ANALYSING THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF AN ADVANCED CERTIFICATE IN EDUCATION IN MATHEMATICAL LITERACY RESKILLING PROGRAM AND THE TRANSFORMATION OF TEACHER IDENTITIES.

Benita Portia Nel

A research report submitted to the Faculty of Science, University of Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Science.

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DECLARATION

I declare that this thesis is my own unaided work. It is being submitted for the Master's Degree in Science at the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

Benita Portia Nel

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ABSTRACT

This study aims to analyse the relationship between the design and implementation of an Advanced Certificate in Education (ACE) in Mathematical Literacy (ML) (reskilling) program and the development of teacher identities. This study confirms that teacher learning in an in-service context is a social process that demands a social-cultural perspective and therefore Wenger's theory was used in this study.

This study illustrates that teachers' participation in an ACE ML community of practice involved the complex intersection of various components of learning: meaning (learning as experience), practice (learning as doing) and community (learning as belonging) when development of teacher identities takes place.

The course was also designed in such a way as to promote a changing way of being. The emerging identities were different in each individual as identity is influenced by the past, the present and the future according to Wenger.

The study reveals that when meaning of the subject ML is gained, the meaning can be translated into changed classroom practice. These result in fostering a specific identity influenced by the ACE ML course's attempts to support the development of understanding in relation to the meaning of ML. This leads to a change in classroom practice and ultimately a change in teachers' way of 'being'. This resonates with Wenger's claim that the four learning components are deeply interconnected and mutually defined. The new trajectories that teachers developed can be grouped into three categories:

- Where teachers back grounded their previous identities and fore grounded their ML identities.
- Where the teachers added their ML identity to their existing identity, leaving them with a dual identity, the one they had before their involvement in the ACE ML course and the ML identity.
- Where those teachers whose existing identity stayed strong, and their ML identity was still developing or was less strong.

DEDICATION

I hereby wish to dedicate this work to my parents, Peter and Georgina Williams, who put me on this path of life-long learning. In the same breath I want to acknowledge the love and support of my husband, Reginald Nel and my daughters Ranique and Melayna, as this journey would be impossible without your continuous encouragement.

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NOMENCLATURE

ACE – Advance Certificate in Education

AMESA – Association for Mathematics Education of South Africa

DoE – Department of Education

FET – Further Education and Training

INSET – In-service Education and Training

LO – Learning Outcome(s)

ML – Mathematical Literacy

NCS – National Curriculum Statement

OBE – Outcomes Based Education

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Chapter 1: Research problem and Rationale

1.1 The aim of the research

The aim of the research was to analyse the relationship between the design and implementation of the Advanced Certificate in Education (ACE) in Mathematical Literacy (ML) (reskilling) program and the possible development of teacher identity.

1.2 Statement of my research problem

An investigation to analyse the relationship between the design and implementation of an ACE ML (reskilling) program and the development of teacher identities.

1.3 Research Questions

1. What kinds of ML teacher identities are promoted within the ACE? How do these relate to the agendas embedded within the course design?
2. What is the nature of the emerging ML identities (if they indeed emerge at all) of the participating teachers?
3. What is the nature of the influence of the learning components of meaning (learning as experience), practice (learning as doing) and community (learning as belonging) on the development of ML teacher identities? In other words, how does developing mathematical literacy competencies, teaching experience, and participation within communities where ML is a focus of the activity, influence teachers' developing identities?

1.4 Rationale

I became interested in this topic in 2006 when Mathematics was made a compulsory subject for all South African learners in grades 10-12. Before 2006 learners could choose whether or not they wanted to continue with Maths after grade 9. Christiansen claims that the two

main reasons for introducing ML were to reach the 200 000 grade 12 school leavers without Maths and the 200 000 additional learners who fail the subject each year (2006, p 10). When ML was introduced in 2006, it placed an extra burden on South Africa's already short supply of qualified Maths teachers. As a result, many teachers from other learning areas were employed to teach ML and this raised questions as to their competence and capabilities in this learning area. I therefore aim to investigate, according to Wenger's (1998) theory, how, if ever, the identities of ML teachers changed when involved in an ACE ML (reskilling) programme. I felt it important to investigate if identity changes took place because I believe that the development of identity is important for developing long term trajectories in ML teachers. This trajectory probably requires the kind of teacher who constantly strives to improve his/her practice as a life-long learner in their particular subject field. There is a great deal of uncertainty and confusion amongst the ML teachers as to what the agenda for ML curriculum really is, in addition to changing the practice from "pure" Maths to Maths in context. Added to the problem is the reluctance of some learners to continue with Maths to grade 12 as some intended to drop the subject after grade 9. So we are facing an interesting challenge: To change our own views and, ultimately, change our practices.

In this study, I looked at the identity transformation that might take place in the teachers participating in the ACE ML (reskilling) course presented by an organisation at a university in Gauteng. Since ML is a new subject, no teachers would have studied it in their diplomas or degrees. Some might have studied Maths while others had no Maths background beyond school. Wenger says that "we define who we are by the ways we experience ourselves through participation as well as by the ways we and others reify our selves" (1998, p149). Reification occurs when we give expression to existing meanings and also then create the conditions for new meanings. For example expressing "Sue is an experienced teacher" or "Sue has experience". It does not assume correspondence between the phenomenon and interpretation because forms can take on a life of their own. Thus in relation to identity Wenger's understanding of reification is that process of giving a particular structure to identity.

We also define ourselves by the familiar and unfamiliar (Community membership), where we have been and where we are going, and how we reconcile our various forms of membership into one identity. This means that our identity is shaped by a number of factors, but what interested me was how teachers' involvement in the ACE ML course shaped their identities. Initially, I wanted to look only at those teachers who had never taught Maths before, but there were only two teachers enrolled in the course who fell into this category. Further more, because ML is a radical departure from Maths and is different in purpose and kind (Brombacher, 2006), participating Maths teachers also needed to develop new identities as ML teachers. The sample therefore included all the teachers that were involved in the course and willing to participate in the research. This form of sampling is called purposeful sampling (Maxwell, 1996, p 70) and this method provides me "with the information that I need in order to answer the research questions". The answering of the research questions were "the most important consideration in (the) qualitative sampling decisions".

Chapter 2: Theoretical Framework and Literature Review

2.1 Theoretical framework

My theoretical framework is Wenger's (1998) community of practice theory of learning. This theory conceptualises learning through participation in a community of practice, involving four components: practice, meaning, identity and community. Wenger argues that "learning and a sense of identity are inseparable: They are aspects of the same phenomenon" (Lave and Wenger, 1991, p 115). Therefore, for a teacher to be reskilled, the teacher's sense of identity will change as well as the form of membership (Lave and Wenger, 1991, p 36).

Wenger's work is based on four premises:

1. That people are social beings is a central aspect of learning;
2. Knowledge is about competence with respect to 'valued enterprises';
3. Knowing is about active engagement in the world;
4. Meaning is ultimately what learning produces (1998, p.4)

In module 1 of the ACE ML course, participants are exposed to international and national readings relating to the notion of ML. Participants are also advised how to work out activities in this subject field and develop different assessment tasks; they are even given information on how to use the internet as a tool for accessing articles and data. This to me is an indication of how to expose participants to the "valued enterprises" and build competence in this subject field. In this process, participants also acquire knowledge of ML, learning more about the subject field. They are encouraged to participate actively in the classes. This lends itself to more engagement in the world and, in the process, learning will take place and meaning can thus develop, the fourth premise of Wenger's work as outlined above.

Wenger summarises this framework in the following diagram (1998, p.5):

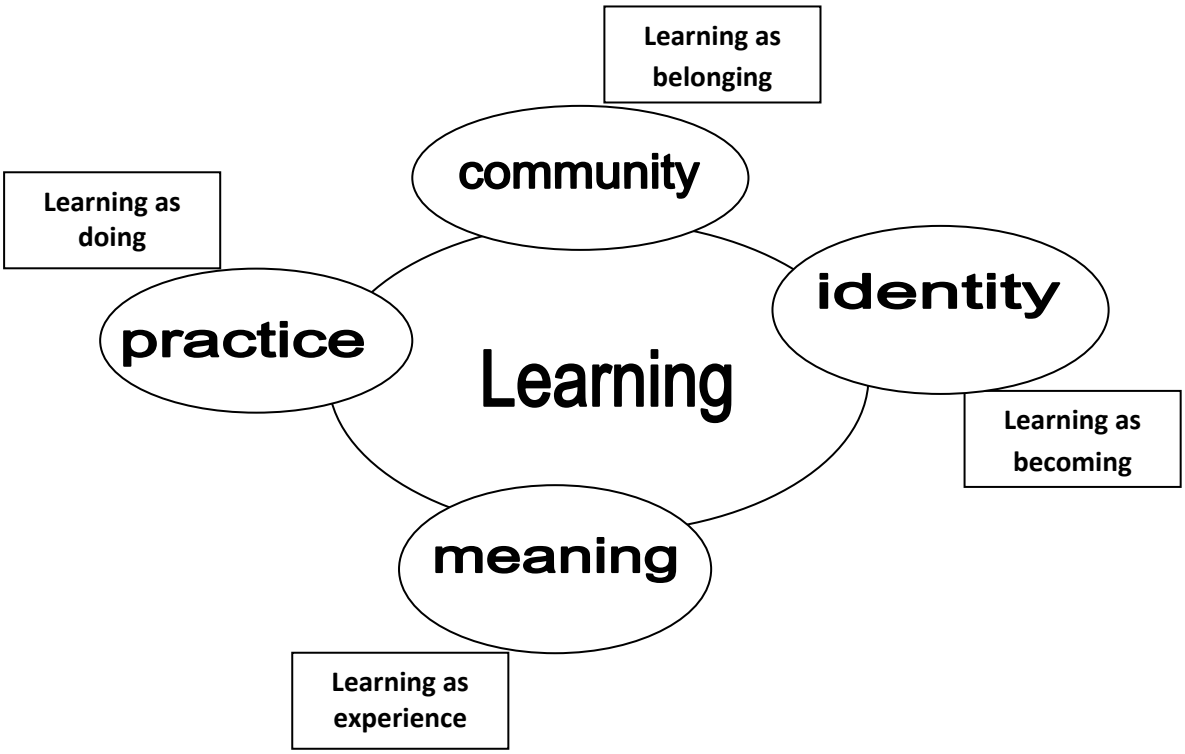

Figure 1: Components of a social theory of learning: an initial inventory

Wenger notes that the elements are "deeply interconnected and mutually defining", pointing out that one can "switch any of the four peripheral components with learning, place it in the centre as the primary focus" (1998, p.4). "According to Lave and Wenger, learning is located in the process of co-participation and not in the heads of individuals; not located in the acquisition of structure but in the increased access of learner participation, and it is an interactive process in which learners perform various roles" (Graven, 2002, p 144). We can thus argue that "learning and a sense of identity are inseparable" (Graven, 2002, p 145). Wenger (1998) defines identity as ways of talking about how learning changes who we are. I have placed the identity component in the centre as my primary focus. This is shown in the diagram on page 8 below.

Graven states that “mathematics educators are increasingly noting the importance of Lave and Lave and Wenger’s (1991) work for analysing mathematics teacher education” and that this theory can be used to understand teacher development (Graven, 2002, p 141). The whole notion of identity as learning as becoming will be explored in this research.

2.2 How Wenger’s components relate to my study

Wenger defines the community of practice as community where “collective learning over time, results in practices that reflect both the pursuit of our enterprises and the attendant social relations. This community of practice is created over time by the sustained pursuit of a shared enterprise” (1998, p 45). Since the ACE ML course was a course in which participants engaged regularly for two years, meeting twice a week for three hours per session to engage with the ML curriculum development, it was de facto a community of practice. The ACE ML group can be considered a specific kind of community of practice: a “learning community” (Wenger, 1998, p 214). Participants are thus involved in a “joint enterprise”.

From the analysis of the ML curriculum, it was evident that ML requires teachers to develop new beliefs, perform new roles and construct new identities in relation to Maths. ML is different ‘in purpose and kind’ from Maths and so requires a shift in identity. Furthermore, the contextualisation and newness of the subject requires that teachers act as facilitators, being more participants in the classroom than didactical leaders. In the two years of involvement, participants were exposed to and encouraged to develop learning, teaching and assessment tasks and all of this could lead to a specific common practice. As the ACE ML course has a reskilling purpose, participants are inducted to these “new” ways of doing things in and around the classroom, possibly leading to “new” practices being adopted by participants. Extra funding was also raised so that participants received support in the form of class visits. This relates to Wenger’s learning component of practice (learning as doing).

Wenger says that “human engagement in the world is first and foremost a process of negotiating meaning” (Wenger, 1998, p 53). Each participant, while grappling with the vast

amount of resources and exposure to the curriculum will negotiate meaning out of it. In the course participants were exposed to using the internet to develop activities and this is an example of the creation of a new learning experience – these teachers had not been exposed to using the internet to generate assessment tasks before.

Wenger notes that " As trajectories, our identities incorporate the past and the future in the very process of negotiating the present … Learning events and forms of participation are thus defined by the current engagement they afford, as well as by their location on the trajectory" (1998, p 155). The trajectories and identities of the participating teachers will be influenced by the ACE ML community of practice through its different forms of participation and access to resources. It is important to note that this learning framework does not assume this will be in a positive direction. Instead, it is open to participation resulting in trajectories away from ML, away from being and becoming a ML teacher.

2.3 A focus on Identity

This study focuses on the components of Wenger's theory: the learning as becoming component (identity) in relation to teachers' participation in the ACE ML community of practice. This is backgrounded by the component practice (learning as doing) and meaning (learning as experience), both in relation to identity which assists in responding to research question three. The following figure illustrates this:

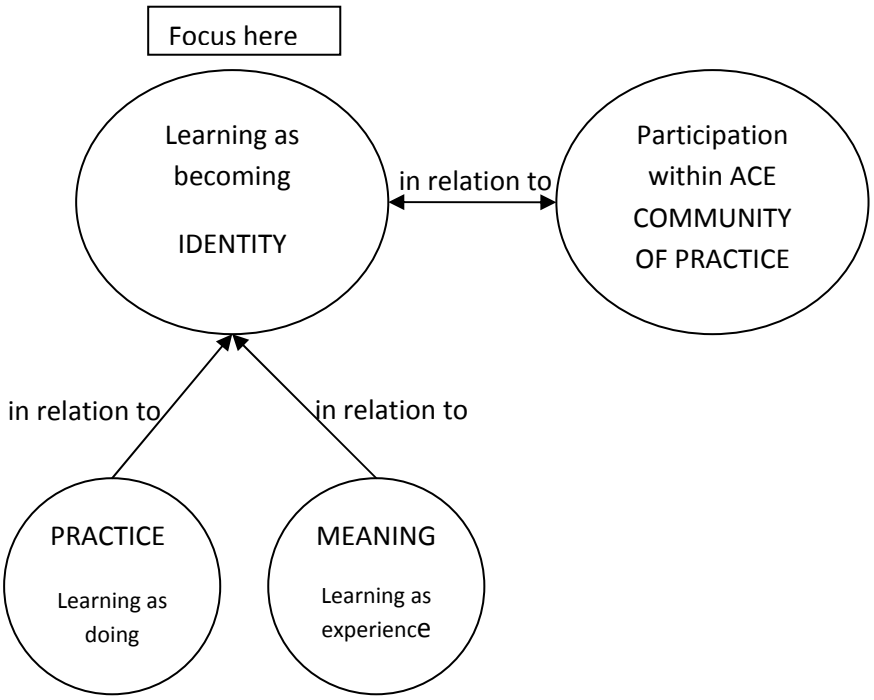

Figure 2: Identity is the focus while practice and meaning is seen in relation to identity

As Wenger says, these components are all mutually influenced by each other. Although these components influence learning, I am focusing on how they influence the component of identity.

Wenger (1998, p 149) gives five characteristics of identity:

- Identity as negotiated experience. We define who we are through our participation and by the way we and others reify ourselves.
- Identity as community membership.
- Identity as learning trajectory. We define who we are by where we have been and where we wish to go.
- Identity as nexus of multimembership. We define who we are by the way we combine our various forms of membership into one identity.

- Identity as a relation between the local and the global. We define who we are by relating our local ways of belonging to broader 'constellations'.

These characteristics help to guide data collection and analyses in relation to research questions two and three.

2.4 Literature review

For this study I draw on a range of literature within three areas.

Firstly I do a documentary analysis of the ML Further Education and Training (FET) curriculum.

Secondly I draw on literature in Mathematics teacher education both nationally and internationally that has used Lave and Wenger (1991) and Wenger's (1998) framework of learning and notions of learning as changing identity, for example I will draw on the work of Boaler (1997 &1999), Adler (1998 & 2001), Graven (2005) and Parker (2006).

Thirdly I review some of the local and international literature relating to ML (or Quantitative Literacy as is referred to in the United States of America (USA) (Steen, 2001)) and its implementation (Christainsen in AJRMSTE (2007), Pythagoras (2006) and Graven & Venketakrishnan (2006)) – with particular focus on the special issue of Pythagoras dedicated to ML.

2.4.1 A documentary analysis of ML curricula (FET):

The National Curriculum Statement (NCS) defines ML as "a subject driven by life-related applications of mathematics. Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world" (NCS, 2003a, p9). So the teaching of ML is done through participation in the modern world, tying in with the socio-cultural theory of learning. Wenger emphasises that "knowing involves primarily active participation in social communities" and requires "inventive ways of engaging

students in meaningful practices" (1998, p10). The NCS also states that ML must be taught in such a way that "learners will be provided with opportunities to engage with real-life problems in different contexts, and so to consolidate and extend basic mathematical skills" (NCS, 2003a, p9). Wenger argues that "meaning exists neither in us, nor in the world, but in the dynamic relation of living in the world" (1998, p54). He talks about this way of living in the world as participating in the world. This participation can be both personal and social and that it is a "complex process that combines doing, talking, thinking, feeling, and belonging" (Wenger, 1998, p55).

This gives a different meaning to learning. In the FET Maths class, learners were taught to manipulate numbers in a superficial and abstract manner, without context. Learning now is supposed to take place via social interaction as well as the self. Interpretation of scenarios is expected from learners and teachers. The NCS also states that ML "should enable the learner to become a self-managing person, a contributing worker and a participating citizen in a developing democracy" (NCS, 2003a, p10). Again the participating citizen highlights socio-cultural learning. The teacher guide (DOE, 2006, p 4) emphasises "the challenge for … teachers … to use situations or contexts to reveal the underlying mathematics while simultaneously using the mathematics to make sense of the situations or contexts, and in so doing develop in your students the habits or attributes of a mathematically literate person". The challenge to use the Maths to make sense of a situation, or vice versa, is easier said than done. Teachers can easily get caught up in the situation or in the Maths; the balancing of the situation (context) and the Maths (content) cannot be achieved.

Teachers struggle to balance the two and need practice to improve this skill. At the recent Association for Mathematics Education in South Africa (AMESA) conference held in Port Elizabeth (July 2008), a presenter gave the audience a graph on interest to interpret. The bulk of the presentation time was caught up in the presenter answering questions on how to answer the questions at hand and not on the topic prepared by the presenter. This demonstrates how some teachers find it difficult to adapt to the "new" situation of understanding, in this case graphs relating to real life situations. The teacher guide (DOE,

2006, p 2) stipulates resources needed to teach ML, including articles and advertisements from media that are supported by, for example, graphs and tables, sales brochures offering different payment options, recipe books. When teachers were trained initially, they were not necessary skilled at using these resources in the classroom, or even in their personal lives, in the manner stipulated by the ML curriculum. Teachers therefore need support to use these resources properly and effectively.

The teacher guide also mentions that "the actual time needed for each unit will depend among other things, on the prior knowledge of (the) learners, the interest of the learners and the amount of time needed to develop and practise the skills that the unit targets" (DOE, Jan 2006, p 3). This is an indication that the pace of ML is not as fast as that of the Maths curriculum where timeframes needed to be adhered to. But it is not an easy task for a teacher who, used to having timeframes stipulated the amount of time spent on each topic, now has to use his/her discretion with each topic and group of learners. One of the aims of ML is clearly that more time must be spent on topics so that learners can cope with Maths in everyday contexts. Bernstein talks of a weak framing "where the boundary between what may and may not be transmitted" is blurred (Bernstein, 1982, p 159). Teachers in South Africa have not experienced this kind of openness, where they can decide what they want to teach in which context and for how long.

2.4.2 Learning as identity transformation in Mathematics (teacher) education

Graven (2005) investigates the identity transformation of teachers that took place when they were involved in an In-service Education and Training (INSET) programme, and focuses on the identity transformation of one teacher. She investigates the relationship between the identity transformation of an INSET teacher and his involvement in different communities of practice, using Wenger's (1998) theory of learning. The theoretical field in this case was learning as being a participatory member in different communities of practice. This INSET programme became important due to drastic changes in South Africa's

curriculum where teachers' roles and responsibilities were supposed to change from a teacher-centred environment to a learner-centred environment. Some of the findings of the research were that teachers valued the participatory approach to learning in which their participation and acknowledged professionalism was considered a key resource (Graven, 2005, p 10). This was in contrast to their experience in other INSET programmes and workshops run by the Department of Education. Graven's research illuminated the way in which this teacher's (Sam) identity changed from a temporary Maths teacher to a professional Maths teacher with a long-term trajectory within the profession.

This story of Sam (the teacher involved in INSET programme) links up with my research problem. As Graven's article concludes: "this research highlights the importance of designing and implementing INSET in ways that enables teachers to positively transform their identities through providing them with 'access to a wide range of ongoing activities, old timers, and other members of the community; and to information, resources, and opportunities for participation'" (2005, p 10). In my research, I look at the relation between an ACE ML (reskilling) program, its design and structure, and the nature of possible transformation of the teachers' identities.

Graven's paper has limited applicability to in-service teacher education in South Africa because the study was based on an intensive program which was very different to the usual short term in-service programs. It is unusual for INSET program in South Africa to give attention to activities such as individual and group reflection sessions, commenting on each other's videos of lessons, field visits of overlapping communities, and presenting papers at AMESA conferences. However, the ACE program that informed my research is a two year program where teachers meet twice a week and receive some classroom support. In this sense, the empirical field of my research is similar to that of Graven's which is a longitudinal INSET program based on teacher learning about curriculum change. A further similarity is that, as in Graven's research, some of the teachers in my sample have not necessarily studied to become Maths teachers, therefore the notion of Mathematical confidence and learning in relation to changing identities can be an important aspect of learning. I see the

fact that the INSET program did not lead to a qualification, while the ACE program did, as the major difference between the two programs.

A further issue in the Graven study is that Graven was both researcher and presenter of the course. While Graven explains this relationship as dialectical it is still a concern that the INSET program was structured to enhance participation within a community of practice. The nature of the INSET was influenced by her theoretical perspective on learning, which involved the notion of learning as becoming. Once again this limits the reliability of her findings about teacher learning to other programs. My research of the ACE program is different as I was not involved in the course and thus provide an outsider's perspective on the research.

Graven (2004) addresses the overall educational problem of the absence of the notion of confidence in Wenger's theory of learning. The theoretical field in this instance is (teacher) learning. This research is relevant here as I also use Wenger's theory and investigate Maths teacher learning in an INSET program. The findings also assisted me in looking at the identity changes in teachers involved in the programs.

The ML curriculum aims at transforming the Maths classroom to a more integrated and context-driven subject area. This will then lead to a change in the role of the educator from the person standing in the front of the class, directing the learners in all aspects, to a facilitator in a learner-centred class where different learning areas are integrated. In the past, the teacher was not compelled to illustrate the role of Maths outside the classroom. This new challenge of integrating both context and content requires that teachers' identities need to be transformed, and they need to be trained so they can meet these transformation ideals (Parker, 2006, p 2). Academic institutions therefore need to produce teachers who meet the requirements of this new role by running appropriate pre-service and in-service teacher programs (Parker, 2006, p 3). How Maths teacher educators select and prioritise knowledge will determine the particular teacher identity they want to promote (Parker,

2006, p 4). Bernstein notes that “teacher identity is… embedded in the social practices of an education community within ‘a particular social order’ and develops in this context through relationships” (1982, p 73). This is in line with Wenger’s observations of the influence of the community of practice. An increase in access and openness to the different role-players in the educational community and different practices will influence the identity of the teacher (Parker, 2006, p 5). In this study, therefore, I need to look carefully at these aspects of the training program.

Gee adds to Wenger’s theory, defining identity as “a certain ‘kind of person’ in a given context” (2000/2001, p 99), and talks about how identity “can be used as an analytic tool for studying important issues of theory and practice in education” (2001, p 100). Gee also argues that institutions are reliant on practices to construct and sustain identity, but that identity can be constructed without the institution through discourse and dialogue (2001. p 103). So discourses and dialogue outside the ACE ML course can also assist in the construction of the identity of teachers.

Parker argues that in the shift to a new curriculum a new identity is implied for teachers (2006, p3). New curricula sometimes imply changed roles for teachers “in relation to their orientation to knowledge and learning, and in their conception of what it means to teach” (Parker, 2006, p 6). Teacher education, then, needs to design new pre-service and in-service teacher qualifications to help create the desired pedagogic identity required by a new curriculum (Parker, 2006, p3). In the ML curriculum teachers no longer teach mathematical content knowledge in its abstract form, but rather facilitate learning in context. Teachers thus need to implement new ways of doing and being in the classroom; therefore the design of the teacher education curriculum must adapt to this new identity. Teachers will then need “to develop new images of ‘good practice’ for mathematics teaching and new pedagogic identities that enable them to carry out these practices” (Parker, 2006, p 9).

Parker also argues that there are three different mathematically related pedagogic identities that a novice specialist Maths teacher should develop through any teacher education program:

1. An identity as a student of mathematical sciences (becoming an able Maths learner)
2. An identity as a student of Maths education (becoming someone interested in learning from research in the field of Maths teaching and learning)
3. An identity as a Maths teacher (becoming someone who can utilise their knowledge to help learners develop productive Mathematical identities and be motivated to learn the discipline at higher levels) (Parker, 2006, p 11)

My analysis of the ACE ML course reveals whether the above identities development was incorporated in the design of the course.

Parker (forthcoming) also argues that "the pedagogic identities projected by policy are symbolic and cannot simply be adopted by teachers without major internal changes to their orientations to mathematical knowledge and meaning, to who they are or want to become, and to the social and educational context in which they practice". So the reskilling of teachers to become ML teachers is a challenging task.

These articles shaped the thinking on my research.

2.4.3 **Local and international literature relating to ML curricula and its implementation:**

Venkat argues that ML "teachers are faced with implementing a subject which does not have established aims, understandings and practices associated with it" (2007, p 76). It is also so that the first grade 12 national common ML exams will be written at the end of 2008 where teachers will see which outcomes will be tested. Only now will teachers begin to

develop some sort of common understanding of which outcomes this learning area aims at as the examiners' and moderators' interpretations of these aims and outcomes will be evident. Bowie and Fritz argue the vital importance of an educational community in South Africa in order to develop a clear and shared understanding of what ML is (2006, p 29). This will assist in the effective implementation of the learning area.

The question is then: How are teachers currently implementing ML in the class? Venkat's research examines how different teachers implement the two different agendas of Maths and Literacy in ML (2007, p76). Since 2006, a section of the ML teachers have started implementing the curriculum without enough training and continued teaching Maths. Some did get training, but did not make the mind shift away from Maths. Some teachers continue with only the Maths content; others give activities in real-life scenarios but abandon the context early on to focus on the content. Venkat also identifies the tendency to 'displace' the Maths when other agendas are brought into the teaching of ML. Venkat grapples with the issue of "whether a mathematical agenda can and should be brought together with the literacy agenda" concluding that the mathematics and literacy agendas are not incompatible (Venkat, 2007, p83) and that teachers need to integrate Maths and literacy agendas in a supportive way. I argue that is easier said than done. Christiansen suggests that the ML curriculum has a Mathematical gaze (2007, p 101). She argues that the experienced teachers of ML (usually existing Maths and Science teachers) "would have to either teach from what they know … or would require retraining" (Christiansen, 2007, p 100) if the curriculum is to be implemented appropriately.

Christiansen (2007) sees the DoE definition of ML as ambitious. The definition of ML is as follows:

"Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern word. Mathematical Literacy is a subject driven by life-related applications of mathematics. It enables learners to develop the ability and

confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems" (DoE, 2003, Chapter 2, Definition of ML).

Christiansen argues that the first formulation "implies that the role played by mathematics in 'the modern world' is well known to the educators who have to implement this curriculum in order to ensure that the learners will have the required awareness and understanding. It also assumes that it is easy to facilitate this awareness and understanding" (2007, p 92). She challenges this assumption, which can have implications for the implementation of the ML curriculum. Christiansen also claims that the second formulation out of the definition "clarifies that the curriculum is not to be driven by mathematics, but by applications" (2007, p 93). She concludes that the NCS "assumes direct transfer to be a straightforward process" (2007, p 95) and asks if teachers in the classroom are competent and equipped to facilitate this. She later claims that the teaching of Maths "for critical citizenship and/or in relevant applications requires knowledge both in and outside of mathematics" (2007, p 101) and notes that teachers will be faced with serious challenges.

Lave (1996) claims that learning will be enhanced if we teach in such a way that learners do not see the world of school and the rest of their lives as different communities of practice (Boaler, 1998, p 89). Boaler asks if teaching in a different "context" really makes Maths more meaningful for learners (Dickson, 1999, p 37). This relates very much to ML. Dickson analysed the research by Boaler on two different schools with different approaches to teaching Maths. She concluded that learners of the school where activities were set in different context "could transfer their learning to real-life problems (as) they had been enculturated into 'practice' of thinking and interpreting in the classroom that allowed them to do the same outside the classroom" (Dickson, 1999, p 38). Boaler, however, argues that the different 'communities of practice' assisted in this school's learners' ability of "being able to transfer their knowledge to out of school situations".

Christiansen (2007, p 101) also claims that "a teacher of ML would have to know enough mathematics and enough about applications of mathematics, misuse of mathematics, and

effects of using mathematics to further learners' awareness and understanding of the role that mathematics plays in the modern world, help them develop the ability and confidence to interpret and critically analyse social, political and practical situations using mathematical skills transferred from one context to another". When retraining/reskilling is intended, all the above needs to be taken into account.

Chapter 3: Research Design (Overall)

3.1 Introduction

In this chapter I explain how I set about achieving my research aims, and indicate the sources of data and the methods I used for data collection. I also explain how I selected the sample.

I explain what I did, who I did it with and why I did it this way (Opie, 2004, p 52) in order to answer the research questions stated in Chapter 1:

1. What kinds of ML teacher identities are promoted within the ACE? How do these relate to the agendas embedded within the course design?
2. What is the nature of the emerging ML identities (if they indeed emerge at all) of the participating teachers?
3. What is the nature of the influence of the learning components of meaning (learning as experience), practice (learning as doing) and community (learning as belonging) on the development of ML teacher identities? I.E. how does developing mathematical literacy competencies, teaching experience and participation within communities, where ML is a focus of the activity, influence teachers' developing identities?

3.2 Research Methods

My overall research design is a qualitative study involving a case study of one group of teachers participating in an ACE ML reskilling course. The choice of a qualitative study is in keeping with the aims of my research and my theoretical framework. The term qualitative research means "any type of research that produces findings not arrived at by statistical procedures or other means of quantification. It can refer to research about persons' lives, lived experiences, behaviours, emotions…" (Strauss and Corbin, 1998, p 11). There are times that data is quantified, but the analysis is interpretive. A qualitative study allows me to

analyze in-depth the identity transformation that takes place amongst participants in the ACE ML programme.

3.3 Selection of case study

Mouton describes case studies as "studies that are usually qualitative in nature and that aim to provide an in-depth description of a small number (less than 50) of cases" (Mouton, 2001, p 149). The case in focus in this study is the teachers participating in the ACE ML reskilling course at a university in Gauteng and conducted by a non-profit organisation in partnership with the university. They are the first cohort and therefore make this case unique. I chose this case partly for convenience but also because it is not part of the institution where I work. I am therefore an outsider to the participants and course coordinators.

3.4 Data Sources and Data Collection

The five main sources of data are:

1. Documentary analysis of the course material
2. Course coordinator interview(s)
3. Reviewing of participating teachers' biographical details
4. Teacher Questionnaires
5. Teacher interviews

I now explain how/why these sources were used:

The documentary analysis of the course material was done using the collected ACE handouts. I focused on modules 1 and 2 of the course as they were already completed by the participants at the time when the research was conducted. Modules 3 and 4 have not

been analysed and were still being conducted at the time of the analysis and are outside the scope of this study.

The official academic proposal for the ACE ML course was put through and registered with SAQA in 2006 and approved in 2007. All four modules are compulsory and need to be passed. All these modules are first year courses. The documentary analysis assisted me in answering research question 1.

The course coordinators changed during the two year period. So I conducted two interviews, one with each of the coordinators, gathering as much information as possible. These interviews assisted me in answering research question 1, aimed at gathering information about the teacher's identity the course wanted to promote.

The biographical details of the participating teachers were analysed to provide background information on the teachers' histories which, in Wenger's framework, are important for research question 3. This assisted me in understanding teacher histories before they started this course. Wenger claims that one's past (history), present and future influence your identity development and I therefore analysed the teachers' histories. The teachers' background before the course is also pertinent to research question 3 as this question deals with the developing identity. The analysis of the course material in conjunction with the interview with the course coordinator(s) assisted me in answering the second part of research question 1.

Wenger says that "an identity is a layering of events of participation and reification by which our experiences and its social interpretation inform each other" (1998, p 151). Each person's participation in communities is different, our social interpretations are different, so our "journey" in life will differ and, thus, also our identity. I argue that the interviews allowed individual respondents to express their own "journey" in identity transformation. Each

person's identity transformation is unique and therefore I needed an instrument, in this case the open-ended interview, which could accommodate the different participants' journeys.

A questionnaire (see Annexure A) was given to all the teachers who gave their consent to be involved in the research. The questionnaire assisted in answering research questions 2 and 3.

The questionnaires helped me to plan for the face-to face interviews I had with the seven participating teachers in the course. This was the main instrument as I wanted to study in-depth the possible identity transformation of teachers as mentioned in the second research question. I used a questionnaire, knowing that this would probably not get to the complexity of the identity transformation process. Responses from questionnaires can be limited by the medium of expression (writing) and the time and space needed to communicate. The questionnaire was, however, a useful first round of data gathering (Opie, 2004, p 95), allowing me to get a sense of the group of ACE ML teachers. But it is the interviews which were the primary source of data for this research.

The interviews probed similar data to that of the questionnaire, but were more open and probed deeper to acquire more detailed information on the identity transformation. Data in both written and verbal forms enabled comparisons between responses and verbal data assisted me in answering research question 2 and 3.

According to Wenger, identity transformation is a process that takes place over time. This can be unnoticed by a teacher him/herself unless probed to intentionally reflect on this. [In my Master's course we were all required to reflect on our own identity transformation in the field of Maths education. It was only then when, through probing, I became aware of the changes that took place in me.] I decided to focus on interviews because I could probe

for more information, allowing the interviewee to reflect on the process of their identity transformation.

3.5 Selection of sample for the interviews with the teachers:

I used the questionnaire responses to select participants for the interviews. Fourteen participants completed the questionnaires out of the ACE ML group of eighteen participants four were absent the day I conducted the questionnaires).

I first eliminated those who were not teaching ML. I did not want to interview participants with little or no experience on teaching ML because I felt this was likely to limit their engagement. In looking at the responses of the questionnaires, I found that those teachers who were not teaching ML at that time or before wrote very little resulting in possible multiple interpretations to their responses.

I was left with a possible eight teachers who taught ML. One of these requested not to be used in the interviews due to time constraints and I was left with seven interviewees. All seven interviews were conducted and transcribed.

3.6 Limitations of the interviews with teachers

It was challenging to find time for the interviews during the ACE ML course as the participants had classes two afternoons a week, starting just after school and finishing late. Data collection can be very time consuming – a limitation of case studies, as noted by Mouton (2001, p 150). For this reason I conducted most interviews at the schools, with permission of the schools' senior management. I requested and was given quiet venues. By going to the schools, I could interview two or three people a day, which resulted in quicker data collection than interviews at the ACE ML course.

The interviews were conducted in English, the teachers' second or even third language. This was not ideal but was my only choice as English was the only shared language between the interviewees and me. During the interviews I felt that the use of English was an obstacle. There were times when interviewees found it difficult to express themselves and would comment, for example: "How will I now put it?" There were also times where interviewees answered questions by merely rewording the same question into an answer, for example "How did your teaching change?" was answered as "My teaching changed". In future research, a translator present at the interviews would assist in overcoming this language barrier. On reflection and while I was transcribing the interviews, I realised that I could have prompted the teachers more and thus maybe gathered more information, particularly when teachers' answers were rewordings of questions. In addition to the teacher interviews, I conducted interviews with the two course coordinators.

3.7 Ethics Statement

The confidentiality and anonymity were carefully monitored and maintained (Opie, 2004, p 115) in this research. Participants' names were not used in the research write-up and the raw data was only accessed by the researcher and the supervisor. All the data gathered for the study is securely stored in the researcher's office at the University of Johannesburg (where the researcher is employed at), and will be destroyed three years after the completion of the analysis and reporting.

For the purpose of this study permission was requested from the university and the organisation who conducted the ACE ML program. Permission was then granted.

A letter of consent which was given to all the teachers in the ACE ML course in which I ask their permission to collect the mentioned data and their willingness to participate (See Annexure D). I described this invitation to participate in the research verbally after handing

out the consent forms. I was available for any questions and my contact details and those of my supervisor were provided on the consent forms. Those who were willing to participate signed the consent form.

I applied to the Human Resource Ethics Committee (HREC) of Wits University for ethical clearance to conduct the research. The application was successful.

3.8 Time line

In June 2008 I did the documentary analysis of the course. During July I asked the ACE students for their permission to participate in the research and to access their biographical information. During August and September I interviewed the participating students and course coordinators. Thereafter I analysed the data and wrote up my findings.

Within my theoretical framework it is assumed that some shifts in participants' identities will occur due to participation in the ACE ML program. The nature of the changes in identity, whether positive or negative in relation to the aims of the ACE ML programme, and the factors that enable or inhibit such changes, are what I explore in the data analysis that follows.

Chapter 4: Documentary analysis of the ACE ML course

The ACE ML course is a certificate in Education for the reskilling of teachers to enable them to teach Mathematical Literacy. Reskilling in this situation implies that the participants are skilled teachers in a learning area other than ML and will become skilled ML teachers. The entry requirements for the ACE ML course are a pass in Matric Maths and the course targets teachers who want to be reskilled as ML teachers. This implies some experience of Maths during schooling and some degree of success in studying the subject in the FET band.

In the introduction to the course it is stated that the ACE ML programme aims to:

1. Provide a course which covers issues relating to the National Curriculum Statements within an OBE approach.
2. Offer a range of teaching resources which can be critically evaluated and incorporated into teacher's own teaching programme.
3. Develop an integrative approach to learning and teaching.
4. Promote an atmosphere which will foster active participation in the course.
5. Promote a space for dialogue with colleagues, and encourage this dialogue to be taken into their schools.

The aims relate to issues of curriculum, some teaching resources which can be incorporated into teaching, and the development of an integrated approach to teaching and learning. It is evident that the first aim of the program stated in the introduction relates to the National Curriculum Statement within an OBE approach. This relates to knowledge and understanding of the curriculum which relates to Wenger's component of meaning. The fact that the OBE approach is also mentioned points to the intended promotion of this approach in the classroom. Aim one on OBE approach and the second and third aims which is on teaching resources and developing an integrated teaching approach, related to the practice of teaching which aligns to Wenger's component of practice although it is not stated as changing the practice, but rather offering the range of teaching resources. The last two aims

focus on the nature of the intended participation within the ACE community by highlighting the importance of active participation and dialogue. Although the two aims are not stated in community of practice terms, they do relate to Wenger's component of 'community'.

The ACE ML reskilling programme consists of four modules:

Module 1 – An introduction to Mathematical Literacy and its rationale

Module 2 – Numbers, Space, Shape and Measurement

Module 3 – Financial Mathematics and Functional Relationships

Module 4 – Statistics and Probability

4.1 Analysis of modules

I will only analyse modules 1 and 2 as they had already been covered in 2007 by the pilot group at the time of this research. Within the modules are statements relating to how the course communicates the aims and the outcomes of each module.

4.1.1 Module 1 – An introduction to Mathematical Literacy and its rationale

In the overall purpose and outcomes of module 1 it is stated that this module aims to "improve the confidence and competence of the teachers as a ML teacher in today's classrooms". This implies developing the teachers' way of being in the classroom (developing an identity of confidence and competence) as well as relating to the practice of teaching (developing competent practice). The purpose statement of module 1 further indicates that through this course the teachers will develop their skills of planning, teaching and assessment, using a range of teaching technologies (indicating a focus on the practice of teaching).

However, the specific stated outcomes of the module have a greater emphasis on information and understanding in relation to the curriculum documents, as can be seen by the following outcomes of module 1 (ACE ML Module 1 course outline, 2007, p 2):

- Critical analysis of national and international literature on maths literacy
- Introduction to the new FET curriculum documents
- Discussion of the implementation of the Mathematical Literacy Curriculum and the design of learning units for use in South African schools
- Analysis of Mathematical Literacy learning materials and text books
- Understanding the equivalence between the DoE FET Maths Literacy Curriculum and SAQA Unit Standards
- Analysis of exemplar Matric Mathematical Literacy Papers
- Critical analysis of issues related to the contextualisation of mathematics

These outcomes seem to suggest a focus on understanding curriculum issues and curriculum implementation issues, thus suggesting a focus on Wenger's learning component of meaning. The discussions on the implementation of the ML curriculum mentioned in the third outcome may potentially link with classroom practice and could enable strengthening the teachers' identities through negotiation of meaning. Those links, however, are not stated in the outcomes. The discussions could, for example, include engagement between more and less experienced teachers and facilitators with different experiences, skills and opinions. Teachers could share ideas and experiences, and in the process, meaning can be negotiated as "meanings exist neither in us, nor in the world, but in the dynamic relations of living in the world" (Wenger, 1998, p 54).

Active participation and dialogue are explicitly noted in the aims of module 1:(ACE ML Module 1 course outline, 2007, p 4):

- Lecture sessions will allow for:

  a) Reflecting on course material

  b) Interacting with colleagues and presenters about the material

c) Developing your critical thinking about the information presented

d) Active participation in discussions

- You will not sit back and listen to the presenters during the lectures; you must come prepared to participate actively!

Aims (b) and (d) and the last statement reiterate the importance of engaging with others and being an active learner in the course. This resonates with the notion of Wenger theory which is focused on "learning as social participation". Wenger sees participation as "a kind of action and a form of belonging". According to Wenger's component of 'community', participation is central in enabling change in what teachers do, who they are, and how they interpret what they do (1998, p4).

In addition, aim (b) encourages teachers to interact with colleagues and course presenters. This could enable the strengthening of their unique identities as "each participant in the community of practice finds a unique place and gains a unique identity, which is both further integrated and further defined in the course of engagement in practice" (Wenger, 1998, p 75). Through their interaction in the class, a distinct community of practice can form where teachers will "sustain dense relations of mutual engagement organized around what they are there to do" (Wenger, 1998, p 74). This in itself could foster the development of identities as ML teachers.

The document on module 1 also encourages thorough preparation for lectures "so that teachers can get the full benefit of discussions and activities through being an active participant in the sessions" (ACE ML Module 1 course outline, 2007, p 3). In order to be active participants, some knowledge of the topics is needed. The preparation that teachers do before the classes also provides an opportunity for them to make sense of the course, making meaning of what is at hand.

The course also aims to develop skills of planning, teaching and assessment, using a range of teaching technologies (ACE ML Module 1 course outline, 2007, p 2). This implies intent to change the teachers' way of doing and will have an influence on teachers' practice in the classroom. "The course will also offer some reflection and small research opportunities, where certain portfolio activities will call on you (teachers) to try things out in your class. This will encourage you (teachers) to be critically aware of your own teaching activities, which is what reflective teaching is all about" (ACE ML Module 1 course outline, 2007, p 3). When these activities are tried out in class, these hands-on experiences can enable learning through doing, trying out ideas, and can possibly lead to new forms of practice and new ways of being in the classroom.

In the purpose and outcomes section of module 1 it is stated that "the two assignments in module 1 will focus on key areas relevant to (the) use of resources in (the) mathematics classroom". It further states that the first assignment "will cover the most important features of mathematical literacy" (ACE ML Module 1 course outline, 2007, p 2). This assignment focuses on the meaning of the ML curriculum, thus assessment knowledge of the curriculum document. So the first assignment is in alignment with the stated outcomes of module 1. The second assignment requires teachers to design their own ML assessments (ACE ML Module 1 course outline, 2007, p 2) , thus focusing on the practice of developing assessments – learning by doing. A significant number of sessions (11 out of 26) were spent on assessment.

The module also encourages teachers to integrate their study material with their work in schools and states that "sharing ideas will be a self-helping as well as a community building exercise" (ACE ML Module 1 course outline, 2007, p 3). This strengthens the mutual engagement, meaning making and becoming competent through reification. Gee links this to a school reform that calls for creating classrooms as "communities of learning where collaborative learning and distributed knowledge is emphasized. This results in a distinctive creation of identity amongst the class members" (Gee, 2000, p 107).

The module also states that it wants participants to reflect on their practice. This will assist participants in critically evaluating their practice and changing their identities. By discussing information that was read, the community of practice is strengthened and the environment is conducive to a change in identity as new insights and changes in perspective can occur.

In summary, according to the documentary analysis of module 1, the purpose of this module relates to changing and developing teachers' way of being and practice in the classroom (through teachers' competence and confidence as ML teachers in today's classroom). According to the outcomes of this module, knowledge and thus the component of meaning is key to this module. Similarly the assignments focus on knowledge and classroom practice.

These descriptions reveal that in module 1 the learning component of meaning and practice are primary and the component of community is also noted through the enhancement of active participation and engagement with the material, the fellow teachers and the lecturers. This intends to enhance the negotiation of meaning, the forming of a community of practice, critical thinking and reflection on issues at hand. Words like "active participants, discuss, do activities" confirms this.

4.1.2 Module 2 – Numbers, Space, Shape and Measurement

Using the same rhetoric of module 1 (and in fact identical wording), the purpose of module 2 is stated as aiming to improve the confidence and competence of the teachers as Maths teachers in today's classrooms (ACE ML Module 2 course outline, 2007, p2). As in module 1, this implies that the course aims to develop the teachers' way of being in the classroom. However, this module includes a focus on the practice of learning in relation to developing skills in planning, teaching and assessment, using a range of teaching technologies. So this aims to develop the teachers' way of being in the classroom, which relates to identity, as well as to develop the teachers' practice in the classroom, or their way of doing.

The outcomes of module 2 are as follows:

- Demonstrate knowledge and understanding of the mathematics in the course content.
- Demonstrate the ability to solve problems based on the content as embedded in real-life contexts.
- Demonstrate the ability to apply the knowledge and skills attained to the teaching and learning of Mathematical Literacy in the FET band in accordance with the ethos developed in Module 1.

The first outcome indicates an emphasis on the content knowledge and understanding of numbers, shape, shape and measurement. This is the first outcome and, I argue, the most important for this module. This relates to Wenger's learning component of meaning, learning as experience.

The second outcome relates to problem solving based on the content as embedded in the real-life contexts. What I conclude out of this is that the participants need to develop competence in putting mathematical content in context. Here again we deal with learning as experience, where meaning making is engendered. This claim can be strengthened by the stated outcomes of session 1: making sense of numbers in media reports. Here numbers must be understood in the context of media reports, a concept embedded in a real-life situation. An example of problem solving is the outcome of session 5: Create floor plans of rectangular shaped houses using a rectangular or square footprint to estimate, measure and calculate the perimeters and areas. Again, the content is embedded in a real-life context. In addition to this, to "demonstrate the ability to solve problems …", impels the learner to show that he/she can generate solutions, which relates to practice. The second outcome of module 2 therefore reflects Wenger's component of meaning as well as practice.

The third outcome of module 2 is to demonstrate the ability to apply the ML knowledge and skills gained in the teaching and learning of ML in the FET band in accordance with the ethos

developed in module 1. The intention is to apply the content and skills learned in the classroom. This relates to Wenger component of practice, learning as doing.

There is one assignment in module 2:

1. Find a paragraph in a media report containing social statistic numbers. Use this paragraph as the context for a 40 minute ML lesson and write down the lesson.
2. Include an introduction and a short piece for learners to read.
3. Teach the content listed using your own material, e.g. a worksheet.
4. Relate this content material back to the context you have chosen.
5. Include appropriate timing of each stage of the lesson.
6. If you are a ML teacher and would like to teach your lesson to your class, write some feedback on the lesson.

The intended aim of this assignment is to give the participating teachers the skills to compile a lesson plan for a ML class. This emphasises learning as doing. The teachers were also encouraged in the assignment to teach the prepared lesson and to then write some feedback on the lesson, which I perceive as encouragement to reflect on their own practice. So a further area of development for these teachers is not only compiling the lessons, but also reflecting on their classroom practice. This is another aspect of their practice the ACE ML course attempts to develop. In session 16 teachers had to critique a lesson plan and identify the essential elements of a good lesson, very different aims to session 1. To identify the essential elements of a good lesson is a way of determining and enforcing the shared repertoire of the ML community. Wenger talks about the shared repertoire "that the community has produced or adopted in the course of its existence, and which have become part of its practice" (1998, p 83).

Words that also appear in the module are cultural forms, artefacts and ethnic beadwork, and World Cup 2010. This indicates to me a practice where that emphasises the use of real-life scenarios in class that are familiar to the communities these teachers serve. The module aims at skilling teachers in linking the learners' real life with what is taking place in the classroom, linking context with content. There are also attempts made to skill learners (participating teachers) on how to read a map, how to calculate time differences when travelling internationally, adjusting recipe quantities, and how to do navigation using a compass or trigonometric ratios. I argue that the intention was to develop ML competence also links to new ways of acting and being in the world and thus to new identities.

The aim was that, by the end of module 2, participating teachers would be competent in the content of numbers, space and shape as well as measurement. They would be able to compile ML lessons and teach the lessons according to the ML ethos and be able to integrate the content with real-life contexts.

Chapter 5: Data Analysis

5.1 Analysis of interviews

5.1.1 Analysis of interviews with course coordinators

I started my data collection with the two course coordinators' interviews. The first course coordinator, Jane (pseudonym), was the course coordinator for the ACE ML course from the beginning of 2007 to mid 2008 when she left to take up a job at another institution. She taught two modules and was the course coordinator for three quarters of the duration of the course. The course coordinator who took over from her was Kate (pseudonym). Kate was one of the lecturers of the ACE ML course but, after Jane left, she took over as course coordinator. Both course coordinators were willing to assist me in the interviews. I interviewed both of them with the main aim of understanding what they perceived as the intended identities for teachers.

Interviews with the course coordinators were conducted primarily to provide insight and data relating to research question 1: What kind of ML teachers identities are promoted within the ACE? How do these relate to the agendas embedded within the course design?

I analysed the interviews of the course coordinators in relation to the four components of Wenger's framework: meaning, practice, community and identity. The interview was structured around the following four key questions (see Annexure B):

1. If you describe a highly successful student in terms of meeting the aims of the ACE course, how would you describe him/her?
2. How does this highly successful student participate in and engage with people on ML?
3. Who does the highly successful person discuss ML with?

4. If we look at the course design, how does it intend to foster identity development in participating teachers as this is a reskilling course?

To analyse the two interviews, I broke them down into utterances to ascertain where emphasis was placed in terms of the various learning components.

In the interviews with the two course coordinators there were fourteen utterances in response to the first question. Kate made four utterances on question 1, of which two related to the component of meaning; two were on the component of practice and none related to community and identity. Jane made ten utterances on question 1, of which three were on the component of identity, three on meaning, four on practice and none on community. In total, for question 1 there were six utterances on practice, five on meaning and none on community.

The learning component of Wenger that was mentioned most frequently in answering the first question was on practice, in particular, classroom practice. Most of Jane's utterances were on classroom practice, learning as doing, and two of Kate's four utterances were on practice. Jane described a highly successful student in the ACE ML course as follows:

> Someone that knows what is expected of them with regards to assessment and has a good understanding of your different cognitive levels. Somebody that is able to take the context for anything interesting that they come across in the newspaper, in adverts, something they see on TV and from that actually find the maths in it and be able to develop something that is relevant to their classes.

According to the above quote, Jane claims that the ACE ML course aims to help teachers understand the curriculum document, which sets a platform for how to teach the subject, how to do assessment and how to develop classroom activities that relate to the real-life

contexts. Jane also mentions issues around classroom practice in relation to the pedagogy of teaching:

> I would say you would … um … actually ask learners for input as much as possible. Let them perhaps speak in groups about this specific lesson topics or context in terms of the maths and have them get answers and then evaluate and critique all of these answers … um … in a responsible manner.

So Jane saw a student coming out of the ACE ML course as someone who can apply a learner centred approach in class, apply group work effectively, and prompt the class to be critical about their thinking. These classroom practices resonate well with the learner centred OBE approach which underlies the new curriculum.

Meaning was the second most common utterance in answering the first question. On describing a highly successful student of ACE ML, the first point Kate made was that this student would gain a good knowledge of the ML curriculum. This relates to meaning as Wenger describes: meaning as learning as experience. Both course coordinators mentioned this and thus are in line with the focus of the outcomes in module 1. Evidence of an utterance on meaning is found in the following comment by Kate: "It is a person who knows the curriculum document well and has a good understanding of what is in the curriculum". An example of an utterance by Jane on meaning is: "(to) learn more and more about the context and Maths curriculum you can apply to that context." Both Jane and Kate made mention of the ability to link content with context. A focus of the curriculum document is the use of contexts; both the course coordinators emphasize that a successful ACE ML student will have a good understanding of this and a new way of acting in the world. One of the major differences between ML and Maths is that, in ML, the content is driven by real-life context. Students' ability to do this is claimed to be a key outcome by these course coordinators. Kate reiterated this: "Somebody that is able to take the context for anything interesting that they come across in the newspaper, in adverts, something they see on TV and from that actually find the Maths in it and be able to develop something that is relevant to their classes."

In relation to the learning component of identity, Jane made utterances which related to ways of being. For example, she said a successful student will be “passionate about the subject and [would not] feel threatened in some way by the context”, and “must not feel [they] are contained in some way or another”. She saw the course as able to make a participating teacher passionate about ML, confident with any context that might be presented to him/her, and feeling free to, for example, explore the subject. Kate did not make any utterances in relation to this component.

On the second question (How does the course coordinators see a highly successful student in ACE ML participate in and engage with people on ML?), there were ten utterances in total from the two course coordinators. Kate made three, of which one related to the component of meaning, two to community, and none to practice and identity. Of Jane’s six utterances none were on meaning and identity, two were on practice, and four were on community. Together there were seven utterances on community, two on practice, one on meaning, and none on identity. So most of the utterances on question two related to the learning component, ‘community’. Jane mentioned that a highly successful student of the ACE ML course will see not only the classroom as a ML community, but will also see potential for engagement about ML in communities outside the classroom. This includes, for example, their family environment, teachers from other schools. Jane’s explained:

> I would like to not only have the teacher speak in the ML way in the classroom, but also out of the classroom as well when they with their family, when he is reading a newspaper, whether they are with other teachers in the school … um … thinking of ways to see the world through mathematical eyes not only in the classroom, but everywhere else.

Kate’s comment on community reiterated the classroom as the primary community of practice where teachers engage with ML. Another comment by Kate was revealing: “I am hoping that the person will already have discussions and meetings with other ML teachers within their schools.” The word “hoping” struck me as one of her personal aims for these

participants. Another community Kate felt a successful student should be involved in was cluster groups, “where they share ideas”. Wenger talks about community members influencing each other when they engage.

Jane was the only one who commented on the component of practice and new ways of acting in the world, (thus identity). She said she would like to see a highly successful student “reading a newspaper” in a mathematical way, that he/she should “see the world through mathematical eyes”. She would like to see that the person’s way of doing (practice) is mathematical in all spheres of life. This links up with an utterance made by Kate when she was talking about seeing the world through the lens of how it can be used in the classroom. I argue that this is another important aim of the course which links to the component of practice and speaks of a “teacher identity” where the person notices the Maths in everyday situations and evaluate whether or not it could be useful in the classroom.

Kate mentioned the following: “They [the participating teachers] ask content knowledge [questions] as well. I think particularly this group – [in] these modules there is quite a strong emphasis on the content… So they also tend to need some help with the content.” Kate claimed that questions about content will be asked when the ACE ML participants engage with people on ML as some do not have a strong mathematical background. This relates to the component of meaning, learning as experience. It seems to me that Kate anticipates that some of the participants will continue to need support on the learning component of meaning in ML, even after the curriculum document has been covered with them.

The third question probed who a highly successful student discusses ML with. Jane‘s first response was: “Well anyone he could encounter”. This implies that she would like to see a highly successful student discussing ML anywhere with everyone. Kate responded as follows: “If you are passionate about a subject, you would just also discuss it at home with your husband, with your kids”. This to me implies that a highly successful student coming out of the ACE ML course, according to Kate, would be passionate about the subject and

discuss ML with everyone, even at home. She further added that “this [ML] should take over all aspects of your [the highly successful person’s] life.” This reiterates Jane’s point of discussing ML with anyone anywhere and adds that ML will become part of a student’s way of being.

The fourth question in the interview with the course coordinators focused on how the course, although a reskilling course, aimed to foster identity development in participating teachers. Both course coordinators claimed that the deep engagement with the curriculum document assisted in the fostering of identity development. Kate claimed that, by the end of the course, teachers would know what is in the curriculum and what is not. Jane argued that when meaning of the subject is gained it can be meaningfully translated into the classroom practice, which will foster a specific identity:

> once they gained that meaning of what the subject is, they can translate the meaning that they gained into practice, that is the class practice that they will work with and also building this into the classroom practice will give them a specific identity in terms of who they are and the way other people see them, … um … what they are in terms of identity.

Jane argues that because the ACE ML course attempts to enforce the meaning of ML, this will lead to a change in classroom practice and ultimately a change in teachers’ identity. This resonates with Wenger’s claim that the four learning components are deeply interconnected and mutually defined. Designated identities to become ML teachers will develop through what the teachers learn at the ACE ML course.

It must be noted that Kate and Jane made no links to the component of community when responding to this question.

5.1.2 Analysis of the interviews with the teachers

In this section I analyse the seven interviews with the teachers in the ACE ML course. Some details about these teachers is given below:

Table 1: Biographical detail of interviewees

Pseudonym	Years teaching experience	Years ML teaching experience	Reason for doing ACE ML course
Ben	15	2	No one on staff wanted to teach ML and he was interested to know what ML entails.
Bano	4	3	Liked challenges as ML was a new subject he wanted do something new.
Metse	4	3	She wanted to find out what ML was about as people said it was difficult.
Lisa	5	2	She was interested to see what ML entails as she did Maths but never continued it at tertiary level.
Soma	5	6 months	She wanted to know more about this subject ML.
Maphi	12	6 months	She was the HOD of Maths and later ML and thus wanted to know more about the subject.

Lieko	4	6 months	The principal told her to do the course.

All these seven teachers taught in township schools.

During the interviews, the seven teachers described their learning through their involvement in the ACE ML course. They focused on their knowledge of the curriculum, their abilities to understand ML (meaning), their practice in the ML classroom, and their way of interacting and talking to people in different communities. Each of these changes related in some way to changing ways of being in the world and thus to the component of identity.

In the interviews there were a range of utterances by teachers which related to these components. Because I chose Wenger's four component model as my theoretical framework, I analysed and organised my data in terms of meaning, practice and community. In so doing I place identity at the centre as this is my main interest. As mentioned earlier, Wenger notes that any component can be placed at the centre and related to the other components. My third research question is: How do developing mathematical literacy competencies, teaching experiences and participation within communities, where ML is a focus of the activity, influence teachers' developing identities? I therefore analysed teachers' utterances about the changes that took place in each of the three learning components (meaning, practice and community) in relation to identity.

5.1.2.1 Meaning

I will now draw on teachers' utterances to highlight the teachers' learning as changing experiences, and changing understanding of the ML curriculum as meaningful. In doing so, I explore the links between these experiences and the changing ways of being and becoming (new identities).

In the past South Africa only had Maths as a subject and some teachers did not know about ML. The subject ML is defined as "driven by life-related applications of mathematics" (DoE, 2003, p 9). In module 1 of the ACE ML course teachers were exposed to the curriculum document and readings related to ML to give them a better understanding of the subject. In the interviews, all seven teachers commented on the component of meaning: 38 utterances on meaning were made.

Four teachers first explained that they had little knowledge of ML. For example Lieko said:

> Actually I did not have a choice [in doing the ACE ML course]. Yah, I didn't know anything about it. Yah, so the principal told me that … [there are people], they are looking for people who can attend ML course – those who don't have ACE. Yah, that's how I've attended the course. I was reluctant to do it. Yah, because it was for ML, and I didn't know anything about ML ... And then I was told that I was given ML classes. But by then I was very nervous because I was asking myself what am I going to do in the class because I don't know anything about this subject.

Later on in the interview she expressed her better understanding of ML: "But then, since I attended ACE I found that ML is a very simple subject for me …", and even later: "Now I am able to distinguish between ML and Maths and it also helped me because ML is all about what we do everyday".

Another teacher, Metse, said: "And then after some time I got to know what it is really about [ML]."

This shift indicates learning as changing experience. The teacher's changing interest in the subject is noted in the interview. This teacher, Metse, who was reluctant to attend the ACE ML course, said later on that she did not want to teach any subject other than ML. This indicates a change from a forced trajectory into the subject to ownership of a longer term trajectory of not only teaching the subject but focusing on it.

When asked what the main benefits are that the teacher has gained from the ACE ML course, Bano answered:

> I really benefited a lot because it's the first time that I hear about ML it is also an animal that I never seen before that I am just hearing about. So I wanted to see if I now got an idea of what is happening in ML. It is really talking about life situations. Things that we do in there we now can prepare for the learners before they can come face it outside.

Some teachers initially thought ML was a learning area of lower value, that teaching the learning area was "impossible", that it was a sub-subject to Maths. Since their involvement in the ACE ML course, their attitudes to ML have become more positive.

Utterances that are an indication of this are:

Metse: I thought ML is, for what I know, its basic Maths. I thought that was it. Little did I know that it is everyday things.

Maphi: No I have changed. The thing is I had an attitude towards the subject because of I didn't have that knowledge. But my attitude has now been positive. I am now positive towards ML.

> When I started learning the content, understanding the content, then I started to know: No, this is not so much difficult.

In the ACE ML course teachers were confronted with for example, the curriculum document, the content knowledge, the assessment policy, and how to approach the concepts. This knowledge enabled them to change their understanding of ML. All seven teachers indicated in their interviews that they were more positive about the subject as a result of the ACE ML course.

Five teachers mentioned that ML is now a "good subject" because they are familiar with the content and the approach to the subject. I interpret this as teachers feeling more confident in interacting with and understanding ML content. Lieko now calls it a simple (easy) subject. So their attitude on ML changed due to more exposure to the subject content and the approaches to ML. Utterances that illustrate this are:

Maphi: …When I started learning the content, understanding the content, then I started to know: No this is not so much difficult … [The content knowledge] made me to change towards the subject as a whole.

Somo: I've benefited a lot now because my mind was only focused on Maths knowing that $x \times x = x^2$ but only to find that we have to do things that are real [life] in ML.

Teachers' knowledge of ML increased and the application of this knowledge extended beyond the classroom. They claimed to have gained a great deal of knowledge of the subject in the ACE course. Their level of expertise increased with a result and it appeared that they had a new outlook on this subject:

Somo: I was not knowing about, anything about a graph and I was not interested in reading the newspaper, especially when I see this pictures of the graph or whatever, I was just lying. But now I learnt a lot, I learnt a lot now.

And later on in the interview:

> Now my knowledge is broad concerning this subject. I can say the changing is that I now got ML based on real life situations and then it doesn't end up in the classroom, in the textbook, it goes broad.

Bano: The information given to me by my lecturers through ML, that have really made me change.

The above quotes provide evidence of teachers noting the importance of their increased knowledge of the subject, as well as how an increase in mathematical ability strengthened them to experience the subject as meaningful.

There is also evidence to suggest that the lecturers assisted in meaning-making.

Maphi added that:

> Those lecturers, they assisted us a lot especially with the colleagues because the way they were able to answer to something that you don't know, whether you gonna win it or lose it after everything. But they know their stuff, to understand this, detail by detail, word by word.

This indicates her confidence in the lecturers, that they assisted the teachers by answering all questions and explaining the work thoroughly. The lecturers thus also assisted in meaning-making.

Ben also added a comment on two way learning with lecturers: "I also think that even the lecturers are benefiting from that. You find there are things that they do not know."

Wenger says that "meaning exists neither in us, nor in the world, but in the dynamic relation of living in the world" (1998, p 54). Wenger also says that everyone learns in the community. Ben's statement that the lecturers also learnt in the process reflects this.

Through their involvement in the ACE ML course, teachers could see the specific emphasis ML has on content knowledge being linked to real-life situations. Soma said: "We started to learn about (ML) and at the end I saw that it's real. ML is real-life application."

She thus made the shift from seeing the subject as abstract and now more applicable to real life. Later on in the interview she added: "I've benefited a lot now because my mind was only focused on maths knowing that $x \times x = x^2$ but only to find that we have to do things that are real in ML."

From this it is apparent that Soma saw Maths as a subject that was only visible on paper and abstract; now she sees ML in everyday life.

These excerpts on meaning indicate a changed way of being in the world. In analysing the interviews, teachers' excerpts on meaning as influencing changing ways of being in the classroom were less pronounced than those excerpts on changed ways of being in their own lives. It appears that teachers first tended to make meaning out of ML applicable to themselves before teaching the subject.

Analysing the interviews indicates that teachers' participation in the ACE ML course created more confident "ML thinkers" who observe the world through a mathematical literacy lens where they see content in context, and can expose learners to this way of thinking. Evidence of this is the utterance of Soma when she replied on the question as to the difference between those learners being exposed to a teacher involved in the ACE ML course and those who are not:

> Well I think they will know the same content, but be able to apply it in two different ways: that is real life in two different ways because a maths learner that has been taught by a person with the ML mind, will tell you: I can tell you right where we are, how I can apply maths. A maths learner that has not been taught, that has been taught by me before the ML course, would say: I need a paper and a pen.

The pen and paper to me refer to see maths as abstract and seen merely on paper.

All the above indicates that participants' changes in meaning are interrelated with changes in identities and, ultimately, practice, which is discussed below.

5.1.2.2 Practice

Here I examine how teachers' involvement in the ACE ML course contributed to their learning as changing practice. I wanted to find out if the increase in knowledge affected their teaching practice in any way. Was what they learnt in the ACE ML course used in the classroom and other areas of their lives?

The teachers claimed that their teaching changed a great deal since they started the course. When asked how she has changed since starting the course, Lisa answered:

> Hay, I've changed a lot, when I compare it with the, my basic Maths that I did in high school and in tertiary first year. I see myself as a changed person because some of us that are both me and my fellow teachers grappled with how are we doing this, how can I approach this concepts [in class]? So I found it [teaching] very challenging part that I am now coping [with].

When asked how her teaching has changed, she replied:

> You know I am, would just teach and then sit down and try and see if I was on the side track or not. It has empowered me. I would sit and come up with a different strategy so that my learners will be able to understand what I'm teaching. What is important for the learners to have listen and then be able to understand what I was offering to them. At some stage these things have challenged me, but some of my colleagues in class assisted me as to how you approach this in class. So with more [of] everything I have learnt, I found very helpful in my teaching.

It appears that this teacher's way of teaching changed due to her involvement in the ACE ML course, in particular due to her interaction with colleagues in the ACE ML group.

Another teacher, Soma, said:

> My teaching … day by day I'm doing better … Last year to be honest, I didn't know just what I was doing actually, but as time goes on then I started learn a lot. This is

> how I should actually unlock this knowledge to the learners … I have different styles of teaching now that I can apply in my teaching.

This teacher acknowledges how her learning in the ACE ML course changed her teaching styles and way of 'doing' in the classroom. In the above excerpt, the ACE ML course is not mentioned explicitly, but it does seem to be implied.

Teachers indicated that they had learnt to relate their teaching to everyday experiences (activities), integrating Maths with contexts by linking context and the content and differentiating between the two. This was a significant shift to make as South Africa's education focus was not on integration before the introduction of Curriculum 2005. To integrate content and context is a skill that one must acquire through practice it is one thing to learn this skill in theory, but putting it into practice is not automatic. All seven teachers interviewed in the ACE ML course talked about how they could now apply in practice integrating mathematical content and context in real-life situations.

The following excerpts support this:

On the question on how the he experienced the teaching of ML for the first time, Ben replied:

> It was a learning curve. There were many things that I've learnt. You can get more knowledge than you can with Mathematics. You see things you come across in every day life. Activities. You talk about interest rate, ML will help you understand economy, [and] you talk inflation. We don't know [in the past] what is inflation. So more of a general knowledge, things you come across everyday, you just need a bit of mathematics … Well before I joint the ACE course I was teaching mathematics. Purely mathematics in the class … because I didn't understand the difference between [the two subjects], I couldn't draw the line between the two subjects … But after I came to the difference of ML, I could now see that the emphasis is now on the context not the mathematical content. You put the context and then look carefully at other things to ensure the content.

Ben argues that making a mind shift in his teaching of ML by integrating the content with the context changed his practice. On the question of how he benefited from the ACE ML course, Bano replied:

> It is really talking about real life situations. Things that we do in there we now can prepare for the learners before they can come face it outside [in the real world]. Now I understand what ML is all about.

Maphi said: “And I can marry the two [context and content] so that the lesson can be more interesting and exciting to the learners.” Another said: “[In class] I am going to talk about things that learners see outside.”

In the past, the Maths taught was abstract to the learners, but the classroom practice has changed in such a way that learners can now “see” it in their everyday lives.

Due to the change in teaching practices, learners’ participation and enjoyment in the class and the quality of learning improved. This was explicitly mentioned in four interviews.

Maphi commented that:

> [In the past teaching ML] was very difficult. You go there and teach those learners because I didn’t know what content to teach and then how to teach that context because ML is different from mathematics. You have to combine the two, that is the content and the context … So I must be able to say: This is my content and this is my context. And I can marry the two so that the lesson can be more interesting and exciting to the learners.

The way she taught in the past has changed to where she can combine the content and the context, as is required for teaching the subject ML. The change in the teachers’ understands of what ML is about, in this instance, marrying content and context, leads to a change in teaching strategies as real life scenarios are included, which contributes to learners’ enjoyment of the lessons.

Another teacher, Lisa, commented that her involvement in the ACE ML

> helped [the learners] because ML is all about every day life experiences. So I found my learners, if I sit with it, they are enjoying some of the things that I teach. I make them to feel that this thing is not Maths, it is ML. So let us do it according to ML, not pure Maths because we do it practical. And then I encourage them to bring teaching aids so that we can utilize them for example like we were doing the BMI, that is the body mass index. So learners came with teaching aids, some with their own things and that was nice.

Once again, a changed teaching strategy of incorporating real-life situations in lessons resulted in learners enjoying the subject and they contributed to the lesson by bringing teaching aids to class. This indicates an ownership of the lesson by the learners.

Lieko also mentioned that "things are coming from their (learners') side also." This is another example that teachers describe that their learners feel part of the learning process.

The ACE ML course also assisted teachers in how to introduce new concepts. Because of this, teachers describe their practice as having changed, leading to more learning taking place in class.

Maphi mentioned that:

> [In the past] I don't think I was able to clarify: This is how we should go about this concept, like in the past I never knew what I should do. I was stuck in class or say to the learners: 'No, go and research about the concept.' But now actually I am a bit clearer and bit more confident.

A definite shift took place from being unable to introduce a concept to a more confident approach. This affects both the teacher's identity (now being able) and the amount of learning taking place in class.

A comment by Lisa revealed changes in her practice: "So each and every day when we did a task [in ACE] and then, I come with that task and then do it in class with my learners."

The task done in the ACE ML course could be used directly in class, contributing not only to the introduction of concepts but also to more appropriate activities in class and possibly effective classroom practices.

One teacher said that the ACE ML course affected how she assesses learners: "[ACE] helped us to assess learners, how to assess learners, how to attempt those types of questions". This influenced her way of teaching and assessing and thus "doing" and "being" in the classroom too.

The insight gained in the ACE course was noted to affect the teachers' personal lives, that the changes in their 'practice' due to their involvement in the ACE ML course went beyond the classroom.

When asked how his interaction with other people changed, Ben replied:

> I am able to talk to them [teachers] – for instance when we discuss issues, I can also talk about the interest and all – where we debate the insurance, where it comes from, how do they determine the value of the property when they talk about the inflation, whether the property is depreciating, compare both the car and house, how is depreciation calculated and so on.

This shows that this teacher developed beyond the classroom. In talking about debating these issues, he reveals an even bigger leap in the development of his understanding of these concepts. This is evident in his participation and the way in which he and others reify themselves. At a later stage in the interview Ben shared how he used this information practically:

> I am able to debate in whatever issue that are taking place in our everyday life even issues that are linked to commerce. Even, I have changed my account, my bank account, I just put it practical. I looked at the account that I had … and I went to change it. I compared the accounts; I could see that I paid a lot of money.

When the researcher asked: “And you would say that was able through the ACE course?”, he replied: “I mean that was what we discuss in class”. It is therefore apparent that what was learnt in the ACE ML course influenced aspects of this teacher’s everyday life, his way of doing as well as being, and thus his identity.

In his answer to the question on the benefits of the ACE ML course Ben mentioned the following:

> ... for some year back … I’ve heard about selling a car, buying a car. I did not know what is happening when you sell a car, when you buy a car. Now I’ve got the idea because we did this in ML. I now know that if you get the car for that amount, you really consider a lot. There are some formulas that you use to work out the price. You can work out the price before you go, take the price of the car, or this car is costing so much, you work it out before you go there and know how much you are going to pay for the month … now I’ve got an idea by myself.

Due to his exposure to ACE ML he learnt concepts that enriched not only his professional life but also his personal life. As a result of this learning, his personal and professional identity changed.

The analysis of all the interviews, focusing on ‘practice’, reveals that the changes in practice relate more to teachers’ personal lives and less to their teaching. The reason for this is may be because of teachers’ trajectories: Four of them enrolled in this course out of curiosity, and first wanted to apply their ML knowledge in their own lives. Maybe later on, after gaining more confidence in this subject, they will focus more on changing their classroom practice.

5.1.2.3 Community of Practice

Communities of practice, according to Wenger, “are an integral part of our daily lives” and involve “mutual engagement, a joint enterprise and a shared repertoire” (1998, p 73). A community is where meaning is negotiated and where, ultimately, a practice develops through learning. The teachers in this study attended the ACE ML course for eighteen

months. They became “like friends” and influenced each other in different ways. Wenger also claims that “each participant in a community of practice finds a unique place and gains a unique identity, which is both further integrated and further defined in the course of engagement in practice” (1998, p 76). So people’s membership in the same community of practice does not imply sameness in identity as each person’s engagement and meaning making is different. Different identities will therefore evolve, even in the same community. Analysis of the interviews of the teachers indicated twenty utterances on participation in a community.

Teachers claimed they were now able to participate in discussions on ML, and even debate issues, due to the understanding of the subject. Some are teachers who said they knew nothing about ML before they joined the course. An example is found in Ben’s response to a question on the main benefits of the participation in the ACE ML course: “I am now able to participate in discussions, but before I wouldn’t have participated, you know. I wasn’t confident, but now I am.”

This indicates new forms of participating and engaging with people. Wenger based his work on four premises (1998, p 4), one of which is that knowledge is about competence with respect to ‘valued enterprises’ determined by the specific community of practice. This teacher is thus competent with regards to these ‘valued enterprises’ that the community of practice value, and he feels a part of the ML community.

Teachers got assistance through their involvement in the community of practice. This involvement led to better insight and understanding of the issues around ML. Wenger quotes:”… learning is located in the process of co-participation and not in the heads of individuals; not located in the acquisition of structure but in the increased access to learner participation, and it is an interactive process in which learners perform various roles” (in Graven, 2002, p 144). Wenger (1998) defines identity as ways of talking about how learning changes who we are and what we see through the interviews where teachers talk about their journeys, is that their identities change through their involvement in the ACE ML community of practice. As a comment by Bano revealed:

Benita: How have your interaction with other colleagues, how has it assisted you in the development?

Bano: You see, it really helped me a lot because when I talk to my colleagues, some of the things I thought I know then, only to find they also feel this in a different way and if I then start to compare mine with theirs, I see, hay, I must change there because this is very much good rather than the information I was having.

Through his interaction in the community he gained new insights, and his way of belonging changed too.

Through different interviews it appears that teachers in the ACE ML course assisted one another in gaining a better understanding of this new subject and the teaching of it. Metse mentions that "… [if] I have something that I do not understand, I always go to my colleagues and then they help me with 1, 2, 3. And then they cannot help me, I talk to my teacher [lecturer]." Later on she mentions that "We exchange [test/exam] papers. Something that has been happening. How do you feel about my question paper? Then you moderate [my paper]." So this teacher claims to be comfortable to assist and be assisted, thus benefiting from these interactions and learning takes place in the process.

Other comments related to this assistance within the community of practice are:

Lisa: .. but some of my colleagues in class will assist me as to how to approach this in class.

Soma: The assistance [of colleagues] was very effective because if I don't understand, they [other teachers] did help me a lot.

Teachers also learnt from each other in group work and presentations where ideas are shared. They found these interactions very helpful in their development, enabling them to grow and overcome challenges.

When asked what aspects of the course led to the changes she was experiencing, Lieko replied: “We used to make presentations. And then when you present there, and then they used to correct us: No you shouldn’t do this, you must do that.” Later on she mentioned that “If you present something to your colleagues because they are my colleagues I believe they know more, better than the learners. So if I present that to my educators, I think you benefit a lot.” The participants, then, experience a new way of belonging. At first they were uncomfortable with comments about the presentations, but later saw the input from their colleagues as beneficial. So the nature of their positioning and their participation within the community changed.

Similarly, Lisa said that “At some stage these things [new teaching strategies] have challenged me, but the, some of my colleagues in class will assist me as to how to approach this in class.”

Later on, when asked if she would encourage other teachers to work with colleagues, she replied:

> Yah, I think it is definitely, the team work, to share some of the things you don’t understand, people must not go empty handed or empty minded in the class. They should share with the colleagues so that they can rectify you and say: No, the best way to approach this chapter is like this, so that you can do it better [your strategy], so that you can teach better.

So this teacher acknowledges the benefits of participation in a community of practice and how she learnt and changed through this social interaction.

Maphi is a head of department in Maths and did the ACE ML course as she had to manage ML as a subject and felt she knew little about it. Maphi claimed to have been so empowered by the ACE ML course that she felt confident enough to run workshops with, for example novice teachers. She said:

> As a person I'm now more confident compared to when I started teaching it then and I have more knowledge on the subject. I can even share some experiences that I had before with some of my colleagues and then I can also, even involve them actually or just give them a workshop on some of the concepts. I can see by friends are having problems in an area. Cause, not meaning I'm an expert, but you can say that: This is how you should address this concept and even manage to accomplish that…

I argue that Maphi acted in an accountable manner towards the newcomers in the ML community. She had developed her way of being in the ML community and wanted to share her experiences with others, to help them move from the periphery of the community to the centre and full membership.

Maphi's experience implies that she, and possibly those who she workshops, will experience a new way both of belonging in the different communities and of being in the world. This will also affect their identity as they will identify themselves as leaders, able to contribute in numerous ways.

The teachers also acknowledged the lecturers' positive influence on their development. This relates to the work of Lave and Wenger where the 'master' in the community of practice gives the 'newcomer' access to participation and, in the process, the 'newcomer' learns the practice of the 'master' (1991, p 14). Lave and Wenger see learning as being located "in the increased access of learners to participating roles in expert [master] performances" (1991, p 17). The teachers' acknowledgements of the roles of lecturers as "masters" were evident in some of the interviews.

Maphi mentioned: Those lecturers, they assisted us a lot, especially with the colleagues because the way they were able to answer to something that you don't know … But they know their stuff …

Bano: Like my first lecturer, Mr …, this gentleman really did so well. He has planted this love of ML in me.

Lecturers are part of the community and, as the experts in the community, can contribute to the participating teachers' learning. All this contributes to teachers' way of belonging within the community, where the opportunities to learn empower them enough to become experts (masters) in the specific field themselves.

When asked who they, as teachers, engage with about ML, responses were varied and included colleagues, learners, lecturers, family and teachers from other schools. Some even said anyone they meet. Six teachers responded that they engaged with colleagues, four with learners, three with lecturers, and two with family and anyone they meet. These are the different communities teachers engage with about ML.

I claim that teachers mostly engage with colleagues as six of the seven mentioned their engagement with colleagues (colleagues in ACE ML course and colleagues in education). Ben acknowledged: "I think we [class] had time to sit together and debate all the issues in the class."

Maphi also acknowledged this as, in the interview with her, the following transpired:

Benita: Who do you engage with, with regards to ML? Who are the people you talk to with regards to ML?

Maphi: I talk to my lecturers at the university.

Benita: Yah.

Maphi: My colleagues, my colleagues here at work and my friend at home actually who are teaching at other schools. We come together and discuss the pros and cons of ML in detail.

Benita: Is it!

Maphi: Yah.

Benita: How regular do you do that?

Maphi: More often, but we meet this year once in a month.

Benita: Ok.

Maphi: We do meet and then we meet and discuss actually.

Benita: Ok! Is that in an informal way?

Maphi: It is in an informal way because they have the very same problems that I had last year, actually.

Benita: Ok. And you can assist them?

Maphi: I can assist because the way I am today.

Benita: And they have assisted you?

Maphi: They assist me because there are instances I don't know and then they come up with: Maki, this is how we do it.

Here we see how Maphi acknowledges her involvement in the school community, and the community of friends who also teach ML. In all these communities she was influenced to learn more about ML and also to engage in different ways of belonging. Sometimes her key role is that of 'master' and in other instances her role is that of learner. So sometimes the communication is one way, in other cases both ways. ML is the centre around which they, as members, configure and deliberate in order to become more competent ML teachers or more competent in their understanding of the subject. Teachers are thus in a learning community where their key role is mediating their understanding and, in so doing, influencing one another.

Teachers were also identified by others as experts in ML and approached by them for assistance. Metse's comment was: "Cause some of the parents; they call me [for assistance]." A significant number of teachers mentioned how they assisted parents and

others in real-life situations in a mathematical way, using what they had learnt through ML. Their identification by the community thus changed. They became identified as people who could do problem solving in everyday situations requiring mathematics or quantitative reasoning. They have knowledge of something that a significant number of South Africans do not know about and take on the roles of sharing and explaining ML. In some cases, that help people who are mathematically illiterate. Participation here is different than in the ACE ML community as here it is about teaching friends and family and they are key members in this community. Because the teachers know more than the others about ML, the communication is more one way: teachers are the 'masters' who do the teaching.

Through this we see that people are members of different communities of practice, and might have different roles and responsibilities in each community.

Sfard and Prusak see the stories that people tell of their current state of affairs as their actual identity and stories which tell of what is expected as their designated identity (2005, p 18). The actual identity is told in the present tense, the designated identity in the future tense. There is thus a gap between the actual and designated identity and, to close this gap, certain actions must take place. According to Wenger trajectories incorporate our past present and our future and thus learning trajectories involve the process in which we define who we are by where we are going. Therefore I argue that trajectories involve the process of closing the gap between actual and designated identities.. Sfard and Prusak say that one's "designated identity give direction to one's actions and influences one's deeds to a great extent". They claim that learning has taken place if the gap is filled. In the interviews there were evidences of two teachers who felt that, although they learned a great deal in the ACE ML course, there are still 'gaps' in their development. One teacher said: "… but I can be so helpful with more knowledge about the content" and another said: "I need to be workshopped more …" They still identify with a trajectory of learning within a deliberately organised learning community of practice, such as workshops and courses, rather than a trajectory of continued learning solely within the practice of being a ML teacher. A need for more classroom support visits was noted as teachers felt they had benefited from this classroom support.

5.1.2.4 Trajectories

According to teachers, there were numerous benefits resulting from the ACE ML course. Teachers claimed that learners began to enjoy the learning area and found it interesting. They became more interactive in class, raising issues they see in everyday life. Learners even played in class, bringing teaching aids to class. They talked to their parents about financial issues, sometimes resulting in parents asking the ML teachers for guidance in financial matters.

Another benefit of the course was that teachers felt more confidence in ML, in the content knowledge and their teaching. There were six utterances on confidence, including:

> "I am now confident. I wasn't confident, but now I am confident."
> "I felt confident when I started to realize it is new knowledge we have."
>
> "As a person I'm now more confident compared to when I started teaching it then."
>
> "No, definitely the confidence. I know what I'm doing and it has also opened my eyes."

Confidence is defined by Graven as being "part of an individual teacher's ways of learning through experiences, doing, being, and belonging. As such it is deeply interconnected with learning as changing meaning, practice, identity and community" (2004, p 179). Graven also talks about "the interrelatedness between confidence and Wenger's four learning components; and the way in which confidence enable… mastery of becoming and being a professional [ML] teacher" (2004, p 207). So when teachers say the word 'confidence', they reveal a facet of their identity as a ML teacher.

The teachers also used the knowledge gained in the ACE ML course in their personal lives when conducting financial transactions. As noted earlier, even parents contacted teachers for assistance in financial matters. Wenger's fifth characteristic of identity deals with the relation between the local and the global. He says that "we define who we are by relating

our local ways of belonging to broader 'constellations'" (1998, p 149). There were five teachers who noted in their interviews the relationships between the local (classroom) and more global (broader life) ways of participating. For example:

> "[I've benefited] in everything, I don't know how to put it, in a classroom situation and in my life also."
>
> "What we see and then what we are everyday, but then I realize that it was ML like for example if you go to a bank and then you have to fill the deposit slip … I use to have problems to do that … But now I, because that's what I teach every day. So I have an idea how to complete a withdrawal slip or deposit slip."
>
> "… You know I've for some year back … I've heard about selling a car, buying a car. I did not know what is happening when you sell a car, when you buy a car. Now I've got the idea because we did this in ML."

Something else interesting that emerged in the interviews was the reasons why the teachers enrolled in the ACE ML course. Four out of the seven teachers (Bano, Metse, Lisa and Soma) enrolled because they were curious about the subject. Their trajectories were focused on self knowledge and self empowerment. These four teachers, later in the interviews, explained how this trajectory influenced them as they applied their new knowledge in their personal lives. The example below illustrates this:

Benita: Why did you choose to do the ACE course?

Soma: You know it's because ML it was something that we… I was going to

learn about it. So I choose to do ML because I wanted to know more

about this subject.

Later on in the interview, she also explained how the course influenced her personal life:

Benita: How did your interaction now change with regards to, when you talk about the subject?

Soma: Alright. No, you know most of the time I just interact with people, telling them about ML that is very good in coming to budget, whatever.

Benita: Mm.

Soma: Yah and then in fact, ah, I say interact with people in many things with ML, concerning the budget, whatever, the gambling, whatever or, you see, you even buy a house, I can tell you if you buy a house, you'll get the loan whatever the percentage … Now I can understand it.

The other three teachers told similar stories about applying ML in their personal lives. Their learning trajectory was influenced by their own curiosity, their desire to know more about ML. Thus, in relation to Wenger's components of practice and meaning, the focus was on their own ML experience and ML learning by doing in their own lives rather than teaching practice. These teachers talked more about the influence of ML in their personal lives than the influence of ML on their teaching.

For example, one of the four teachers' responses was the following, which also strengthens the point of focusing on their own ML experience and ML learning:

Benita: Why did you choose to do the ACE ML course?

Metse: Because I wanted to find out what is it really about, because I've heard

people saying it is difficult, yah.

Benita: You, you've decided to do the course just to find out?

Metse: Yah.

Benita: Ok, did you plan to teach the subject or not really?

Metse: Not really.

The reason for Metse's coming into the course was to learning more about the subject, thus for personal gain. She did not intend to teach the subject and initially did not have a learning trajectory towards being a ML teacher.

At the end of the interviews, teachers were asked how they saw themselves at that moment. I used different wording as it was a prompting question following the last question on the interview sheet. The purpose of this question was to investigate the future trajectories of the different participating teachers in order to assess how, if at all, their identities had changed. It was a difficult question to ask without leading the interviewees, and I had to phrase my questions carefully. As an example of how this was done, I will go to the interview with Bano:

BP: 4 years back when people would ask you what kind of a teacher are you, which subject you specializes in, …

B: 4 years back, or in the 4 years?

BP: No, 4 years back when you started teaching,

B: Yes.

BP: You would tell people you're a maths teacher.

B: Yes.

BP: Would you tell them the same today?

B: No.

BP: What will …

B: I will rather put something different.

BP: OK.

B: I'm a ML teacher. I'm a maths and ML teacher. I will rather add something.

Different responses were given. Some interesting responses that emerged indicated differences in emerging trajectories. Some of the teachers backgrounded their previous teaching identities and foregrounded their ML teaching identities. Others added a ML identity to their existing identity, while a third group of teachers' existing teaching identities

stayed strong while their ML identity was still developing or less strong. I now categorize the seven teachers' responses and discuss the responses in relation to these categories:

5.1.2.4.1 Teachers who foregrounded a ML identity:

The first interviewee, Ben, responded as follows:

Benita: Hm, Hm. How would you describe yourself now? Like what kind of a teacher are you? Are you still Geography?

Ben: I'm not Geography now. They tried to get my teach Geography now. We have lost a lot of Geography teachers now. They called me to the meeting and say: You are the Geography person. Can you come and help? And then I told them that hm, I have not been teaching Geography for a long time and I am now focusing on this ML. It will be difficult for me to come but because of – I didn't really have a choice because of the learners didn't have a teacher. I had to go and take one senior class.

Benita: But you are considering yourself now as?

Ben: A ML teacher

Benita: Ok

Ben: Yah, definitely

When examining identities, according to Wenger, "our identities incorporate the past and the future in the very process of negotiating the present" (1998, p 155). This teacher earlier in the interview referred to himself as a pioneer as he was the only teacher in his school teaching ML. Before teaching ML, he taught Natural Science and Geography for fifteen years having majored in Geography at university. Ben was asked by the school to teach Geography

again after he started teaching ML, and finally negotiated to teach only one senior Geography class as he only wanted to teach ML. It can be argued that this teacher's identity changed since he started the ACE ML course as he now defines himself as a ML teacher. I also argue that he now defines himself differently because of the subject that he teaches - ML. He said he is "now focusing on this ML" as this is the subject he mainly teaches. It is thus a new practice and because of this he now calls himself a ML teacher. So he backgrounded the Natural Science and the Geography identities (and the practice and experience of teaching these subjects) and foregrounded the ML identity (and the practice and teaching of ML). Ben did not say anything on his future teaching, so we cannot assume anything on this future trajectory on the subject.

Similarly, in the interview with Metse she backgrounded her English and Maths identity and foregrounded a ML identity. The reasons were different from Ben's: she saw ML as beneficial for her own personal use. Her interview responses were as follows:

Benita: Ok. Now if people ask you now what kind of a teacher are you, which subject is now your field of expertise, what would you say?

Metse: Obviously ML.

Benita: Why do you say obviously?

Metse: Yah. Maths start to bore me now because the fact is that I am using ML as a everyday thing. I am using it every day.

For the five years before participating in the ACE ML course, Metse taught English and Mathematics. She saw the benefits of ML in her everyday life and discovered the abstractness of Maths as a subject (in contrast to ML). She moved away from the English and Maths and replaced it with ML. She thus foregrounded the ML teacher identity (as Maths started to "bore" her) and backgrounded the Maths teacher identity. She argued that in her life she operates in a ML manner: "I am using ML as a everyday thing." This implies that her way of being in her everyday world changed. There is thus a direct correlation

between Metse and Ben as both of them replaced their existing identities with new identities.

Similarly Lieko replaced her earlier identity with a ML identity. She describes a future trajectory into ML teaching which Ben and Metse did not mention.

Benita: Hum, if the principal today give you a[n] opportunity to say what do you want to teach next year, what will be your preference?

Lieko: ML, I don't want any subject except ML.

Benita: When you started teaching, you would define yourself as a Maths teacher.

Lieko: Yah, as a Maths teacher.

Benita: How would you define yourself now?

Lieko: (laugh)

Benita: You can just be honest please.

Lieko: Hum, a few weeks ago somebody said: Hey, we are running short of Maths teachers. I think next year we give you maybe one class of Maths.

Benita: Hum.

Lieko: I said no, I'm no longer a Maths teacher (laugh).

Benita: What are you?

Lieko: I'm a ML teacher.

Benita: Ok, ok. Very interesting. And that is because you …

Lieko: I enjoy the subject, enjoy the subject.

Lieko clearly shifted her field of expertise from being a Maths teacher to that of a ML teacher. She had been teaching for four years and in the year of the interview only taught ML, to grade 10 and 11 learners. This teacher also sees a future trajectory as a ML teacher:

"… actually I use to have a negative attitude towards my career, like teaching, but since I've started doing ML believe me I enjoy my teaching. I enjoy my teaching."

She identifies herself now exclusively as a ML teacher and later in the interview reiterated how much she enjoys teaching ML. She seems very confident and comfortable with the subject.

The previous three teachers foregrounded a ML identity. I now turn to teachers who kept their existing teaching identities and added a ML teaching identity.

5.1.2.4.2 Teachers who added a ML identity to their existing identity

In the interview with Bano he responded as follows:

Benita: [Four years back] you would tell people you're a Maths teacher.

Bano: Yes.

Benita: Would you tell them the same today?

Bano: No.

Benita: What will …

Bano: I will rather put something different.

Benita: OK.

Bano: I'm a ML teacher. I'm a Maths and ML teacher. I will rather add something.

Bano was teaching ML for the first time that year, before which he taught Maths. Bano does not make ML teaching synonymous with Maths teaching. Instead he sees ML as a separate aspect of Maths. Earlier in the interview he stated that: "I am now, when I look at Maths now, I look at Maths as if it has got a child, you see. That is something else that we call ML".

In saying he "will rather add something", he is not taking away, but rather adding something. He now has a dual identity of both a Maths and ML teacher.

Similarly, in the interview with Lisa it became evident that she kept her existing commerce identity, and added a ML identity. She responded as follows:

Benita: Which specific learning area [did you specialize in?]

Lisa: I was a commerce teacher.

Benita: Commerce teacher?

Lisa: I was a commerce teacher never to think one day I will teach Maths and then with … they elected me to go and uplift and empower yourself and at the end you will come and then I was willing to go. That is why I went to this university and everything. But that time I was teaching the commercial subjects.

Benita: If somebody ask you what, what is your field of expertise, what kind of a teacher are you, what will your answer be today?

Lisa: (laugh). I will just say both.

Benita: Ok. Both commerce and?

Lisa: Yes, Maths, Maths.

Benita: Ok.

Lisa: You know I am proud of learning more about Maths. No, I can see any subject being challenged, but I can be so helpful with more knowledge about the content.

Benita: So you're enjoying it.

Lisa: I've, I've. Hm, enjoying it.

Benita: Ok.

Lisa: I would not say I'm a Maths or commerce teacher, I would say both. Or even with someone coming to give me more knowledge, I will be some one else.

Benita: You are already someone else. [Name] thank you very, very much.

Lisa has been teaching Economics and Business Economics for five years, and teaching ML only since the year of the interview. Lisa talks about Maths [implying mostly ML] and, like Ben, has a dual identity: that of a commerce and a ML teacher. She added ML to her existing identity. I claim she maintains this commerce identity as her ML identity is still developing due to the fact that she has only been teaching ML for a year. This teacher also has developed an identity of disposition to future learning as she talks of "someone coming to give me more knowledge". She developed some expertise in ML, but this also made her aware of the gaps in her knowledge. This designated identity, because it is different to her actual identity, can create discomfort and therefore an urge to seek out further learning.

5.1.2.4.3 Teachers whose previous identity stayed strong and whose ML identity was still developing or was less strong

Soma responded as follows:

Benita: Ok, ok. Now when you started teaching six years back, you considered yourself as what kind of a teacher?

Soma: As a good teacher, especially in Maths.

Benita: Which subject?

Soma: Maths.

Benita: And if people ask you now today, what kind of a teacher are you, which subject is you …

Soma: I'll tell them that I'm teaching ML.

Benita: Ok. And in the future what is it your want to do?

Soma: Eh.

Benita: Both Maths and ML?

Soma: [silence]

Benita: Preferably?

Soma: It will depend, but the way I enjoy ML now, I think the years coming I'll be a teacher in ML.

This teacher first identified herself as a good teacher, and especially good in Maths teaching. But now she teaches ML. She did not say she is a ML teacher; she referred to her teaching only. So her identity is based on what she teaches. While she says Maths, she also refers to ML as she does not see Maths and ML as different learning areas. She has a strong Maths identity; her ML identity is still in a developing stage as there is no evidence that her identity has developed to ML. This is perhaps why she is not yet confident enough to call herself a ML teacher. Like Lisa, she started teaching ML the year the interviews were conducted, and she does have a designated ML identity (according to Sfard and Prusak) as she said that in the year forthcoming she will be a teacher in ML.

Like Maphi, her previous identity as a Maths teacher stayed strong and she is still developing a ML identity. Her responses in the interview revealed this:

Benita: If you in 1995, you would classify yourself as a Maths teacher.

Maphi: Mm. If I were to …

Benita: In the beginning of your career.

Maphi: Yah.

Benita: you would mm class yourself as a Maths teacher or what would you say were you which subject are were you the specialist in?

Maphi: (Silence)

Benita: When you started teaching.

Maphi: I would say I'm still a Maths teacher, because Maths and ML are intertwined. It cannot separate one from another one. They are interwoven, they are interdependent actually. They are interrelated. So I'm still a Maths teacher, the umbrella will be a Maths teacher but the baby one will be the ML.

Benita: Oh. Would you say you're a ML teacher also?

Maphi: I would say also because I'm a ML teacher also.

This teacher was employed as the head of department of Maths and probably sees herself as an expert in that field. She was also given the duty to head up ML when it was introduced in the school. Because she describes ML as "the baby", I argue that she sees ML as having lower status than Maths. Giving up her Maths identity implies to her, lowering her status in the teaching profession. Wenger claims that one's identity is influenced by your past, your present and your future; this teacher's identity did not shift significantly towards being a ML teacher. She claims to also be a ML teacher because she is teaching ML to one class, but maybe also because she is the head of the ML department. She became quite confident in ML content and even feels capable of running workshops on ML for new teachers, but this may be because she has a strong Maths identity. She sees her ML identity as less strong than her Maths identity.

It is interesting that the two teachers whose previous identities stayed strong, and whose ML identity was still developing, had taught Maths for several years. They were both trained as Maths teachers and both added on ML as a secondary weaker identity. It would be interesting to assess in future whether these teachers' ML identities just needed more time to develop into stronger identities. On the basis of this study however, I categorise their ML identities as weaker than their Mathematical identities.

When these interviews were analysed, it became apparent that the nature of the teachers' learning in relation to Wenger's components of meaning, practice and community were different. The responses can be grouped into three categories:

- A category where teachers backgrounded their previous identities and foregrounded their ML identities. Ben, Metse and Lieko fall in this category.
- A second category where the teachers added their ML identity to their existing identity, leaving them with a dual identity: the one they had before their involvement in the ACE ML course and the ML identity. The teachers who fall in this category, are Bano and Lisa.
- The third category consists of those teachers whose identity before the ACE ML course stayed strong, and their ML identity was still developing or less strong. The teachers who fall in this category are Soma and Maphi.

So we see teachers in different stages of identity development due to their journey in the past, their current journey and their future trajectory. Although it is quite evident that all seven interviewees learnt quite a lot in the ACE ML course, the nature and degree of learning differed. As Wenger accurately puts it "each participant in a community of practice finds a unique place and gains a unique identity …" (1998, p 75).

The table below summarises the teachers' qualifications and subjects taught:

Table 2: Qualifications and areas of teaching experience of interviewees

Name of teacher	Category	Teacher qualifications	Subjects taught in past
Ben	1	BA (Ed). Majored in Geography and Education.	Geography and Life Sciences.

Metse	1	University Diploma in Education. Majored in Maths, Biology & English	Maths, English, Technology
Lieko	1	Secondary Teacher's Diploma. Majored in Maths, Woodwork and Technical Civil.	Maths
Bano	2	Senior Primary Teacher's Diploma. Majored in Maths, English, Biology and Sepedi.	Maths
Lisa	2	BA and Teacher's Diploma. Majored in Business Economics and Business Studies.	Maths and Economics
Soma	3	Senior Primary Teacher's Diploma. Majored in Northern Sotho, English, Maths and Biology	Maths
Maphi	3	Senior Teacher's Diploma, ACE (Maths), Bed (Hons). Majored in Maths, Agricultural Science and Education.	Maths and Technology

5.1.2.5 Other findings

Reio (2005) claims that "successful adaptation to change requires a workplace environment that embraces both formal and informal learning" (2005, p 4). During discussions with the teachers and the school visits when conducting the interviews, I realised that the schools where the ACE ML teachers come from allowed them to leave earlier on the days of the course and that staff meetings were not scheduled in that time. This is an indication that the workplace, to some extent, supports formal learning, assisting in the successful adaptation to the new curriculum and, therefore, changing ways of being for teachers. Reio also claims that "as it is the teacher who implements reform at the classroom level, considerable learning opportunities must be present or successful reform implementation is far less likely to occur" (2005, p 988). In the ACE ML course teachers were given opportunities to do lesson plans and presentations for critiquing. They also had school-based support in their classes, indicating learning opportunities that supported the implementation of the ML curriculum in the classroom. Teachers were also shown how to link the content with the context, how to use the newspaper as resource tool, and how to introduce different concepts. This gave them the competence and confidence to call themselves ML experts. Reio strengthens this argument when he says that "increased and consistent opportunities for learning equip teachers with the tools they need to develop their subject matter and instructional expertise, reduce negative emotional reaction related to ambiguity and uncertainty, and promote the formulation of a positive personal and professional identity (2005, p 6). This is verified when ACE ML participants say things like "I love it (ML) now" or "A very interesting subject, quite interesting that we can even enjoy".

Chapter 6: Conclusion

6.1 Identities promoted within ACE ML course

The kinds of teacher identities that are promoted within the ACE ML course include teachers with a good knowledge of the ML curriculum, in line with the outcomes of module 1 in the course design. The course coordinators also promote an identity of intense engagement with people in the ML realm. They see the ACE ML classroom as the first community of practice where these teachers are involved in discussions around ML. The course also promotes an identity where teachers can have spontaneous discussions and meetings with other teachers within the ACE ML group. This can be confirmed by, for example, 'hints' in the course outline which stipulate that participants should "discuss new or confusing ideas with (their) colleagues at school …" (ACE ML Module 1 Course Outline, 2007, p 8). The course coordinators take it further saying that participating teachers should discuss ML with anyone they encounter, from family and friends to colleagues in ML or colleagues teaching in other learning areas. They maintain that a person passionate about ML will discuss it with anyone. The coordinators strive to create an identity where teachers have a ML gaze on the world, whether, for example reading a newspaper or engaging with family and friends.

The identity promoted is one where the ML teachers will marry content and context, facilitate learning in the classroom, know how to do assessments, and confidently develop activities for the classroom practice that relate to real-life scenarios. Many opportunities were created in the course for compiling class work where Maths was contextualised. A significant amount of time was spent on assessment, such as how to assess, how to do mark allocation, how to compile memorandums of worksheets. Assignment 2 of Module 1 focused on assessment, linking to the promotion of new practices and way of being in the area of assessment. The course was also designed in such a way as to promote a changing way of being in the classroom. Participants had to draw up lesson plans and present these lessons for critique to the groups in the ACE ML course. Assignment 1 of module 1 was on the use of resources in the classroom, creating another opportunity to develop a changed way of being in the classroom.

6.2 Nature of the emerging identities

The second research question was on the nature of the emerging identities of participating teachers. The emerging identities varied as identity, according to Wenger, is influenced by the past, the present and the future. Some of the teachers described their emerging identities as that of a shift from a forced trajectory into ML to an ownership of a longer term trajectory of continuing to teach ML and focusing on the subject.

6.2.1 Meaning

The teachers' knowledge of ML increased and their application of this knowledge broadened beyond the classroom. Their level of expertise increased as a result of their improved knowledge, and they appeared to have a new outlook on the subject. There was also an emerging identity of seeing the subject as a 'good' or 'easy' subject, in contrast to the earlier perception of ML as an 'animal' (negative connotation), a learning area of lower value, an 'impossible' subject. The emerging identities were also competent and confident with, for example, the ML curriculum, the Maths content knowledge, how to read and interpret graphs, how to marry content and context, how to work with probability.

6.2.2 Practice

Teachers began to see themselves as facilitators in the learner-centred classroom, they became more competent in introducing new concepts, could use a broader variety of resources in the classroom and they started to enjoy teaching the subject. Particularly interesting in this study is that teachers tends to focus on describing their changed practice more in terms of their personal lives than their classroom practice, as four of the participating teachers explicitly mentioned them applying ML in their personal lives. So their evolving identity emerged beyond the classroom to where participants saw themselves as leaders in the field of ML.

6.2.3 Community

Teachers changed in their ways of belonging. They described their relationships with fellow ACE ML participants as being 'like friends' who influenced each other in different ways. Where they might have been negative at first when receiving criticism from colleagues, they later saw it as a learning experience when "advice" was given. One participant felt so empowered and confident that she was willing to conduct workshops to share her knowledge of ML with "newcomers" in the ML community of practice. Their roles also changed within cluster meeting as they took up more prominent roles due to their confidence in the ML subject field.

6.2.4 Trajectories

Different identities did develop amongst participating teachers during the course. The responses can be grouped into three categories:

- Where teachers backgrounded their previous identities and foregrounded their ML identities.
- Where teachers added their ML identity to their existing identity, leaving them with a dual identity: the one they had before their involvement in the ACE ML course and the ML identity.
- Where teachers whose identity before the ACE ML course stayed strong, and their ML identity was still developing or less strong.

6.3 Nature of the influence of the learning components of meaning, practice and community on the development of ML teacher identities

The third research question was on what the nature of the influence of the learning components of meaning, practice and community were on the development of ML teacher identities. When meaning of the subject ML is gained, it can be translated into a changed classroom practice as this meaning will be built into their practice. This results in fostering a

specific identity because the ACE ML course attempts to enforce the meaning of ML, leading to a change in classroom practice and, ultimately, a change in the teachers' identity. This resonates with Wenger's claim that the four learning components are deeply interconnected and mutually defined. Therefore, through what teachers have learnt and gained through the ACE ML course, they will develop designated identities to become ML teachers. This is about changing ways of being in the world and the teachers did change, to varying degrees, in their experiences (meaning), in their ways of doing (practice) and in their belonging (community).

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ANNEXURE A

Questionnaire for all participants

Name and Surname:_____

1. What are you hoping to achieve through participating in the ACE ML course?

2. Why did you choose to do the ACE ML course?

3. Are you currently teaching Mathematics Literacy or have you taught ML? If yes, how did this come about?

4. Who do you talk to about ML? Explain these discussions.

5. Can you describe any changes that have occurred from before you began this course to now in relation to:

a) your experience/understanding of what ML is about

b) your teaching

c) the way you interact with parents, other teachers, district officials, friend, family, etc about ML (if at all)?

6. How do you think has participating in the ACE influenced these changes, if at all?

7. What aspects of this ACE have you found most useful?

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8. How have/did your interaction with other colleagues and lecturers in the course assist you in your learning as a ML teacher?

9. How has your participation in the ACE course with the ACE group change, if at all, over time? Explain.

Thanks for participating.

ANNEXURE B

Interview Questions with course coordinator of the ML ACE programme.

1 The ACE ML aims at developing ML teachers. If you describe a highly successful student in terms of meeting the aims of the ACE course, how would you describe him/her? (in terms of knowledge and understanding about ML, practice (do), how do they act in the classroom or the world.)

2 How does this highly successful student participate in and engage with people on ML.

3 Who does the highly successful person discuss ML with?

4 If we look at the course design, how does it intend to foster identity development in participating teachers as this is a reskilling course?

ANNEXURE C

Interview Questions with participants

10. Why did you choose to do the ACE ML course?

11. I see you taught maths for _____ number of years. How did this come about?

12. What are the main benefits you feel you have gained from participating in this ACE course?

13. How do you feel you have changed from when you began this course to now? (Prompt if necessary:

    - in your teaching
    - in your experience/understanding of what ML is about
    - in the way you interact with others about ML (parents, other teachers, etc.)

14. Who do you engage with about ML? Has the way you engage with these people about ML changed over time? If so, how and why?

15. What aspects of the course or your participation in the course have led to these changes? Explain.

16. How would you say did your involvement in the ACE course influence the way you are as a ML teacher you are today?

17. How has/does your interaction with other colleagues and lecturers in the course assist you in your development as a ML teacher?

ANNEXURE D

Dear ACE student

Mrs Benita Nel from the University of the Witwatersrand seek your consent to have access to your biographical profile and to conduct a face-to-face interviews with you in the ACE course as part of my research toward a MSc degree at Wits university. My aim is to understand the identity transformation of participants of the ACE course. I stress here that in all my reporting related to this data, the names of the participants will be kept anonymous, and that sharing of our data will be restricted to the purposes of research and development. If you are happy to participate in this research can I ask you to sign the consent slips below. I stress that there is no compulsion to participate. If you require further details, please do not hesitate to contact me on 011 559 6586 or e-mail: bnel@uj.ac.za

1. Please will you sign the separate consent form for the questionnaire, interview, and biographical profile.

1. Additional information

The right to withdraw:

All research participants have the right to withdraw from the study at any point in time.

Anonymity and confidentiality:

Anonymity of all participants is assured.

Storage and security of data

All the data gathered for the study will be stored under lock and kept in the School of Education at the University of the Witwatersrand, and destroyed 3 years after the completion of the analysis and reporting.

I thank you for your participation in this research

Yours truly,

Benita Nel

……..……..

I have read all of the above and consent to my participation:

Name (participant): ……

Signature: ……..

Date: ……