

# RESEARCHING AND LEARNING MATHEMATICS AT THE MARGIN: FROM “SHELTER” TO SCHOOL

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## ABSTRACT

*I draw attention to the mathematics education of that group of learners who are usually on the margins of society and also on the margins of mathematics education research, theory and practice. These are children who for various reasons have left home, eke out a living on the streets of a city – referred to as “street children”, and are often placed in “shelters” and “homes” (Chetty, 1997). I refer to research conducted related to providing mathematics education for such learners, to address firstly, the question of how such children come to engage particular experiences of mathematics education and secondly, the challenges and consequences of doing such research. The story I tell to respond to the theme of this panel – working for inclusion and diversity in mathematics education - is that of Nellie and Wiseman as researched and documented by Sheena Rughubar (2003), but I also reflect on broader issues of doing research and its processes and relations that involves working outside mainstream schooling and on working with research students in such settings.*

## INTRODUCTION

This opportunity to work with children who are very much at the margins of society and schools began with a project that the Faculty of Education participated in at the then University of Durban Westville. It was a collaborative venture with the Department of Health and Welfare and involved the City Council but the task for the faculty was that of setting up a school at what was a residential shelter for children who were in various ways recruited, rescued, sometimes arrested from the streets and brought here – called the Thuthukani Harm Reduction Centre (Amin, 2001). This is where Sheena began her study closely investigating a small group of learners as they were taught mathematics. It was here that she saw Wiseman, who surprised her with his interest and capacity to do mathematics despite the conditions of his life and the quality of the learning environment.

The intention of the school at Thuthukani was to provide educational support to the learners so that they could be integrated into the mainstream public school system. Sheena intended therefore to follow a group of mathematics learners from the shelter school into a mathematics classroom the following year. But the next year none of the children she had interviewed and observed in the shelter could be found. She searched for several months and almost dropped out of the study. It was then decided to reframe the study and look for another learner from a shelter who had been placed in a public school. After much difficulty Sheena located and met Nellie and the study was rescued. The research focus shifted to investigating how mathematics is taught to

and learnt by such learners in two different teaching and learning environments – a “shelter” and a “mainstream” mathematics classroom.

## **METHODOLOGY AND LEARNING SETTINGS**

Both Thuthukani and Sanville Secondary School are characterised by considerable distractions and disturbances for learners. In the case of Sanville the school is close to an airport and both learners and teachers were observed having their interactions interrupted by the level of noise with various consequences such as loss of concentration and disengagement by the children. Thuthukani is in the middle of the city, located in a building in a state of disrepair. There is much traffic noise and intrusions of city life into the workings of schools especially since learners are allowed to leave and return at will. On some days the school does not function because meals are not provided to learners. Any school in its normal run of events copes with events and other disruptions which in various ways coincide and conflict with those faced by a learner within a classroom setting, sometimes significantly reducing actual teaching and learning time. This intensifies discontinuities in learning that learners like Wiseman and Nellie bring into the learning environment.

Mrs. James’ classroom at Sanville is overcrowded with forty learners and barely any space to walk between desks that are arranged in traditional rows. Nellie sits in the middle of the class. There is strong discipline and structure that regulates behaviour and attendance in the school, which is also maintained in the classroom by Mrs James who is an experienced and qualified teacher. Nellie sits in the middle of the classroom, is generally quiet and is often observed not participating in the lesson. Thuthukani runs its school in a large hall, with little groups of learners working in classrooms without walls. Although the desks are clustered in traditional rows, learners have to concentrate hard to ensure that they can hear Mr Xulu and also put up with the regular streams of visitors, donors and administrators who walk through the hall throughout the class period. The repeated interruptions require patience and perseverance on the part of learners and teachers. Mr Xulu, a novice, recently graduated and qualified mathematics teacher, who is teaching virtually on a voluntary basis at the school, while hoping to find employment in a public school, is flexible, light-hearted and takes the disturbances in his stride. Wiseman does not miss school, usually sits alone and pays attention during lessons.

Teachers and researchers are seldom prepared for facing the erratic events of classrooms and also the poor material conditions of places like shelters. Nevertheless, a broad range of data in both settings were generated including: video recordings of lessons; photographs; interviews with Nellie and Wiseman; informal discussions with teachers and learners; written reflections and their class documents such as exercises and tests; and a researcher’s journal. These were first analysed in terms of categories that examined the learner and his/her mathematics learning and the environment as well as the mathematics teacher, teaching and content. The analysis being focussed on here that emerged from the study is mainly that related to learning and the learners

Wiseman and Nellie (rather than their teachers and teaching); and this is extended to reflect on the research itself.

### **DISRUPTIONS, DISTRACTIONS AND DISCONTINUITY**

For many learners in shelters or homes, disruption in their schooling in general and mathematics in particular, is marked by moving to several schools and very erratic attendance. Nellie and Wiseman are both fifteen years old, black, and appear to have had some primary schooling. Although it has been difficult to establish Wiseman's primary schooling level, Nellie has had a disruptive primary schooling having attended three different schools. Nellie is quiet in the classroom, and by her own admission scared to speak but volunteers much about her life to Sheena including the abuse that she had suffered at the hands of her mother which caused her to leave home and impacted on her schooling. Wiseman, on the other hand, is articulate in class, even correcting errors in the mathematics that the teacher makes, and volunteering to work out problems on the board, but does not speak about his life.

These discontinuities in learners' mathematical lives are also present in the learning settings. Nellie has been placed in a grade 8 classroom where the teacher is observed leaving the mathematics classroom to attend to other school functions. Mrs James' large class does not leave any time for her to provide any additional support to Nellie to bridge the gaps left by the discontinuities of the classroom or of Nellie's own life. The work Mr Xulu is doing with Wiseman's class is at grade 7 but he often seems unprepared, relying only on a textbook. He has to cope with erratic attendance of learners and constantly changing groups to work with and the distractions of the learning environment.

Establishing background data for learners is not a simple process when school life is linked to painful personal life experiences. For the researcher working in these settings on the margin, disruption and discontinuity in their data production strategies are reflected in the lives learners or indeed even in their (non)availability as well as in the settings in which learning is taking place. Situations of poverty produce uncertainty because acquiring the basic necessities such as food or shelter take precedence over schooling or attending mathematics class. Overlaid with emotional and other injuries, mathematics learning is engaged within and against this whole life experience. Yet learners and teachers continue to do the work of mathematics education as do researchers. The question is how do practices and theories of learning mathematics take account of the whole, often disrupted life of a learner as they interact with specific mathematical tasks- the focus of much mathematics education research.

### **MATHEMATICAL VERSUS EMOTIONAL AND PHYSICAL NEEDS OF LEARNERS**

Despite the hardships endured, both Nellie and Wiseman continue to attend school and mathematics classes regularly. However, Nellie was often observed falling asleep in the mathematics class or not paying attention and is embarrassed by the teacher

and other learners when caught. The teacher admits “*I don’t know much about her background... but she lives in a home for children in the area*” and states that she treats all the learners the same. Nellie, however, like many of these learners is working through experiences of abuse, neglect and poor health while trying to cope with schooling. She explains to Sheena how she was hospitalised when she fell ill in school. It is not surprising that such learners often lack confidence, have poor self concepts and low self esteem (Booyse, 1991). Yet in many respects Wiseman is different. Not only does the teacher affirm him and regard him as one of his best students who will definitely be placed into one of the public schools, Wiseman is proud and derives confidence from his mathematical ability and assists others in mathematics in the class participating in discussions. Nellie and Wiseman experience the mathematics classroom in quite different ways. Falling asleep and being silent are ways in which to escape or disappear from the classroom when being forced to be there by the rules and rituals of a mathematics class. But a mathematics classroom can also be a place to feel *good* about yourself; hierarchies of needs established in psychological studies do not fully explain why and how learners in poverty and violent situations continue to learn and want to learn mathematics.

Exploring mathematical experiences of these learners forces researchers and teachers to engage much broader needs. When learners disappear from class or are found engaging in illegal or other activities, working with such children also has an emotional impact on the researcher. As the extent of the suffering endured by these children becomes known the researcher’s questioning of her own participation in the research or educational endeavour and deeper values and life experiences often surface. Depending on the research paradigm in which the researcher is working, dealing with this could include the generation and analysis of the researcher’s biography and engaging issues of the ethics and politics of research more directly and explicitly. This often includes reflections of their own relationships with their students, parents or other life experiences and acting on these in reciprocal relations within the research process or as an outcome of the research. The point here is that mathematical needs cannot be examined or addressed in isolation from emotional, physical and other needs. Sheena, a mathematics teacher herself, repeatedly reflects on how this research experience has made her notice and redirect her gaze in her mathematics classroom; and reshaped her own practices and understandings in teaching mathematics in the mainstream.

### **ALIENATED AND SHARED IDENTITIES**

Street children as a group develop their own identity within a particular sub-culture from having to survive in the harsh street conditions. When they enter the shelter they share those experiences which get played out in the shelter school in the construction of the learning environment. To this extent the notion of “community of practice” (Lave and Wenger, 1991) may be relevant and useful for explaining how Wiseman participates in the shelter math classroom. Even though this community may fragment along other lines of community such as “gang alliances” or identities of age,

geographic urban-rural home etc., for the period they are in the mathematics classroom, they are participating in a particular social world that collides and coincides with these different identities. The teacher may not know the full individual histories of his learners but he is aware of their fragility as a group.

In the mainstream school children from shelters are often singled out and face discrimination from both teachers and other learners (Vithal, 2003) and Nellie is no exception. If the classroom is deemed a community of practice then Nellie is clearly located outside this particular community: *“I live at the home and they don’t... I feel different... the other children they do not understand... they will laugh at me... tease me”*. She is marked as different in this classroom not only by virtue of living in a “home for children”, she is a black learner in a school that is predominantly “Coloured” - an apartheid invented racial categorisation that still dominates to refer to people of mixed origins. The equality perspective that the teacher entrenches by claiming to treat all children equally further ensures that Nellie’s different personal circumstances are not taken account of in supporting her mathematics learning. So she continues to be “othered” also by her (lack of) competence in mathematics.

No doubt researcher identity is productive of particular data with particular research participants in particular settings. Sheena’s relation with Nellie could not be reproduced say by a male researcher. Nevertheless, researchers who come with a particular gender, race and social class identity, have to overcome their own prejudices and experiences of “street children” and develop empathy and understanding. This may be achieved by developing close relationships with individual children over time; and gaining knowledge about the whole life of a child and the severity of their life conditions and experiences. This is necessary to provide a much wider data set within which to place any analysis of their engagement with mathematics teaching and learning.

## **INTENTIONALITY, INTEREST AND INVOLVEMENT**

How much genuine interest, enjoyment and involvement any learner invests in the learning is linked not only to background but also to how they see their present learning connected to a future life scenario – their foreground. Learners come with different dispositions which shape their “intentions-in-learning” both with reference to their backgrounds and their foregrounds (Olro and Skovsmose, 2001). While backgrounds have been overemphasized in explaining mathematics performance and participation, foregrounds have not been adequately factored into studies of learning. One way of understanding Wiseman’s interest and investment in learning mathematics may be by noting his hopes and dreams for the future “I want to go to Moment High School. I want to be a scientist. I like science and mathematics”. In the shelter schools there was no compulsion to attend school, though non-attendance was questioned. Wiseman came to all classes and paid careful attention, even becoming annoyed when detecting errors made by the teacher.

Nellie's poor performance in mathematics and negative experiences of her interaction with the teacher can be related to her poorer levels of interest and involvement. Despite her low performance, Nellie claims to like mathematics. Nellie's intentions may be described as broken or destroyed. As Sheena observes, "*Nellie does not refer to anything in the future but rather continues to reflect on the past*" (Rughubar, 2003, p. 92). The construct of intentionality is useful for locating and linking explanation for learning (or not learning) to aspects both inside and outside mathematics and the mathematics classroom.

Whatever the methodological design, researchers who bring also particular intentions to these settings often get much more deeply involved beyond and outside their research projects. The significantly impoverished situation of the learners and their environment compared to the resources, both physical and intellectual, that any researcher brings means that they are often in a position to contribute to improving the situation. Researchers have the possibility to make a much wider social situation available to learners as possibilities for the future. In they confront in direct ways the objectivity-subjectivity dilemmas of their positioning in the research.

### **TRANSITIONS, CURRICULUM AND RELEVANCE**

In the shelter school, the teacher worked with a small group of between 6 to 10 learners, and this meant that the curriculum could be organised much more tightly around the needs, performance and interests of learners. But the imperative to place these learners back into mainstream often resulted in rather traditional curricula offerings. The notions of "transitions" (Abreu, Bishop and Presmeg, 2002) may be useful for exploring the bridge between the practices engaged in the shelter school and those of mainstream school. The tension that this transition opened is that since not all learners in the shelter school were likely to be placed into public school, a "mathematics for life" versus a "mathematics for school" became visible. For Wiseman this may be described as including elements of a "mediational transition" – where the shelter school learners "interact in an intentionally educational activity designed to change perceptions and meanings before involvement" (Abreu, Bishop and Presmeg, 2002, p. 17) in school mathematics, to facilitate their participation and experience of school mathematics.

Nellie on the other hand may be described as experiencing a "lateral transition" – "moving between two related practices in a single direction" - having much in parallel with that of "immigrant students in mainstream schools" (Abreu, Bishop and Presmeg, 2002, p.17). She moved from a predominantly "African school experience" to a different institutional culture of a "Coloured school" and having to reconstruct her identity as a learner who lives in a "home for children". Unlike Wiseman she is not accommodated or included in this setting, being lost in a large class of over forty learners.

Mainstream research education and training seldom prepares researchers for the trials and turbulences of facing contexts like shelters and learners on the margin in their

research. Much of the focus in research has been in what Ole Skovsmose (2004) calls “a prototype mathematics classroom” which are well resourced with well-behaved teachers and learners all interested and engaged in the mathematics. Often well-designed strategies collapse in the face of resistances, lack of trust or the impoverishment of the setting. Learners refused to have photographs taken because of fear of media exposure for criminal involvement, they resist writing a journal because of poor language competence or they fear of having confidences betrayed that could have serious consequences for them.

### **MARGIN, POWER AND VOICE**

The notion of margin is used in this paper in a number of ways. Shelter schools are one kind of margin that exists in relation to mainstream schools. Within classrooms, shifting margins and centres exist. Nellie is excluded and lives on the periphery of the classroom both in terms of mathematics and pedagogy. As a group of children, both Nellie and Wiseman are on the edge of society belonging to what Castells (1998) refers to as the “Fourth World” or regarded as “disposable people” (Skovsmose, 2003). Despite the harsh conditions of life both inside and outside schools and classrooms, these learners still choose in some sense to attend mathematics lessons. How then does mathematics and its mediation participate in their experience of life both inside and outside the classroom? And how is this represented in mathematics education theory, research and practice?

The status of mathematics secures interest and through this power, success in mathematics translates into improved self-concept and self esteem. This is because doing well in mathematics provides not only a gateway to a better life but also bestows prestige on the learner given how it is valued in schools and societies and by the learners themselves. Both Nellie and Wiseman state that they like mathematics and want to succeed in it. Notwithstanding the background each brings into the learning setting, inclusion into or exclusion from mathematics is to a large extent mediated by the teacher. Both teacher attitude and teacher knowledge (in its broad sense) is critical in how empowerment and disempowerment are enacted in a mathematics classroom. Mrs James does not show the caring that Mr Xulu does, while Mr Xulu lacks competence in the content that Mrs James demonstrates. Wiseman is excluded by limited access to mathematics and Nellie by a pedagogy that that does not recognise and account for her difference.

Doing research in such settings draws attention to the plight of these learners to a different audience of mathematics education researchers and practitioners. Issues of voice and who speaks for whom has been extensively debated, especially in gender studies and must always be raised when attempting to speak for those who are powerless and voiceless in society. Yet research and researchers can and must speak for such learners: firstly to address the enormous disadvantage and suffering of such learners but secondly because it redirects the researcher and practitioner’s gaze in the mainstream to other margins by developing a different more empathetic gaze on those learners to fail to learn mathematics. It forces researchers to develop a more

caring and creative research approaches with a sharper concern for the ethics and politics of the research setting and research relationships. The focus on the “outliers” in research sites and participants opens for possible refutations and development in the theories of teaching and learning mathematics, a practice well-established in mathematics yet surprisingly lacking in mathematics education research.

As diversity increases, inclusion and exclusion become more acute in mathematics classrooms, requiring teachers and researchers to broaden explanations for failure and success in mathematics learning. Psychological perspectives typically locate such explanations in the learner him/herself; and in mathematics education research tend to keep the focus narrowly on the mathematics and its learning. However broadly the notion of margin is understood, by focussing on the margin, new insights could be gained for the centre; and such insights allow mathematics educators and researchers to account in more authentic ways for the diversity in their classrooms and schools in more equitable way. The failure to learn mathematics lies, perhaps more significantly, outside mathematics, its teaching and learning, than inside. This assertion points to an imperative to bring political, social, cultural, economic and other perspectives into a closer dialogue in mathematics education research, theory and practice with the more dominant psychological perspectives. The papers presented in this theme point to how separating out social, psychological, cultural, political and other perspective in research, theory and practice may have outlived their usefulness for providing understandings and action in mathematics education.

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