

Professional mathematics teacher identity of a pre-service teacher: a case study

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Abstract

This study investigates the development and nature of Professional Mathematics Teacher Identity (PMTI) in pre-service teachers. It is an exploratory, descriptive case study in which six Fourth Year mathematics education students participated. PMTI is examined in terms of three aspects: Subject Specialisation; Teaching-and-Learning Specialisation and Caring, and the actualisation of these aspects is analysed in the context of the teaching practicum classroom. The effect of each student's personal biography, including their schooling, view of the subject mathematics as well as their experiences during tertiary training and teaching practica is probed. The study revealed that, while certain of these students say they *are* something which in fact they are *not*; others say they are definitely *not* something, which in fact they *are*. They may believe that they are subject specialists, teaching-and-learning specialists and nurturers, but when they are observed at work in the classroom these specialisations are not necessarily, or not consistently evident.

Key Words: Professional Mathematics Teacher Identity; Influencers; Actualisation.

1. Introduction

"Who is the self that teaches?" is the question at the heart of my own vocation. I believe it is the most fundamental question we can ask about teaching and those who teach – for the sake of learning and those who learn. (Palmer, 2007, p. 8)

There is a sociologically constructed 'group identity', such as is described by Wenger (2000) as a community of practice. For Gee (2000), the concept is best encapsulated as follows: "Being recognized as a certain 'kind of person', in a given context, is what I mean here by 'identity'. In this sense of the term, all people have multiple identities connected not to their 'internal states' but to their performances in society" (p. 99). He describes identity as "an important analytic tool for understanding schools and society" (p. 99).

While there is a generally observable "community of practice" (Wenger, 2000) identity of the education students at University of Pretoria (UP), who are these students as professionals in their field? In Gee's words, what kind of person is this in this given context? Now the "clarity of identity as a variable" in terms of their *professional* identity as *pre-service* teachers of a specific subject (mathematics, in this case) is not evident and requires investigation. What does it look like? How is it acted out in the classroom?

According to Borko and Putnam (1996), students come into tertiary training with "entering perspectives [that act] as a filter that determines how experiences within the teacher education program are interpreted" (p. 679). These filtering "perspectives" are recognised in this study as part of the Professional Mathematics Teacher Identity (PMTI) of such students, which is already in existence before they attend a single university module. These students are eventually, after three years of training at UP, sent out to schools for a

practical teaching period. Palmer (2007) declares that “we teach who we are” (p. 2). By implication then, that “who we are” only becomes visible when “we teach”. So, the professional identity of these pre-service mathematics teachers needs to be observed in action in the classroom, so that we can gain insight into the “kind of person” (Gee, 2000, p.99) that is to be released to teach in the South African mathematics classroom.

2. Context of the study

In South Africa, despite internationally recognised changes that have taken place in the country since 1994, there remains a deep and serious concern about the state of mathematics education in this country. Ensor and Galant (2005) analyse the situation as follows: “While the pathology is widespread... we are concerned that research has thus far failed to ascribe to teachers and learners a positive subjectivity [identity]. We know what they don’t do, but we have not adequately grasped *why* they do what they do” (p. 301) (emphasis added). I believe that this question ‘why?’ is best answered by an investigation into the professional identity in the early stages of its development. Bullough (1997) confirms this:

Teacher identity – what beginning teachers believe about teaching and learning as self-as-teacher – is of vital concern to teacher education; it is the basis for meaning making and decision making. ...Teacher education must begin then by exploring the teaching self. (p. 21)

At UP, all students in the Faculty of Education who choose to train as teachers of mathematics have taken *mathematics* as a Grade 12 subject. In South Africa, all learners take mathematics as a subject to the end of the ninth grade of their school career. After that, they may choose to do either *mathematical literacy* or *mathematics* to Grade 12 level. Therefore these students have each been in a mathematics class for twelve years before commencing their tertiary studies. As students in the UP’s Department of Science, Mathematics and Technology Education, they are required to complete, amongst others, modules about mathematical content, the methodology of teaching mathematics, and teaching practicum, and after four years they are released into the professional world of teaching.

It is against this backdrop that this study takes place: it investigates the ways in which students studying to be teachers of mathematics at the University of Pretoria (UP) “act out and recognise” (Gee, 2000, p. 99) the identity described by scholars as professional and related to the teaching of mathematics (see Beijaard, Meijer & Verloop, 2004; Boaler & Greeno, 2000; van Zoest & Bohl, 2005; Day, Kington, Stobart & Sammons, 2006; Graham & Phelps, 2003; Hodgen & Askew, 2007; Jita, 2004; Lasky, 2005; O’Connor, 2008; Walshaw, 2004; Zembylas, 2003). In this study, this specific identity is called Professional Mathematics Teacher Identity (PMTI).

3. Professional teacher identity

Abdelal, Herrera, Johnston and Dermott (2006) describe the literature around professional identity in string terms: “the current state of the field amounts to definitional anarchy” (p. 695). The literature indeed abounds with a variety of definitions ranging from descriptions of development and function to lists of constituents. In this study professional identity is seen as a narrower version of the concept of identity. It is not the same as the “core

identity” which “holds more uniformly, for ourselves and others, across contexts” (Gee, 2000, p. 99). Professional teacher identity can simply be defined as ‘who I am at this moment in this context’ (Beijaard, Meijer & Verloop, 2004).

PMTI is a further narrowing of professional teacher identity in that it relates ‘who I am’ specifically to the mathematics classroom and the subject itself. PMTI is also narrower than Mathematics Teacher Identity which may include those who, although they teach mathematics from time to time or for a period, are in fact not professional mathematics teachers – they may have been co-opted into teaching the subject because there is no one else to do so in a particular school, or some such circumstance. The term Professional Mathematics Teacher Identity is posited in this research as involving an individual who has studied the subject for the specific purpose of teaching it.

4. Conceptualisation of the research

In the interests of an in-depth investigation into pre-service PMTI, this identity is examined in terms of how it develops and what it looks like. The literature (van Zoest & Bohl, 2005; Varghese, Morgan, Johnston, Johnson, 2005; Boaler, William, & Zevenbergen, 2000; Beijaard, 1995; Kagan, 1992) indicates that teacher identity is not a simple, unitary construct, but has both social (in-the-community) and personal (in-the-mind) roots, and that its nature is complex (Cooper & Olson, 1996; Stronach, Corbin, McNamara, Stark & Warne, 2002; Zembylas, 2003; Beijaard, Meijer, & Verloop, 2004).

This study was guided by an overarching question, refined in three sub-questions.

Who is the pre-service student at the University of Pretoria in terms of her Professional Mathematics Teacher Identity and how is this identity actualised in the classroom?

a) In what way do the influencers of PMTI shape its development? This study looks at sociological and personal influencers which lie within the various contexts through which the student moves or has moved, like their schooling, cultural and family history, and the university experience itself.

Researchers like Thompson (1984), Ernest (1988), Cooney (2003) and Cross (2009) have also found that the teacher’s view of the subject mathematics has an effect on their professional identity. Adler and Davis (2006) call this a “specificity to the way that teachers need to hold and use mathematics in order to teach mathematics – and [that] this way of knowing and using mathematics differs from the way mathematicians hold and use mathematics” (p. 272).

b) What are these students’ perceptions of their PMTI? The actual nature of PMTI is best accessed through the perceptions of the person whose PMTI is being investigated, because, as Beijaard et al (2004) explain, “[t]he world of the self may appear to the outsider to be subjective and hypothetical, but to the individual experiencing it, it has the feeling of absolute reality” (p. 108).

According to Beijaard, Verloop and Vermunt (2000), this identity can best be studied through investigation of the teacher’s perception of self as Subject Specialist, Teaching-and-

learning Specialist (referred to in their study as didactics expert) and Carer (referred to in their study as pedagogics expert).

While the student can be asked to explain the nature of her PMTI, the nature of her PMTI also explains what she does in the classroom. Only in seeing the identity in action can analysis take place of the perceptions which constitute it. This gives rise to the third sub-question which deals with the manifestation of PMTI:

c) How is this identity actualised in the classroom? If Palmer (2007) is to be believed and “we teach who we are” (p. 2), then “who we are” as opposed to “who we think we should be” is what can be observed in the classroom.

Thompson (1984), found that teaching-and-learning skills can be investigated through observing what the person sees as evidence that the learners understand, where the locus of control in the classroom lies i.e. whether the person’s practice is teacher/learner centred, and how flexible their planning allows them to be. Beijaard’s third category, caring, we found could be observed in action by investigating the evidence and purpose of the nurturing to be seen in the classroom. The conceptual framework used for this investigation is thus visualised as follows:

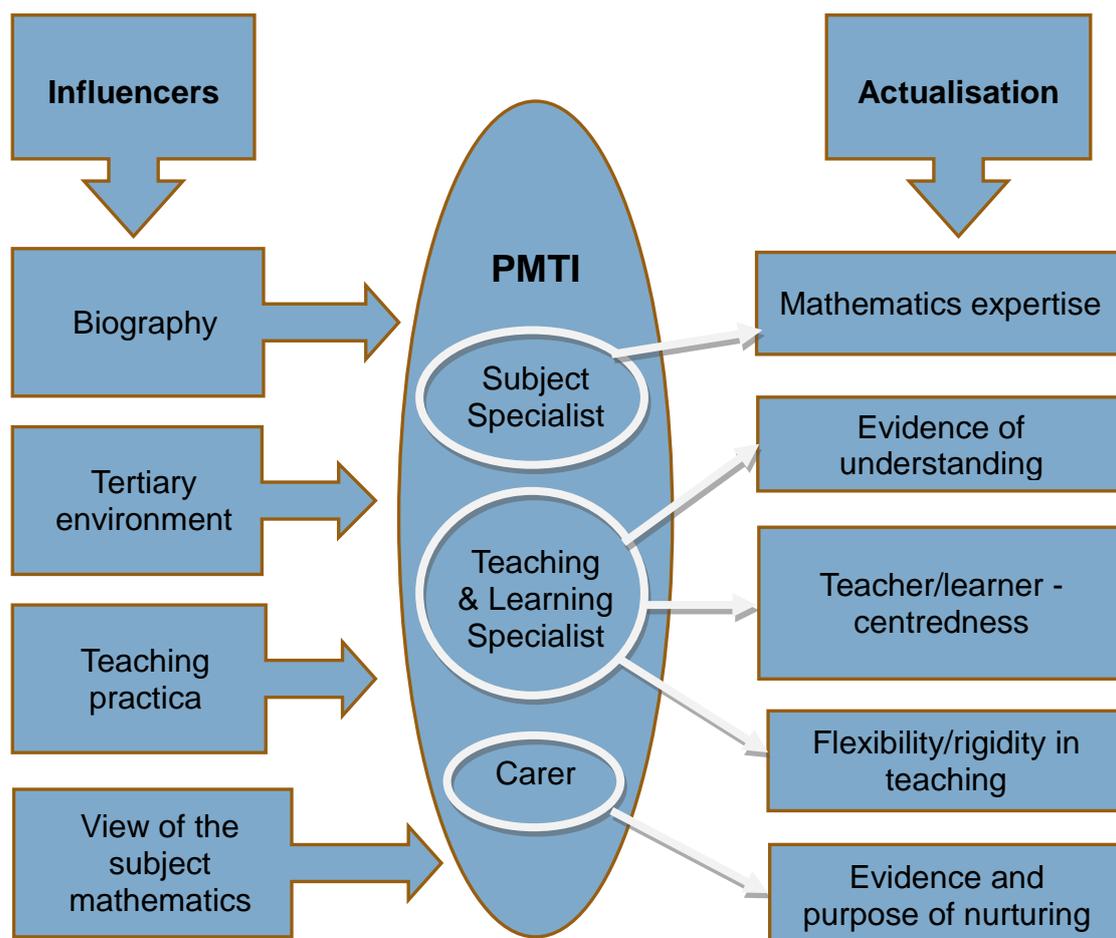


Figure 1. Conceptual framework for PMTI

5. Method

We decided that qualitative methodology was appropriate and that a case study would best facilitate the in-depth investigation of the PMTI of students at UP.

5.1 Sample and participants

The target population for this case study was the mathematics education students of 2010 in the Department of Science, Mathematics and Technology Education of the Faculty of Education at UP. This population was chosen for two reasons: convenience (We have direct access to these students as their lecturers) and the demographic diversity for which the university is known. UP accommodates a large demographic diversity and a range of backgrounds in terms of the schools from which the students have matriculated. According to Paterson & Arends (2009), UP is the second most popular tertiary institution in South Africa for prospective educators, and thus is particularly characterised by the diversity of its students.

The population in question (sixty five in all) is divided into two: those students who are preparing to teach in the FET phase of high school and those students who will eventually teach Grades 4 to 9. The latter group, while majoring in mathematics, amongst other subjects, are not necessarily subject specialists – in fact those grades tend to require generalists in terms of their fields of expertise. However, the group of students who want to teach in the FET phase (of whom there were thirty one in 2010) are trained to be subject specialists and are therefore those who, in theory, are not only *able* but who also *desire* to teach mathematics to learners who have chosen to continue with the subject to Grade 12 level. It is this group of students who form the sample for this study. Of the thirty one students, twenty five consented to be available for selection as participants in the study. Fourteen of the participants in the sample were female, and eleven male.

A questionnaire was administered to these students providing biographical information regarding the type and environment of high school attended, Grade 12 results and sex of the participant. Prior to the political changes which came about in South Africa in 1994, education was generally segregated and there were “white” schools, the better of which were designated as Model C schools, and “black” schools, later usually referred to as “formerly disadvantaged” schools. Despite the changes of 1994, the general constitution and character of many of these schools have remained constant.

Working with Patton’s principle that “if researchers assume that a variable may influence the data they should implement variations” (2002, p. 109), the process for identification of a maximum variation subsample began with the placement of the participants into categories based on the two most obvious variables: gender and race. This subdivision resulted in five fairly homogeneous groupings, three of which were female, and the smallest of which were Female-Indian and Male-white containing one and three participants respectively. These two categories were where the selection process began since they offered little choice in terms of who would be selected. Since there were three female categories and only two male, we decided that two participants would need to be selected from the Male-black category so that the number of female and male participants remained equal. Three men (one English, one isiZulu and one Sesotho) and three women were selected (one Afrikaans, one Sesotho, and one Indian) as a maximum variation sample from a variety of schools.

5.2 Data Collection: strategies and instruments

Two sets of individual interviews were held with these six students, one before and one after the teaching practicum. Classroom observation was done with them during their teaching practicum in the second term of the school year to strengthen the data collected verbally in the interviews. The questions were thus based on their observation of the student's subject knowledge, teaching-and-learning skills, and nurturing propensities.

5.2.1. Questionnaire

A questionnaire was administered to the entire class of Fourth Year mathematics education students at the commencement of their methodology module. The questionnaire was a translated and adapted version of a questionnaire created by Beijaard et al in their investigation of "experienced secondary school teachers' current and prior perceptions of their professional identity" (Beijaard et al, 2000, p. 749). The questionnaire provided biographical data like sex, race (by virtue of surnames) and type of high school, providing the basis for the selection of the subsample, and an opportunity for the students to discuss their self-perceptions as

Subject specialists, Teaching-and-learning specialists and Carers.

5.2.2 Interviews

Prior to the commencement of the practicum, individual interviews were conducted with each of the sub-sample members. These interviews were semi-structured, and the questions were designed to further clarify and provide depth and insight into the beliefs expressed and explanations given in the questionnaire. At the end of the third school term, which brings to an end the long practicum in which the Fourth Year students participate, the sub-sample was again interviewed individually. The semi-structured interviews held at this point yielded data regarding the overall practicum experience, as well as insights into tendencies and behaviours observed in the videoed lessons. The Atlas ti. - coded videos of the classroom observations were watched and discussed during the interviews.

5.2.3 Classroom observation

Although the students had quite clearly expressed their ideas about how they teach and who they are as mathematics teachers in the initial interviews, the classroom observations were designed to give insight into theory-in-use as differentiated from espoused theory (Argyris & Schön, 1974; Maxwell, 1996). The recordings were also transcribed, coded in Atlas ti. and analysed.

6. Analysis

These recordings were professionally transcribed, without grammatical corrections or exclusion of ums and other verbal eccentricities. Both deductive and inductive coding was used initially as Open Coding, and then as Code by List: the elements in the conceptual framework were used as broad code subjects, like "Evidence of Understanding" – hence the deductive aspect of the coding; then a variety of sub- codes were created, drawn from what was said – hence the inductive aspect. The large number of codes created was a function of the desire to code even nuances of meaning.

7. Results of the study

The strongest influence for most of them lay in their personal background, even if this was not explicit in the discussions with them. When Martie¹ was at school, she found that her mathematics teacher was someone who struggled to explain a concept. Martie retaught what he had tried to teach and derived great satisfaction from it. Martie is seen to teach with great enthusiasm and passion, and to be an ‘explainer’ – one who seeks to impart understanding of the mathematics concept in question. Ayesha¹ wanted to be a veterinary surgeon, but was dissuaded by her father who reminded her of the duties of a wife and mother of her culture. In Ayesha’s classroom practice she is seen to be a traditionalist teacher who teaches for learner achievement by emphasising procedure. Thandi¹ holds herself aloof from her learners – her interaction with them is limited to one direction only: she imparts knowledge to them. Thabo’s most vivid recollection of his schooling is of being given the opportunity to teach in the absence of his mathematics teacher: as a learner he excelled in the subject, and loved actually teaching it. When Thabo¹ is standing in front of a class, his joy in both the subject and the teaching thereof is patently visible. John¹ says he was a shy and reticent boy while at school, not drawn out of his shell by his teachers. The one aspect of John’s PMTI that stands out in everything he says and does, is that he values relationships and strives to reach out to his learners on an emotional level. Siphon¹ walks around the class, pausing to talk and laugh with individuals everywhere. He goes out of his way to show the learners that he values each one as an individual. It is thus a finding of this research, in corroboration of the literature studied, that PMTI is influenced by elements related to specific contexts, and particularly by schooling experiences. In fact, Liljedahl (2002) states that “...the formation of teachers’ beliefs about mathematics teaching and learning come from their own experiences as a learner of mathematics” (p. 2).

While their tertiary training allowed these students to develop a deeper understanding of the psychology of learning and teaching, this did not dominate their classroom practice and was mainly evident in what they *said* in the interviews. In this regard, Ball (1988) calls teacher education “a weak intervention” (p.40), not changing the fact that “are most likely to teach math just as they were taught” (ibid., p. 40). To some extent, the teaching practica allowed them to weigh up what they had learnt in the university lecture hall (i.e. the theory) with what they saw and experienced in the school classroom (i.e. the practice). This is exactly what Feiman-Nemser and Buchmann (1985) called the two-world’s pitfall. For some, like Thabo, this meant that he could choose between these to do what worked for him. Others, like Thandi, claimed they could develop their own teaching style.

The single factor which all six students claimed to recognise within themselves was the desire to “make a difference”. They felt that there was that within their PMTI which made them inherently teachers and which received satisfaction from the “aha” moments when learners understood what was being taught. However, this PMTI influencer was found to be less definitive than their contexts.

Their view of the subject mathematics was generally not well verbalised and it would seem that they had given little thought to the notion of what mathematics really was in their understanding.

7.1 Perceptions of their PMTI's

Their perceptions of themselves in terms of the three aspects of PMTI which are studied in this research are not necessarily directly in line with what is observed of their classroom practice. These perceptions are held in such a way as to be an intrinsic part of who they think they *are* as teachers, but, paradoxically, not necessarily of what they *do* as teachers.

7.1.1. As subject specialists

Although all six believe that being a Subject Specialist is the foremost aspect of their PMTI, they do not all believe that they in fact *are* such specialists. It would seem that they recognise the importance of this aspect and what its position should be in their PMTI, but they have doubts about their ability to live up to the level of mathematical expertise that the term implies. Ayesha explained as follows: "... I *want* to be a subject specialist; I *want* to know my work." Yet she believes that, because she is able to field learner questions successfully, she in fact *is* a subject specialist. Thandi said almost the same thing: "I *should* be a subject specialist to be able to teach learners good in school. I *should* be well equipped with the subject knowledge that I can pass on to my learners" (emphasis added). However, she found out during the practica that, in this regard, "lots of work is required before one goes to teach in schools..." She felt that her lack of mathematical expertise was a problem because it meant that she had to research each topic before she taught it, but she could also rationalise her lack of expertise by indicating that this meant she was able to identify what was difficult for the learners because it was also difficult for her. Thus, "I can see a good mathematics teacher because I'm still learning mathematics, I'm not a specialist." John also recognises his inadequacies as subject specialist, as testified to by his mentor teacher: "He hasn't come here pretending to know it all. He's come with questions..."

Thabo, however, indicated that he found it easy to teach because he understood the intricacies of what he was teaching. Martie is aware of the emotional aspect associated with the learning and teaching of mathematics: "People in general have this psychological block against, well, mathematics." She, however, loves mathematics and is fully persuaded of her expertise in the subject. Her mentor teacher in fact repudiated Martie's prioritisation, saying that in fact these three aspects were not on a par in her PMTI – she was predominantly a subject Specialist.

These students attach great value to "knowing your subject". They all seem to believe that a mathematics teacher who is not a subject specialist is not a good teacher. However, the belief that this aspect of PMTI *should* be the most important does not necessarily make it so for the individual.

7.1.2. As teaching-and learning specialists

The six participants all seem to believe in greater or lesser measure that they know how to teach mathematics. They believe that they have the necessary skills and techniques to convey information successfully. Most of them acknowledge the value of university modules in which they learnt about how children learn. None of them mention their lack of experience in this regard. In fact, most of these students referred directly or indirectly to an instinctive knowledge of how to teach. Ayesha went as far as to say that, "One can't really teach someone how to teach, I think it comes to you naturally..."

Martie, who says that her university training added very little if anything to her knowledge base, admits to having acquired different methods for teaching specific topics, which she finds useful because she believes that learners learn in different ways. She therefore has retained within her PMTI the beliefs acquired at school by observing a teacher whose communication of mathematical concepts was not successful, and by teaching her co-learners who did not understand and achieve as well as she did in class. Ayesha sees herself as a natural teacher, but also espouses the notion of repeated explanation to facilitate understanding. Thandi, however, declared that, "You can see the other teacher doing...teaching in this other way and then when you try it and then it won't work for you." The solution lay within her own PMTI: "You have to develop your own way of teaching that the learners would understand..." Thabo's dominant belief is that lessons should be learner-centred, something he learnt about at university. His own schooling was teacher-centred and described by him as boring. Looking back at the teaching style he used as a learner replacing the teacher, he describes himself as boring. John is concerned about boredom too. His dominant belief is in the necessity of creative involvement of the learners in every lesson. Siphon is driven to teach in such a way that the learners are continually encouraged, and so he has adopted a teaching style which can best be described as entertaining. He sees himself as someone who knows and loves his subject and who knows and loves the learners, particularly in view of their cultural diversity, so his PMTI is characterised by these two beliefs and his determination to integrate them.

All six participants have sustained the effect of their own schooling in this aspect of their PMTI's while also making some of the theory they learnt about at university, like learner involvement, their own. Added to this are also their personalities. So, in terms of who they are as teachers, there is an amalgam of these three that has made them who they are currently as teaching-and-learning specialists.

7.1.3. As carers

With the exception of Thandi, all the participants frequently expressed their concern about the learners and their involvement in the lessons, as well as their own involvement with the learners, despite the fact that all (apart from Martie, for whom all three aspects were equal) of them placed this aspect below the others in their prioritisation exercise. There is awareness among them that mathematics is not universally loved by learners, and is in fact often associated with fear or boredom. There is therefore a noticeable inclination to "make a difference", to involve the learners in an enjoyable way and to help them to experience mathematics as challenging rather than frightening. Martie, for example, recognises that the negative emotions associated with the subject may also be attached to the teacher and does her best to show herself as a continually, smiling, caring, approachable teacher.

John stands out in this regard. He, perhaps because of his own experiences as a quiet, introverted learner at school, is predominantly concerned with reaching out to the learners through relationships, possibly established on the sportsfield rather than in the classroom. Thabo, also concerned about learner-centredness, is driven rather to see the learners understand mathematics the way he does, to see them love the challenge and rise to it. Siphon, denigrated at school because of his colour and despite his mathematical prowess, is determined to 'make right', to treat the learners with respect, to the point of trying to speak their various languages even if they are far removed from his own.

Ayesha and Thandi are somewhat different. Ayesha, while believing that “children are my second passion” and expressing her willingness to be available to them and to help them overcome the learning impedimenta resulting from the fact that “some people are depressed, some people have ADHD and ja...”, holds herself aloof from her learners. This may be attributable to the belief that teachers should be moral preceptors and role models for their learners. Thandi expresses her beliefs regarding nurturing only in theoretical terms: “It is part of every teacher in each and every learning area, even mathematics. Learners are made up of their social space/world.” When pressed to explain what this really means to her as a teacher, she goes no further than to say that if someone is sleeping in her class she would want to know why, in case “that someone is dying and I’ll be responsible”. She expresses no link between the theory of learner involvement and actually caring for the learner.

There is a considerable range of beliefs regarding this aspect of PMTI discernible in this group of students. At the one extreme there is a deep conviction that relationships are the basis for effective teaching (John) and at the other there is the belief that the learners are in the classroom to learn, and that is all (Thandi). In between these two poles is the general belief that teaching should be learner-centred if effective learning is to take place.

7.2. Actualisation of their PMTI’s

Ayesha has a formal approach to both the subject mathematics and the way it is to be taught, and even tends to be traditional in her presentation of the concepts she is teaching. Martie is also formal in her approach in that she is, by preference procedure and process orientated, while simultaneously being focused on bringing the learners to a point of understanding. Thandi’s approach to mathematics in the classroom is defined by the limitations in her subject knowledge: she teaches a concept and then allows the learners to develop it further while they work on the board and even answer questions. This is *not* in fact a form of constructivism in action: she is more at ease with the subject matter in hand when she does not have to present it herself. Thabo is also formal in his approach to mathematics in the classroom; he believes in teaching until understanding is reached, allowing the learners very little leeway for self-motivated discovery. John and Siphon, by contrast, teach by leading the learners to the discovery of the truth that they were intended to find as an outcome of the lesson. Their approach is certainly more constructivist than can be seen in the classroom practice of the other four students.

From a purely visual point of view, these six students present completely differently in the classroom. Martie is friendly and outgoing, smiling frequently and encouraging the learners with gentle laughs and motivational words like “Of course!” and “Nearly there!”; a gentle shake of the head for “no” and a vigorous nod for “yes!” Ayesha maintains a formal distance: she teaches from the front of the class, rarely leaving the space between the teacher’s desk and the board. Even the cardboard triangles she was using to illustrate a point were shown to the class from there. Her expression is friendly and her delivery calm and formal. John, by contrast, walks down the aisles of the classroom, engaging the learners by asking them questions and periodically making them laugh with his quirky comments. His delivery is animated and his facial expression is friendly, often lit up with smiles or laughter. Thabo also walks down the aisles in the classroom, despite the fact that his mentor teacher

advocated standing in one spot in the front of the classroom, teaching with visible enthusiasm and a smiling face. Thandi, however, smiles not at all, remains in front of the class, or to the side near the door, and teaches with a deadpan expression and voice. She only ventures down the beginnings of the aisles when the learners are writing down sums. Siphon moves all around the class, talking in an animated way and gesturing with his hands. He frequently bends over a learner's desk talking briefly to individuals here and there as he is teaching, not just when the learners are writing.

There are a number of techniques that these six students use to determine whether their learners have understood the work or not. Thabo, for example is conscious of the class atmosphere: "the excitement, also the excitement in the classroom would show you that they're they...they...they do understand the concept, they have grasped the concept." Most of the students however believe that body language is one of the most obvious indicators of understanding: Thandi explains, for example, "I read their faces if they understand, they're with me or if they're just lost..." All six of these students were very much aware of the need to find evidence of understanding of the concepts they are teaching. They use a variety of strategies to find such evidence, ranging from the observation of the learners' body language to how their homework is done. However, in some cases the strategy seems more theoretical than practiced: Thandi, for example, at no point in the observations returned to a learner to see if his answer was correct; Ayesha, while receiving chorus answers to her questions did not actually react to the fact that probably half the class did not respond positively at all to her questions.

While these students have a strong sense of the 'rightness' of a learner-centred classroom, their interpretation of the concept varies dramatically. John, for example, believes in involving the learners through every step of the lesson, while Thandi believes her lesson is learner-centred if she gives the learners the opportunity to write sums on the board. For Ayesha, allowing the learners more scope in the class for participation means discipline problems – for Siphon that is no concern at all. Thabo's own reserved nature makes it difficult for him to bring about the learner-centredness in which he says he believes; while Martie has no such difficulties – her friendly and outgoing personality invites enthusiastic responses from the learners.

The students showed varying levels of flexibility in their classroom practice. For Martie and Thabo, planning allows them to be flexible in the sense of not being 'caught unawares' by challenging learners. John and Siphon plan for deviation from the lesson plan: they believe that a lesson plan provides structure, but not rigidity and they leave space to manoeuvre both for themselves and their learners in terms of the lesson plan. Ayesha and Thandi do not readily deviate in any way from their lesson plan: Ayesha because she needs to keep all the learners busy all the time for discipline reasons and Thandi because deviation from the plan would literally mean venturing into the unknown.

The pastoral role which the South African education department requires that teachers fulfil is subject to interpretation as to what its practical outworking may be. To one of the students in this study it means simply being approachable as she stands next to the learner's desk and looks at his mathematics exercise book. To another, it means counselling a learner, if called upon to do so, in terms of the issues in his life that may or may not have anything to

do with the classroom. Sipho, for example, strives to overcome barriers based on language and colour differences, while Thabo tries to encourage his learners consistently. John believes firmly in the value of establishing relationships; he says it makes teaching and learning easier because the learners are willing to “engage”. Thandi however does not believe in the establishment of relationships at all: “No, I don’t. No, I don’t, just be professional and approachable and then learners will be able to approach you... relationships, no.” In her opinion such relationships can too easily be interpreted as favouritism.

8. Conclusion

The most striking finding is the discrepancy between these students’ perceptions of their PMTI and its realisation in the classroom. While certain of these students say they *are* something which in fact they are *not*; others say they are definitely *not* something, which in fact they *are*. This mismatch within their PMTI’s is not evidenced by any apparent internal conflict. Where Beijaard et al (2000) assumed that “teachers’ perceptions of their professional identity reflect their personal knowledge of this identity” (p. 750), it is possible that the incongruence of these students’ PMTI perceptions and the reality of their actualisation may be attributed to their *not* having “personal knowledge of this identity”. Possible explanations for this lie within their inexperience: they have had very little opportunity to test the robustness of who they think they are against who they *actually* are in the classroom; they have acquired neither the habit nor the skills of true reflection. These students thus demonstrate that while they may certainly be teaching who they are, this is not necessarily who they *think* they are.

It was not the aim of this study to generalise its findings. The objective was to describe the PMTI of students in their final year of mathematics teacher training at UP. No single, common PMTI could be identified. However, PMTI *does* exist in these students. Each student, unique in their background, way of thinking and ambitions, evinced a distinctive PMTI. PMTI merits further study as it may, in a longitudinal study, become a predictor of the longevity in terms of career of a mathematics teacher in South Africa, as well as of the effect of changes in the curriculum: pre-service teachers are more comfortable with concepts they learnt and worked with at school than with those they dealt with at university.

Notes

¹fictitious names of the student-teachers

References

- Abdelal, R, Yoshiko, H, Johnston, A. and McDermott. R.(2006). Identity as a Variable. Typescript, Dec 2006 version, available at: http://www.wcfia.harvard.edu/sites/default/files/identity_variable.pdf
- Adler, J. & Davis, Z. (2006). Opening another black box: researching mathematics for teaching in mathematics teacher education. *Journal for Research in Mathematics Teacher Education*, 4, 270-296.
- Argyris, C., & Schon, D. (1974) *Theory in practice: Increasing professional effectiveness*. San Francisco: Jossey Bass.
- Ball, S.J. (1993). Education, Majorism and the ‘curriculum of the dead’. *Curriculum Studies*, 1(2), 195-214.

- Beijaard, D. (1995). Teachers' prior experiences and actual perceptions of professional identity, *Teachers and Teaching*, 1(2), 281-294.
- Beijaard, D., Verloop, N. & Vermunt, J. D. (2000). Teachers' perceptions of professional identity: an exploratory study from a personal knowledge perspective. *Teacher and Teacher Education*, 16(2000), 749-764.
- Beijaard, D., Meijer, P.C., & Verloop, N. (2004). Reconsidering research on teachers' professional identity. *Teaching and Teacher Education*, 20, 107-128.
- Boaler, J. & Greeno, J.G. (2000). Identity, Agency and Knowing in Mathematics Worlds. In Boaler, J. (Ed.), *Multiple Perspectives on Mathematics Teaching and Learning*. (pp. 171-200). Westport, CT: Ablex Publishing.
- Boaler, J., William, D. & Zevenbergen, R. (2000). The Construction of Identity in Secondary Mathematics Education. Retrieved July 28, 2008, from <http://nonio.fc.ul.pt/mes2/dylanboro.doc>
- Borko, H., & Putnam, R. T. (1996). Learning to teach. In Borko, H. & Putnam, R. T., *Handbook of Educational Psychology* (pp. 673-708). New York: Macmillan.
- Bullough, R. V. (1997). Practicing theory and theorizing practice. In J. Loughran & T. Russell (Eds.), *Purpose, passion and pedagogy in teacher education* (pp. 13-31), London: Falmer Press.
- Cooney, T. (2003). Mathematics teacher education in rural communities: developing a foundation for action. Paper presented at the ACCLAIM Research Symposium, McArthur, OH.
- Cooper, K. & Olson, M. (1996). The Multiple 'I's' of teacher identity. In M. Kompf, T. Boak, W. R. Bond and Dworet (Eds), *Changing research and practice: teachers' professionalism, identities and knowledge*. London: Falmer Press.
- Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle Creek, NJ: Pearson Education.
- Cross, D. I. (2009). Alignment, cohesion and change: examining mathematics teachers' belief structures and their influence on instructional practices. *Journal of Mathematics Teacher Education*, 12, 325-346.
- Day, C., Kington, A., Stobart, G. & Sammons, P. (2006). The Personal and professional selves of teachers: stable and unstable identities. *British Educational Research Journal*, 32(4), 601-616.
- Ensor, P. & Galant, J. (2005). Knowledge and pedagogy: sociological research in mathematics education in South Africa. In. R. Vithal, J. Adler, & C. Keitel, (Eds.), *Researching Mathematics Education in South Africa: Perspectives, Practices and Possibilities* (pp.281-306). Cape Town: HSRC Press.
- Ernest, P. (1988). *The impact of beliefs on the teaching of mathematics*. Paper presented at the ICME IV, Budapest, Hungary.
- Feiman-Nemser, S. & Buchmann, M. (1985). Pitfalls of Experience in teacher preparation. *Teachers College Record*, 87(1), 53-65.
- Freese, A. R. (2006). Reframing one's teaching: discovering our teacher selves through reflection and inquiry. *Teaching and teacher Education*, 22, 100-119.
- Gee, J. P. (2000). Identity as an analytic lens for research in education. *Review of Research in Education*, 25, 99-125.
- Graham, A. & Phelps, R. (2003). 'Being a teacher': developing teacher identity and enhancing practice through metacognitive and reflective learning processes. *Australian Journal of Teacher Education*, 27(2), 1-14.

- Hiebert, J., Morris, A. K., Berk, B. & Jansen, A. (2007). Preparing teachers to learn from teaching. *Journal of Teacher Education*, 6, 201-223.
- Hodgen, J. & Askew, M. (2007). Emotion, Identity and Teacher Learning: becoming a primary mathematics teacher. *Oxford Review of Education*, 33(4), 469-487.
- Jita, L. C. (2004). Resources of biography: teacher identities and science teaching. *Perspectives in Education*, 22(4), 11-27.
- Kagan, D. (1992). Professional growth among pre-service and beginning teachers. *Review of educational Research*, 62(2), 129-160.
- Lasky, S. (2005). A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform. *Teaching and Teacher Education*, 21(2005), 899-916.
- Liljedahl, P. (2002). *Changing beliefs, changing intentions of practices: the re-education of pre-service teachers of mathematics*. Retrieved April 27, 2009, from http://stwww.weizmann.ac.il/G-math/ICMI/liljedahl_Peter_ICMI15_propShorten1.doc.
- Liljedahl, P. (2007). *Teachers' beliefs as teachers' knowledge*. Retrieved April 27, 2009, from <http://www.unige.ch/mathematics/EnsMath/Rome2008/ALL/Papers/LIJED.pdf>
- Maxwell, J. A. (1996). *Qualitative Research Design*. Thousand Oaks, California: Sage Publications.
- O' Connor K.E. (2008). "You choose to care": Teachers, emotions and professional identity. *Teaching and Teacher Education*, (24), 117–126.
- Palmer, P. J. (2007). *The courage to teach: exploring the inner landscape of a teacher's life*. San Francisco: Jossey-Bass.
- Paterson, A. & Arends, F. (2009). *Teacher Graduate Production in South Africa*. Cape Town: HSRC Press.
- Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Stronach, I., Corbin, B., McNamara, O., Stark, S. & Warne, T. (2002). Towards an uncertain politics if professionalism: teacher and nurse identities in flux. *Journal of Educational Policy*, 17(1), 109-138.
- Thompson, A.G. (1984). In A. J. Bishop (Ed.), *Mathematics Education – Major Themes in Education* (pp. 58-76). New York: Routledge.
- Van Zoest, L. R. & Bohl, J. V. (2005). Mathematics teacher identity: a framework for understanding secondary school mathematics teachers' learning through practice. *Teacher Development*, 9(3), 315-345.
- Varghese, M., Morgan, B., Johnston, B & Johnson, K.A. (2005). Theorizing language teacher identity: three perspectives and beyond. *Journal of Language, Identity & Education*, 4(1), 21-44.
- Walshaw, M.(2004). Pre-service mathematics teaching in the context of schools: an exploration into the constitution of identity. *Journal of Mathematics Teacher Education*, 7, 63–86.
- Walshaw, M. (2010). *Unpacking Pedagogy: New Perspectives for Mathematics Classrooms*. Cambridge: The Massachusetts Institute of Technology Press.
- Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, 7(2), 225-246.
- Zembylas, M. (2003). Interrogating "teacher identity": emotion, resistance and self-formation. *Educational Theory*, 53(1), 107-127.