionnaires, verbal and written interviews transcripts, and transcripts of audio recording, my research journal and teacher reflective journals.

As the researcher and an Eastern Cape Department of Education provincial officer who has power over teachers, I will therefore need to be careful not to compromise the validity of this study. I will not impose my ideas or use my power to coerce or force the participants.

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