PRIMARY TEACHER IMAGINATION: THE EMERGENCE OF IDENTITIES THROUGH PARTICIPATION IN A NUMERACY COMMUNITY OF PRACTICE

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The paper investigates how primary teachers learn and negotiate their numeracy teacher identities through participation in an in-service community of practice-informed teacher professional development programme (NICLE). The study is informed by a situated theory of learning (Lave and Wenger, 1991)and Wenger's (1998) Community of Practice theory. The paper draws on data obtained from interactive interviews with 10 sampled primary teachers participating in an in-service numeracy education community of practice. Through participation in NICLE teachers explored new ways of being mathematical. Notably teacher histories, the phase taught, one's subject/phase specialization or further training in maths influenced the nature of learning and emerging identities.

INTRODUCTION

This paper focuses on how numeracy teacher identities evolve in relation to participation in an in-service community of practice informed teacher professional development programme. This study contributes to the field of teacher identity research currently popular in many mathematics education research studies. Generally the focus on maths teacher identity has been influenced by the 'social turn' (Lerman, 2000, p.23) and the 'participationist metaphor' (Sfard, 1998) which allows, for the exploration of teacher learning using Lave and Wenger's (1991) situated theory. Identity is key to the sociocultural-participationists' perspective and 'learning and a sense of identity are inseparable: They are aspects of the same phenomenon' (Lave and Wenger, 1991, p.115). Sfard and Prusak (2005, p.19) concur with this, arguing that 'identities are crucial to learning. With their tendency to act as self-fulfilling prophecies, identities are likely to play a critical role in determining whether the process of learning will end with what counts as success or with what is regarded as failure.'

Thus our epistemological and ontological principle of learning elucidates that, participation in communities of practice in which any knowledge exists shapes one's identity and transforms one's knowledge (Wenger, 1998, Lave and Wenger, 1991). Being grounded in such theoretical formations this paper relying on a small segment of data from the interactive interviews of a sample of 10 primary teachers participating in NICLE, explores how teachers construct their numeracy teacher identities. To analyse the data we use one of Wenger's (1998) three modes of belonging, namely *imagination,* and part of Wenger's characterisation of identity as *'learning trajectory'* and as a '*nexus of multimembership'*. Sfard and Prusak's (2005) insights on the notion of identity complements these three faces of identity.

The primary teachers mathematics professional development initiative which provides the empirical field in which this study is situated is called the Numeracy Inquiry Community of Leader Educators - (NICLE), which has been explicitly designed and conceptually framed as both a Community of Practice (Wenger, 1998; Lave and Wenger, 1991) and a Community of Inquiry (Jaworski, 2005) teacher development approach. The NICLE initiative focuses on numeracy teacher development within the foundation and intermediate phases in 15 primary schools in the greater Grahamstown area and currently has 57 teachers who attend fortnightly seminars and inquiry sessions.

THEORETICAL FRAMEWORK

To investigate the development of numeracy teacher identity through participation in a numeracy community of practice (NICLE) this study is informed by Lave and Wenger's Community of Practice theory (Wenger, 1998; Lave and Wenger, 1991). This theory regards learning as social participation (Wenger, 1998). Under this situative perspective, learning within a COP is a dual process transforming knowledge and 'who we are'- it a process of becoming and involves the construction of identities of participation (Wenger, 1998; Lave and Wenger, 1991). This sociocultural-participationists' notion of connecting identity formation and learning is central to this study. Thus to analyse part of the empirical data presented in this paper, this study will be guided by Wenger's concept of identity, which is one of the four components of his social theory of learning. To help us understand the process of teacher identity formation and learning will be '*imagination*', which is one of Wenger's three modes of belonging, namely, alignment, engagement and imagination. Wenger's (1998) characterisation of identity as a *'learning trajectory'* and as a '*nexus of multimembership'* will also support analyses of our research findings. This study also draws from Sfard and Prusak's (2005) operationalized notions of identity which have theorised learning in relation to identity and have provided theoretical opportunities not provided in Lave and Wenger and Wenger's work. Sfard and Prusak (2005, p. 20) define learning as, closing the gap between current[17] and designated identities. This identity framework provides us with an analytical tool and a language to explore how numeracy teacher identities evolve.

CONCEPTUAL FRAMEWORK

Since Adler's (1998) assertion that the social practice theory powerfully illuminates mathematics teacher development there has been a surge in mathematics professional development models employing a situated learning perspective to create maths communities of practice from which teachers participate in and learn through active participation. International studies include for example, Bohl and Van Zoest (2003), Little et al (2003), Farmer, Gerretson and Lassak, (2003), while regional studies include for example, Hulliet, (2004) and Graven (2004). Furthermore the interest in COP professional development initiatives has been against the shortcomings of conventional professional development interventions. Many studies have heavily criticised traditional mandatory one-shot "workshops" run in school districts as being unproductive, fragmented, unrelated to practice,

[17] Sfard and Prusak(2005) do not use the term 'current identities' and instead refer to 'actual identities'. However in personal e-mail correspondence between Mellony Graven and Anna Sfard in November 2008, Sfard indicated that she decided to replace the term 'actual identity' with 'current identity' since many readers interpreted 'actual identities' as declarative. We thus use the preferred term 'current identities' here. See also Graven (2012) for elaboration on this.

lacking in intensity, content and follow up and having little effect on teacher practice (Chisholm et al, 2000; OECD, 2008; Graven, 2012). Teacher community professional development approaches have great potential and many benefits. They are regarded as democratic sites that create opportunities for teacher learning, teacher growth and allow teachers to mutually support each other whilst giving attention to issues of subject matter, teaching practice and student learning which ultimately enables educators to improve the quality of learning experiences for pupils (Grossman Wineburg & Woolworth, 2001; Little, et al, 2003; Adler, 1997; Graven 2004, 2012).

It is against this conceptual backdrop that the South African Numeracy Chair, based at Rhodes University has developed – NICLE, whose main focus is to support quality numeracy teaching in the broader Grahamstown area. The numeracy teacher development programme is explicitly designed as both a Community of Practice and a Community of Inquiry teacher development approach and is framed by Wenger's Communities of Practice perspective (Wenger, 1998, Lave and Wenger, 1991) and by Jaworski's (2005) concept of mathematics Communities of Inquiry, which brings more of a critical perspective. In its first year running teachers have participated in 15 fortnightly numeracy sessions and they have also been exposed to a regional, a national and an international maths conference. The NICLE fortnightly meetings have been presented by key and influential numeracy guest speakers who provide teachers with a sense of the mathematics education community, its practices and diverse perspectives. NICLE is informed and guided by key international and influential numeracy researchers who link 'effective teachers of numeracy' with connectionists maths classroom practices (Askew et al, 1997a) and engage learners in the mathematical discipline (Ball, 1993) leading to learners' 'mathematical proficiency' (Kilpatrick et al, 2001). These writings have shaped the vision of the Chair and the projected professional numeracy teacher identity promoted within NICLE.

RESEARCH METHODOLOGY

The NICLE professional development programme forms the empirical field of research to this study with the unit of analysis being 'the teacher in NICLE'. In carrying out this research we are using an ethnographic approach so as to provide a rich thick description on how primary teachers fashion their numeracy identity through participation in NICLE. Whilst the broader PhD study of the first author, uses participant observations, interactive interviews and reflective journals to gather data, this paper presents part of the data obtained from interactive interviews carried out in November and December 2011. These interviews were conducted by the first author with 10 selected primary maths teachers participating in NICLE. The interactive interview affords the teachers voice in the research and reduced the influence over the interviewing process, with the participants retaining considerable control over the course of the interview (Corbin and Morse, 2003). A semi-structured interview schedule with open-ended questions was used to enable 'conversational intimacy' (Corbin & Morse, 2003, p. 328) and to encourage stories of the 10 selected primary teachers participating in NICLE. The average time for each interview was an hour. All interviews were conducted at the respondent's school and were audio-recorded and fully transcribed.

The ten teachers drawn from NICLE were selected through a combination of the purposive sampling and stratified sampling strategies. We intentionally selected teachers who actively participated in and frequently attended NICLE sessions and additionally those teachers who were willing to be part of this longitudinal research journey. Teachers in the sample are from

four different types of schools in the South Africa education system. Four are from a farm school, two are from a historically African township school, two are from historically Coloured schools in a historically coloured area and two are from an ex model C preparatory school in a formerly white area. We have used two letters (eg SP) to indicate school code names. In this sample of teachers 3 are intermediate phase teachers (one of these is a deputy principal), two are multi-grade teachers of grades 2-3 and grades 3-4, and the other 5 are foundation phase teachers. Notably all foundation phase teachers in the sample are female. The table below provides information on the teachers and shows the identification codes given to teachers. The first digit in the teacher identification number indicates the grade level taught with the only exceptions being multigrade class teachers (SP2/3 & SP4/5) and Teacher AP4-7 who taught grades 4 up to 7. The range and diversity of the teacher groups will assist in explaining how numeracy teacher identities evolve probably in relation to the grade(s) taught or phase specialisation.

Table 1 Sample Teachers background information

School Code	Type of school	Teacher I D	Gender	Phase Taught	Teaching years Experience
SP	Farm school with some multigrade classes	SP1	F	F P	6
		SP2/3	F	F P	14
		SP4/5	F	I P	
		SP0	F	F P	6
OP	Ex model C school in a historically white middle class surburb	OP3a	F	F P	11
		OP3b	F	F P	27
BP	Historically African township school	BP3	F	F P	17
		BP6	M	I P	
AH	Historically coloured combined primary and secondary school in a historically coloured area	AH0	F	F P	6
AP	Historically coloured primary school in a historically coloured area	AP4-7	M	I P	19

A deductive data analysis strategy has been used to synthesise and make sense of raw data (Best and Kahn, 1998), obtained from interactive interviews. Thus the coding and exploration of data was guided by the identity framework elements presented herein. The outlined identity framework will be used to analyse and interpret the sample data. Such structuring of data places identity at the centre and assists in explaining how primary teachers negotiate numeracy teacher identities through participation in NICLE.

NICLE TEACHERS'NUMERACY IMAGINATIONS

In this part of the paper we present part of our research findings and these are interpreted through the lens of the underpinning identity theoretical framework. The data presented here was gleaned from our interactive interview question 7, which read '*What type of numeracy teacher do you imagine to be at the end of the NICLE programme*?' According to Wenger (1998, p.176) imagination 'is the process of expanding our self by transcending our time and space and creating new images of …... ourselves'. This concept of imagination was used to elicit stories of the way teachers foresee themselves within the space, context and opportunities afforded in this numeracy teacher professional development programme. Imagination would assist the NICLE sampled teachers to envision possible (mathematical) futures, possibilities and identities (Wenger, 1998).

The teachers' responses refer to different aspects of identity and we have grouped these into themes. Some teachers refer to two or more aspects of identity in their responses and therefore their notion of imagined identity can fit in more than one theme.

From the responses two of the teachers created images of a *mathematical teacher they longed to be*, by 'being in someone else's shoes' (Wenger, 1998, p.185). Thus Mrs SP2/3 at the end of the NICLE wanted to be 'like Mrs SP1', whom she commended as having 'all the aspects of a brilliant maths teacher'. Mrs SP2/3 and Mrs SP1 taught at the same school, with the latter being a Montessori trained teacher, who foresaw herself being like one of her 'very good (numeracy) lecturers' when she trained. Mrs AH0, a grade R teacher hoped to be 'the best maths teacher …… be like Zonia' (Zonia was the NICLE teacher co-ordinator, who had herself been a numeracy teacher and had won a teacher of the year award).

Mr BP6 an intermediate phase teacher, imagined himself at the end of NICLE to be, '…the perfect teacher,… to be at the top,… to be one of the best maths teachers. I want to leave behind a legacy'. In Mr BP6's case the imagined form of an educator was an embodiment of an idealised teacher rather than a specific teacher (or role model) he admired as in the case or Mrs SP2/3, Mrs SP1 and Mrs AH0.

On the other hand three of the teachers' future numeracy teacher visions related to embracing a *lifelong learning way of being.* So Mrs SP0 said she wanted 'to be a lifelong learner' and Mrs SP1 explained how her uncle, a Professor, had instilled in her the notion of being 'a perpetual learner'. Mrs SP4/5 wanted 'to be a reflective and critical teacher'. Such imagined ways of being may have been informed by the state/official projected teacher identities as contained in policy documents and promote 'life-long learner' as one of several teacher roles. Becoming a life-long learner is also however promoted in NICLE which envisioned professional (primary maths) educators '…who actively engage in opportunities for life-long learning' (Graven, 2011, p.16).

Teacher AP6 who taught the intermediate phase wanted 'to be competent in all aspects' at the end of the NICLE programme. His imagined future numeracy teacher identity was thus different from the rest of the themes identified. Mr AP6 foresaw himself being a *'competent'* numeracy teacher.

Three of the teachers hoped to have new extended (numeracy) identities that explored new relations in the contexts of their maths classroom practices (Wenger, 1998), and the *learners they wanted to develop*. Ms BP 3 and Mrs OP3a wanted 'to produce learners' who are

confident, daring and independent in numeracy. Thus Ms BP3 wanted ultimately to be, '….a teacher that will produce. When my learners enter (Intersen), that is Grade 4, they will be able to be independent in….numeracy'.

Similarly Mrs OP3a's vision of a numeracy teacher was connected to her learners. She realised that, '….children do need to be extended and that children need to be encouraged to use their thought to think in different ways…..I am really hoping that when my children leave me, there would be confident and daring'

Mrs SP2/3 went a step further hoping at the end of the numeracy teacher community 'to empower learners'.

However one of the teacher's portrayals of her numeracy teacher identity showed some tension. Mrs OP3b a high school trained teacher, emotionally responded to the question saying that she was 'tracking along a path that I do not know where it's going to go?' Mrs OP3b was grappling with who she wants to be. Within the interview she grapples with her trajectory within or away from teaching and explains how she has been grappling with this for a while. She says: "You know last year I completed a UNISA course in art, I have just completed it and now I am in NICLE (laughs). How does that fit together? I don't know yet, I don't know so that's what happened. Where I wanted to be , just to cut short and now I'm tracing a path that I do not know where it is going but every second Tuesday I come and enjoy and I go away and I think well I will try this …' Later she explains how her continuous participation in NICLE was providing her with confidence in her teaching and was taking her 'back to what I know is right'.

With the exception of Mrs OP3b, who emphasised that NICLE is helping to confirm much of what she knew from previous teaching experiences in other schools, the question on teacher imagination generated a future numeracy teacher orientation with teachers exploring *new* yet varied extended ways of doing, becoming and being mathematically.

IDENTITY AS LEARNING TRAJECTORY

Wenger's (1998) notion of identity as a learning trajectory is similar to Sfard and Prusak's (2005) definition of learning as both involve the element of 'who we are' (identity), as of now (currently) and where we are going (designated). I will use these two identity concepts to describe how teachers participating in NICLE are changing their perspectives and developing (numeracy) learning trajectories. The data presented here is not from specific interview questions but was gleaned from the teachers' utterances in relation to their numeracy learning trajectories across a range of questions. Mrs AH0 and Mrs SP0, both grade R teachers had started their careers in the entertainment and banking industry, respectively. Both had been teaching Grade R for 6 years but were now eager to teach 'higher grades'. At her school Mrs AH0 was now 'giving Grade 3s extra maths time' and was happy that NICLE had 'introduced me (her) to AMESA' and was 'making me (her) to grow in this field'. Likewise Mrs SP0 looks forward to, 'work with Grade 3s ...next year' and according to her NICLE was helping her, 'develop professionally, my self-confidence with maths' and she could 'see potential to actually call myself a numeracy teacher'. These two teachers had constantly negotiated their identities during the course of their lives and through participation in NICLE and across communities (AMESA and University teacher's college) and in the process their identity formed trajectories inclined towards a numeracy specialisation teacher identity.

Most of the teachers in the sample were starting to indicate that their participation in NICLE was fashioning their numeracy identity in terms of improving their maths classroom pedagogical practices as they felt the need to engage learners in maths classes. In a NICLE presentation the Chair (2nd author) had shown the teachers a Deborah Ball video on teaching even and odd numbers. The video was meant to pave the way for reflective teacher practice and to encourage the use of videos for reflective purposes. Additionally however the video promoted a type of numeracy teacher practice that was learner centred and probed learners' mathematical thinking. Ms BP3 had initially admitted that her understanding and enjoyment of maths teaching 'was lower before' NICLE and through participation in NICLE she had become confident with herself and had learnt that, '…everything those learners are doing in class you should ask them why? I …..give them the space that they could develop more without me …..NICLE has then given me a platform whereby learners can develop their own understanding of something'.

Similarly Mrs SP4/5 who 'was terrified of numeracy. . . . but enjoyed it now' admitted that NICLE, '… helped me to understand, to look at things from a child-centred point of view. …..I feel as though I am on the right track with the way I teach maths…NICLE…supported my methods and my approach so far……'.

Mrs SP4/5 looked forward in the next year to use Singaporean maths in her classes. Mrs Bev Keth, a Rhodes masters student (and principal at a school in East London) had done a NICLE presentation on her research into the use of Singapore maths in schools in the Eastern Cape. Mrs SP2/3 also agreed that NICLE helped her 'to understand particularly how the children understand the maths'. In the same way Mrs 0P3a accepted that participating in NICLE had, '…definitely saved my teaching because I have communicated more with the children about how …,and why they are doing things….it definitely has helped me with the way that I teach maths, the way that I have presented it…'.

In developing their learning trajectories through participation in NICLE, most of the sampled teachers were renegotiating their numeracy teacher identities and this renegotiation was in continuous motion (Wenger, 1998), meandering towards the designated numeracy teacher identity that promoted 'engaging learners' (OP3, interview, 23/11/2011), in maths classes. Such teacher change in relation to maths practices was from the teachers themselves in addition to a field of influence (NICLE in this case) (Wenger, 1998).

The two male intermediate phase teachers in the sample study, from our interpretation of their responses, seemed to navigate a narrower gap between their current numeracy teacher identity and the future projected NICLE numeracy teacher identity. These teachers were quite assertive of their mathematical identity as Mr AP4-7 had said 'I am an authority in the intermediate phase mathematics'. Similarly Mr BP6's teaching trajectory was firmly entrenched in maths and said that he 'wouldn't like to teach another subject'. Such overt mathematical identities we believe are likely to have been promoted when the teachers enrolled for B Ed Maths degrees with the Rhodes University Maths Education Programme (RUMEP) which had a component 'on the maths content for the intermediate phase'. According to Mr AP4-7 NICLE was supporting his understanding of maths which was 'starting to grow'. Mr BP6 also longed to '…try to instil what you learned there (in NICLE)…., you try to practice in class….. (for example)... Singapore maths'.

In articulating their learning trajectories both Mr BP6 and Mr AP4-7's mathematical identities had been uniformly influenced by where they had been, that is attaining numeracy related degrees and their participation in NICLE had supported and reinforced their mathematical practices thus sustaining and strengthening their mathematical personas. This concurs with Wenger's (1998, p.158) argument that learning trajectories (which characterise identity) connects and 'incorporates the past and the future in the experiences of the present.' However Mr BP6, unlike Mr AP 4-7 felt not adequately challenged by NICLE's focus on numeracy foundations and would have wanted to witness 'more content based workshops run by NICLE'. (NICLE focuses on Grade 3 and 4 teachers even while it includes teachers from other grades who have requested participation).

IDENTITY AS A NEXUS OF MULTIMEMBERSHIP

We employ Wenger's (1998) characterisation of identity as nexus of multimembership to analyse data gathered through the participants' responses to two interview questions which read; '*How would you describe yourself as a numeracy teacher?'* and *'Explain to me how you came to be a numeracy teacher?'*. The notion of identity as multimembership shows that 'membership in any community of practice is only a part of our identity' (Wenger, 1998, p. 158). All the foundation phase teachers, with the exception of Mrs AH0 firmly and uniformly asserted that they were not only numeracy teachers. Numeracy teaching was only a part of their teaching. Mrs SP1 had said, 'we teach numeracy, literacy and life skills, I don't really see myself as a numeracy teacher' Mrs OP3a had also said the same thing: 'I wouldn't like to see myself as only a maths teacher…In foundation phase you got to teach everything….you know the three Rs, reading, writing, arithematics and everything else in-between'.

This resonates with what teachers SP4/5, SP2/3 and BP3 had said. Mrs BP3 succinctly captured her multimembership when she said, 'we are mixed teachers, …we teach all the subjects, you teach numeracy,…then there is literacy,…there is life skills, there is art, there is Phys ed (physical education),… whatever there is… we are not really specialist numeracy teachers'.

The sampled foundation phase teachers who were participating in NICLE thus embedded their numeracy teacher identity within their foundation phase teaching across subjects. Thus though they had participated in NICLE their identity was not single (subject-specific) but a nexus of multimembership in which it was both one and multiple (Wenger, 1998). Such a multimembership teacher identity would be attributed either to the phase taught or the phase specialisation under which one was trained at teachers college. As Mrs BP3 said, 'at college you are trained to teach many subjects'. However teachers Mr AP4-6 and Mr BP6 who had attained B Ed degrees with an intermediate phase maths component emphasised their single trajectory subject specialisation as Maths, BP6 would prefer not to teach any other subject, except maths. Consequently it implies that the phase taught, one's pre-service phase/subject specialisation or further training in maths can influence the nature of one's developing mathematical identity and learning trajectory within NICLE.

Whilst NICLE took heed of one's phase specialisation the long term aim is to create numeracy leader educators.

CONCLUDING REMARKS

From our early reading of the empirical data it seems that participation in our numeracy focused teacher development program has shaped teachers' pedagogical identities and to a lesser extent their numeracy identities up to this point. This is captured by Mrs OP3a who says, 'I wouldn't say I have a better understanding of maths than that I had before but it definitely has helped in the way that I teach maths…..' Professional development programs with a strong specialisation such as NICLE will need to navigate the development of specialised leader educator numeracy teacher identities within the broader foundation phase specialisation which is foregrounded in teacher histories and stories and thus at the heart of their current identities. This navigation is not required for the intermediate phase teachers who already embrace strong mathematics specialisation identities. Furthermore the stories these teachers have told in these interviews suggest variation in teacher identities both across foundation and intermediate phase teachers and between teachers in these bands of education. Further elaboration will result from our on-going research of teacher learning within NICLE.

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