

TEACHING GEOMETRICAL SHAPES TO GRADE 4 LEARNERS:

A TEACHER’S SELF-STUDY

BY

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COLLEGE OF HUMANITIES

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I, JANE BUYISILE MAKHAYE, declare that

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Signed -----

STATEMENT BY SUPERVISORS

This dissertation is submitted **with** our approval.

PROF KATHLEEN PITHOUSE MORGAN

DR LUNGILE MASINGA

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ABSTRACT

My research focus was on my learning as a teacher, with a view to understanding how I might improve my teaching practices as a Grade 4 teacher in relation to geometrical shapes. Adopting a sociocultural theoretical perspective on teacher learning helped me to understand that learning does not only take place within you as an individual teacher, but with others, in a particular context. I was the main participant in the study and I worked with my Grade 4 learners as research participants. In addition, I worked closely with two of my fellow Master's students as critical friends. Data were generated using five research practices, namely, artefact retrieval, lesson planning and classwork activities, taking photographs, audio recording, and journal writing. The first question that guided my research was: *What can I learn about learning and teaching of geometrical shapes from my personal history?* I addressed this question by stepping back to give an account of my personal history with my family, the community I grew up in, and my schoolteachers and classmates. My second research question was: *How can I improve my teaching of geometrical shapes to Grade 4 learners?* In responding to this question, I drew learnings from my personal history to develop my teaching of geometrical shapes through encouraging: (a) learning through making and hands-on learning (b) learning through story telling (c) learning through exploring the surroundings and (d) learning through playing games. These learnings influenced me to design lessons to explore how I might improve my teaching of geometrical shapes. I created a collage to represent my learning from designing and teaching these lessons. Images in my collage represented key aspects that I need to be mindful of in continuing to improve my teaching practice: (a) paying attention to the learners in the classroom; (b) designing lessons to stimulate learners' senses; (c) addressing the challenge of lack of space in my school; (d) addressing time management in completion of tasks; and (e) encouraging learners' enjoyment and learning through playing games. Overall, from my self-study research, I discovered that my own learning as a teacher could be enhanced by appreciating the contributions of my personal history and by listening to and respecting the contributions of my learners as active participants in learning and learning.

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LIST OF ACRONYMS

ANA	Annual National Assessment
CAPS	Curriculum and Assessment Policy Statement
DBE	Department of Basic Education
HIV and AIDS	Human Immune Virus and Acquired Immune Deficiency Syndrome
MEd	Masters of Education
PCK	Pedagogical Content Knowledge

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CHAPTER ONE

ENGAGING MYSELF IN SELF-STUDY

Introduction

My research focus was on my own learning as a teacher. My interest in this self-study research stemmed from my personal experiences of learners struggling with mathematics and so I wanted to explore strategies for improving my teaching of mathematics, specifically my teaching of geometrical shapes. I decided to undertake introspection into my own learning by recalling my upbringing at home, and my early learning experiences at school and in my community, aiming at improving my teaching of geometrical shapes to Grade 4 learners. I wanted to grow in confidence and to ensure that I gained a deeper, more context-appropriate understanding of how I could teach geometrical shapes to my Grade 4 learners. Hence, in this study, I aimed to explore how I, as a Mathematics educator in a primary school, could learn about improving my practice in relation to teaching mathematics. In particular, I want to explore how I could improve on the learning and teaching of geometrical shapes with my Grade 4 learners.

Background information

I am a teacher at a primary school that is in a rural area in the province of KwaZulu-Natal, South Africa. The school caters for learners from Grade R to Grade 7. It has 32 teachers. In the Foundation Phase, the prescribed curriculum offers four subjects in Grade 1 to Grade 3. The first three subjects, isiZulu, Mathematics, and Life Skills, are taught in the learners' Home Language, which is isiZulu. Only the First Additional Language, English, is taught in English. However, from Grade 4 upwards, the language of learning and teaching is English for all subjects other than isiZulu. I started teaching Grade 3 in 2001, but in 2008, I started teaching Mathematics and Natural Science to Grade 4 learners in the medium of English, as stipulated in our school's language policy.

Learning and teaching about geometrical shapes

I decided to engage myself in self-study research to improve my teaching of geometrical shapes. Oslund and Crespo (2014) argue that learners depend on teachers' commitment and support to improve the learners' mathematical understanding. Similarly, Kelly (2006, p. 512) affirms, "expert teachers will be those who engage fully in reflective, discursive, collaborative

and inclusive practices to improve their work with colleagues and students.” This suggests that my curiosity, commitment, and collaboration as a teacher are central to improving my teaching practice. This shows that a significant responsibility for teaching and learning lies with me as the teacher and my ability to explore and understand what might work better in my classroom.

Van Hiele (1999) argues, “children whose geometric thinking you nurture carefully will be better able to successfully study the kind of mathematics that Euclid created” (p. 311). From my reading, I learnt that understanding of geometrical shapes should be developed from the early years of childhood onwards and that teachers should use a range of interactive teaching practices that support the learners in developing this understanding (Yun & Flores, 2008). I also learnt that the development of this understanding could be supported if teachers encourage learners to work in ways that are playful, collaborative, and hands-on (Van Hiele, 1999). According to Yun and Flores (2008), children's learning of geometry can be enhanced when teachers give them opportunities to “explore and examine a variety of geometric shapes and discover their characteristics and properties using hands-on materials” (p. 202). Furthermore, Yun and Flores (2008) explain that, to assist learners in understanding geometrical concepts, teachers need to demonstrate activities using concrete objects, and materials that learners are familiar with, rather than having learners memorise or apply a formula.

Hence, I became aware that children’s mathematical understanding could be developed through play and interaction from a young age (Ramani & Eason, 2015). Similarly, the Early Years Organisation (2008) highlights the educational value of engaging young learners with cooperative games and playful activities to enhance their understanding of mathematical concepts. Hence, I realised that I needed to consider how I could support learners’ playful involvement, collaboration, and hands-on activity in learning about geometrical shapes. I anticipated that this would allow me to explore my teaching practices with a view to illuminating key issues that I needed to pay attention to if I wanted to improve my teaching of geometrical shapes.

As a teacher teaching within the Curriculum and Assessment Policy Statement (CAPS) framework (Department of Basic Education, 2011), I saw this self-study research as an opportunity to explore how I could work within the prescribed curriculum to engender what has been found to be crucial in developing learners’ mathematical competence (and in particular their understanding of geometrical shapes) at the primary school level. I realised that I should not merely stick to the CAPS document when teaching, but needed to combine what

is prescribed in the curriculum with games and different activities to assist learners when learning about geometrical shapes.

Another concern for me in relation to teaching mathematics to primary school learners was the issue of language of instruction. In my school, like many others in South Africa, the first three years of primary school are taught in the mother tongue of the learners. However, from Grade 4 onwards, learners are taught through the medium of English, which for the majority of learners is a first additional language. Hence, in mathematics, teachers are expected to help Grade 4 learners to make this language transition from Grade 3 to Grade 4, since they have been learning mathematics in their mother tongue up to this point. However, according to recent research done by Mweli (2018), “Grade 4 teachers reported that they have trouble teaching most African learners using English as medium of instruction” (p. 46). The Annual National Assessment (ANA) conducted in the Foundation and Intermediate phases in Mathematics, IsiZulu and English shows a concerning trend of language, reading and writing becoming impediments to academic achievement in South Africa (Department of Basic Education, 2013). Mweli (2018, p. 47) further highlights that “learners do not understand English and sometimes demand that teachers explain in isiZulu”. Therefore, it was significant for me to explore how I might work with my Grade 4 learners in order to address the additional challenges of language of instruction in learning and teaching of geometrical shapes.

Understanding teacher learning from a sociocultural theoretical perspective

According to Kelly (2006, p. 507), from a sociocultural theoretical perspective, teacher learning can be understood as “the movement of teachers from peripheral (novice) to full (expert) participation in the specific working practices and their associated ways of knowing and thinking which define particular school circumstances”. In my understanding, this means that, from a sociocultural perspective, learning does not only take place within you as an individual teacher, but with others, in a particular context. A sociocultural perspective on teacher learning thus highlights sharing ideas with others and fostering relationships with others (Kelly, 2006). Furthermore, from a sociocultural perspective, teacher learning involves developing “an active and productive relationship with...knowledge in and knowledge-of-practice” (Kelly, 2006, p. 507). In this regard, Shulman (1987) places emphasis on developing pedagogical content knowledge (PCK) as a key aspect of teacher learning. Shulman describes this kind of knowledge as knowing diverse ways of demonstrating or unpacking the subject matter to make it available to others. Likewise, explaining the mathematical knowledge that

teachers require, Thames and Ball (2010, p. 223), affirm, “teachers also need a kind of knowledge that blends content knowledge with pedagogical content knowledge, or PCK.” In my view, a teacher’s pedagogical content knowledge of geometry is therefore productive knowledge that a teacher is developing, which allows the teacher make the geometrical content comprehensible to and exciting for the learners. In my research, I aimed to explore the development of my own pedagogical content knowledge (Shulman, 1987) as a key aspect of my learning as a teacher, with a view to understanding how I might improve my teaching practices in relation to geometrical shapes.

Research questions

The two research questions that guided my self-study research were as follows:

Question One: What can I learn about learning and teaching of geometrical shapes from my personal history? I address this question in Chapter Three of this dissertation. I answered this question by stepping back to give an account of my personal history with my family, the community I grew up in, and my schoolteachers and classmates. In Chapter Three, I highlight lived experiences that might have had an influence on my own learning and teaching. I also consider what I could learn from my personal history that could contribute to improving my practice as a teacher, particularly in relation to the learning and teaching of geometrical shapes.

Question Two: How can I improve my teaching of geometrical shapes to Grade 4 learners? I respond to my second question in Chapter Four and Chapter Five of this dissertation. In responding to this question, I draw from my personal history (as presented in Chapter Three). In Chapter Four, I show how recalling my personal history influenced me to develop my teaching of geometrical shapes through encouraging: (a) learning through making and hands-on learning (b) learning through story telling (c) learning through exploring the surroundings and (d) learning through playing games. I demonstrate how these learnings influenced me to design lessons that might help to improve my teaching of geometrical shapes. In Chapter Five, I present images from a collage that I created to represent my learning from designing and teaching five lessons on geometrical shapes. I discuss five pictures from my collage that represent key aspects that I need to pay attention to in continuing to improve my teaching practice. I explain how these images represent: (a) paying attention to the learners in the classroom; (b) designing lessons to stimulate learners’ senses; (c) addressing the challenge of lack of space in my school; (d) addressing time management in completion of tasks; and (e) encouraging learners’ enjoyment and learning through playing games.

Research methodology

The nature of my research questions necessitated the use of a qualitative approach to gain insight. In qualitative research, the perspective of the researcher matters and is integral to the research (Creswell & Clarke, 2007). In order to answer the research questions, there was a need to offer a detailed account of my own learning and teaching experiences. A qualitative research approach involves a process of inquiry and understanding where the researcher develops a complex, holistic picture, reports detailed views of participants, and conducts the study in the natural setting (Creswell & Clarke, 2007). I therefore chose a qualitative approach to help me to get a deeper understanding of the issues being investigated. I anticipated that this would enable me to answer the research questions by providing a detailed picture of the actual conditions surrounding my teaching practice and context.

As explained in more detail in Chapter Two of this dissertation, the methodological approach that I chose was self-study research, which I anticipated would allow me to study myself in order to develop my teaching practice (Samaras & Roberts, 2011). My decision to undertake self-study research was influenced by an understanding that teacher learning is socially and culturally situated and constructed (Kelly, 2006). This suggested to me to use self-study methodology to develop in-depth knowledge and professional growth through involvement of learners and myself to improve my teaching practice. According to Hamilton and Pinnegar (2009), self-study research does not mean working in isolation. Therefore I worked with my learners as research participants, as well as with two fellow Masters' students and my two co-supervisors, who offered critical reflections on my teaching and research practices.

Conclusion

In this chapter, Chapter One, I have explained my research purpose, which was to perform a self-study of my teaching with the aim of improving my teaching of geometrical shapes to Grade 4 learners. Then I highlighted my initial learning from my reading about learning and teaching of mathematics, and geometrical shapes in particular. I also explained my sociocultural theoretical perspective on my learning as a teacher. To follow, I introduced my two research questions and my research methodology.

In Chapter Two, I offer a more detailed discussion of my methodological approach and my self-study research process.

CHAPTER TWO

DEVELOPING MY SELF-STUDY RESEARCH METHODOLOGY

Introduction

My research focus was on my learning as a teacher. In particular, I wanted to better understand how I could learn to improve my teaching of geometrical shapes. In Chapter One, I explained why I decided to conduct this study. I outlined my research questions and introduced my theoretical perspective and my methodological approach. In this chapter, Chapter Two, I explain my self-study methodological approach and how it assisted me. Then I discuss the research setting and my research participants, who were my Grade 4 learners. Next, I describe how I worked with critical friends. Thereafter I explain and present the five research practices I used to generate represent data in this study. Then, I discuss ethical issues and I explain how I addressed trustworthiness in my study research. Lastly, I describe the research challenges that I experienced and explain how I dealt with them.

My understanding of self-study research methodology

Self-study research involves me as a teacher and those who are around me at home, school, and in my community (Samaras, 2011). By using self-study methodology, I aimed to look at the past and present to learn about how I could improve my teaching of geometrical shapes. Similarly, Masinga (2009) chose self-study as a methodology for observing her practice and herself as a teacher in an introspective manner. I decided to choose self-study to do my introspection by reflecting back on my personal history and by offering a detailed account of learning and teaching experiences in my Grade 4 classroom.

In my understanding, as teachers, we engross ourselves in personal history self-study in order to know ourselves and for professional developmental. As Samaras, Hicks, and Berger (2004, p. 910) state, “personal history is about self in relation to others in historical and social contexts that facilitate educative experience”. LaBoskey (2004, p. 819) affirms, “self-study research is underpinned by an understanding that learning is processed through previous experience and therefore personal history must be considered”. Therefore, I decided to bring back my memories to explore how my personal history might have influenced my own learning and teaching.

Pithouse, Mitchell, and Weber (2009) clarify the value of being involved in a self-study process of stepping back and looking at one's practices as a teacher. Bass, Anderson-Patton, and Allender (as cited in Austin and Senese, 2004, p. 914) affirm, "self-study offers us research that puts us back in touch with who we are, what we do, and we change to consciously be working on ourselves so that we are agents in our daily lives." On the other hand, Austin and Senese (2004, p. 1251) also caution, "self-study maintains its honesty when teachers are not simply using it to justify or affirm current practices". Thus, I did anticipate that self-study research would be challenging because I had to look critically at my own experiences and practices if I wanted to improve as a teacher.

Austin and Senese (2004, p. 1240) maintain, "self-study enquiry requires that teachers depend on themselves in their particular situations to collect data about themselves and their practice in systematic ways". Similarly, Samaras and Roberts (2011, p. 43) explain, "self-study allows teachers to plan, enact and assess their pedagogical strategies with support and critique of professional colleagues while examining what is real and that will make a direct impact in the classroom". These statements enlightened me and informed my decision to undertake self-study as a "a powerful vehicle that can, also help to renew one's passion for teaching" (Samaras & Freese 2006, p. 4). Thus, I anticipated that self-study would engender change in my teaching.

I was conscious that in conducting my self-study research, I had to be transparent and not to hide anything (Samaras, 2011). I had to be prepared to admit that I might not know all the answers and I might not have all the information. I had to become aware of my own learning and to try to be eloquent about what I did and why I did it. Austin and Senese (2004, p. 1249) agree, "teachers should know how to articulate what they do and why they do it because they have a deep understanding of themselves". As Samaras (2011, p. 221) advises, "self-study requires a transparent research process that clearly and accurately documents the research process through dialogue and critique". I was aware that documenting the process of my self-study research should prompt me to change the way I teach. Austin and Senese (2004, p. 1250) affirm, "teachers should be the force for change, so that they have both the means and the occasion to develop as learning professionals". Hence, in my understanding, self-study encourages teachers to develop determination for their own learning and to be optimistic about their hopes for learners.

Research setting and participants

The study was located in my school in the province of KwaZulu-Natal and involved the learners in my classroom and me. My school is located in a remote area. The school has a learner population of 1200. Most of the learners and teachers in my school identify themselves as isiZulu speakers. The school is a no fee school, which means that parents and guardians do not pay fees. Many learners come to school by foot because their families do not have money for transport and survive with government grants. Many learners are also making use of our school feeding scheme. My school is poorly resourced. For example, it has no library or staff room. Teachers sit under the tree when they mark learners' work. Learners go to the community library if they are given projects. However, a corporate sponsor has recently refurbished the existing building structure.

I am an isiZulu-speaking woman of 53 years of age with 17 years teaching experience in the Intermediate Phase (Grade 4 to 6). As this was self-study research, I was the main research participant. I also decided to work with my classroom learners as participants because I wanted to work with them to develop myself as a teacher. My learners showed interest in being part of the research. There are two Grade 4 classes in my school. At the time of my study, my class comprised 50 learners, with 18 girls and 32 boys. The learners were between nine and ten years of age.

When I was teaching the lessons on geometrical shapes as part of my self-study research (see Chapter Four), I met with one of my supervisors, Dr Masinga, to discuss how the learners were responding during the lessons. I told her that learners were responding very well although they responded in isiZulu. She suggested that I could let learners feel free to talk in isiZulu and then translate this into English when I was transcribing the audio recordings of the lessons.

I shared my learning from the study with the learners in the language they were most comfortable with, which was isiZulu. Learners were excited as during the study they experienced something new (see Chapter Four). I also shared key aspects of my learning with parents/guardians during teacher-parent meetings. Parents felt very excited because the learners showed improvement in their understanding and enthusiasm for learning.

Critical friends

According Samaras and Roberts (2011, p. 43), "self-study teacher research is designed to encourage teachers to be agents of their own reform initiatives while working collaboratively

with critical friends”. Austin and Senese (2004, p. 1247) also affirm, “self-study provides critical friends with whom teachers can share their knowledge and new practices which translates into additional benefits for students”. The critical friends in my self-study were two of my fellow Master’s students who were doing their own self-study research and were also being supervised by my supervisors. My fellow students and I met when we were doing our coursework modules in Teacher Development Studies. During the research component of the Masters programme, we usually met once a week as a group with our supervisors to share our ideas and challenges we had with the aim of supporting each other in our research. For example, one the research activities we did together was that we each created a collage and presented it in the group. Seeing how my fellow students created and presented their collages helped me to better understand how I could use collage in my own research. My critical friends also assisted me by asking questions that related to my research questions and they offered other perspectives and interpretations (Samaras, 2011). Engaging with critical friends helped me to find resolutions that I would not have reached alone. By listening to the advice of the critical friends, I took up their suggestions to help me as a teacher and researcher. Therefore working with my critical friends was a blessing because collaboration and friendship were created amongst us and we learnt from one another. For instance, one of the critical friends advised me to design activities for my classroom-based research that are practical and would involve learners playing games. She also advised me to carry my cell phone to record what was being said by learners and to write down in my journal what was being said by learners.

In addition, when I was presenting on my personal history self-study to the group of my critical friends and my two supervisors, one of the supervisors came up with a useful suggestion. I showed an image of a game called *gxum gxa* (hopscotch) that was played in my community. One of the supervisors, Dr Masinga, commented on that game and said that it reminded her of the traditional games that were played in the community but we were not aware that these games developed knowledge of geometrical shapes. During the discussion with my critical friends and my supervisors, I realised that it was important to reflect back on my upbringing at home school and in the community to see what I could learn from that to enhance my teaching of geometrical shapes.

Data generation

There is a variety of techniques that can be used to generate data for self-study research (Samaras, 2011). I generated data using five main research practices, namely, artefact retrieval, lesson planning and classwork activities, taking photographs, audio recording, and journal

writing. I used these research practices in my study to trigger and prompt my discussions of my own experiences reacted to teaching geometrical shapes to Grade 4 learners.

Table 2.1. Data generation

The table shows my research questions, data generation activities, participants and data sources.

Research Question	Data generation activities	Participants	Data sources
<i>1. What can I learn from my personal history about learning and teaching of geometrical shapes to grade 4 learners?</i>	<ul style="list-style-type: none"> • Artefact retrieval. • Taking photographs. • Journal writing. 	<ul style="list-style-type: none"> • Me 	<ul style="list-style-type: none"> • Photographs of artefacts. • Reflective journal entries about my memories.
<i>2. How can I improve my teaching of geometrical shapes to Grade 4 learners?</i>	<ul style="list-style-type: none"> • Lesson planning for five lessons. • Classwork activities. • Taking photographs. • Audio recording. • Journal writing. 	<ul style="list-style-type: none"> • Grade 4 (50 learners), me. 	<ul style="list-style-type: none"> • Lesson plans. • Photographs of class activities. • Audio recordings of five lessons. • Photographs of classwork. • Reflective journal entries about my lessons.

Artefact retrieval

Artefacts can be perceived through the senses, for example, they can be touched and smelled (Mitchell, 2011). Allender and Allender (2004) clarify that artefacts are often old and found in file drawers and in boxes that are dusty. Raht, smith, and MacEntee (2009) explain that the use of artefacts can enhance research and make it come alive. Similarly, Cole (2011) highlights that artefacts can help a scholar to generate personally and professionally meaningful data in qualitative research and understand past events. I used artefacts to provide evidence of my personal history and to enhance my understanding of the past in relation to my teaching of geometrical shapes. Mitchell (2011, p. 36) states, “artefacts might have both personal and collective meanings”. Thus, I collected artefacts or real objects that could assist me to recall and understand personal and shared meanings of the events of my past life experiences.

I chose certain artefacts in order to gain a deeper understanding about my life experience in relation to my first research question. Artefacts of school can include desks, schoolbooks, and school uniforms, or school photographs (Weber, 2008). For instance, a photograph of my former school made me step back and think of how my former teachers taught me (see Figure 3.7, Chapter Three). This artefact brought back emotions associated with past events. For example, when I think of my former teachers I often become angry because they used a cane to beat us learners as if it was an instrument for teaching. A personally meaningful artefact was an old blanket that I took from my grandmother’s chest where she kept things that were old and precious to her (see Figure 3.5, Chapter Three). As described in Chapter Three, I chose the blanket because it reminded me of both bad and good memories of when I was a young child. I would advise other self-study researchers to use artefacts in assisting them to be able to reflect back to childhood experiences. However, they must be prepared to be affected emotionally by recalling these experiences.

Lesson planning

I started by looking at the CAPS document to confirm what it stipulated with regard to teaching geometrical shapes at Grade 4 level and the duration of the content. I found that there was prescribed content and recommended teaching methods, but I tried to think how I could link what I had learnt from my reading to create five new lessons that would align with the ones that were stipulated by CAPS document. In designing those lessons (see Table 2.2), I drew on my reading about the learning and teaching of mathematics, and of geometrical shapes in

particular (see Chapter One), and on my self-study of my own personal history (as described in Chapter Three).

Table 2.2. Lesson planning

The table shows key aspects of my lesson planning.

Lesson plan summary			
Lessons (see Chapter Four)	CAPS Topic/Content	My personal history learning (see Chapter Three)	Learner activities
Lesson 1: Making a television picture	Recognise, visualise and name 2-D shapes drawing 2-D shapes	Learning through making and hands-on learning	Cutting and sticking 2-D shapes on a chart.
Lesson 2: Story of a robot	Regular and irregular polygons	Learning through story telling	Drawing and writing inspired by a story of a robot.
Lesson 3: Learning more ways to sort 2-D shapes and a shape walk with parents or	Describe, sort and compare 2-D objects in terms of Straight and curved sides and number of sides	Learning through exploring the surroundings	Sorting the 2-D shapes that are the same and drawing them on the grid paper. Homework of identifying household objects that are 2-D

family members			shapes and drawing them.
Lesson 4: Lesson four: Learning through playing games	Drawing 2-D shapes on a grid paper	Learning through playing games	Drawing objects that are 2-D shapes. Playing games with 2-D shapes.
Lesson 5: Making 3-D objects	Recognise, visualise and name 3-D objects	learning through making and hands-on learning	Making 3-D objects out of 2-D shapes.

Taking photographs

I used my cellular telephone to take photographs of artefacts that assisted me to think of my personal history in relation to learning and teaching of geometrical shapes. Weber (2008, p. 45) affirms that photographs and other visual images, “tend not only to convey additional information but also to burn themselves into our brain, forming internal memories that may be hard to erase”. Therefore, I thought that taking photographs of my personal history artefacts would assist me in my research.

Taking the photographs reminded me of incidents of my personal history during my childhood. For example, one of my personal history artefacts was an old stainless steel bucket that was used by my cousin when he was milking the cow (see Figure 3.4, Chapter Three). I told my aunt that I would like to take a photo of the old stainless steel bucket because if I looked at it, I might remember the past things that were happening that would assist me in my research. I chose to photograph the water bucket because to me it symbolises the friendly atmosphere within our family, which was something that was not easy to erase from my mind. It also made

me step back and to brought back memories that could assist me to think of different activities I might use to improve my teaching of geometrical shapes.

I also used my cellular telephone to take photographs while I was teaching the lessons on geometrical shapes (see Chapter Four). As Oslund and Crespo (2014, p. 566) state, “photographs can make students’ math work visible that otherwise could easily go unnoticed”. I asked for the permission from parents/guardians to take photographs, but assured them the photographs would not reveal learners’ identities (see Figure 4.2, Chapter Four). However, I found that it was not always easy for me to take photographs while I was discussing with the learners and they were interacting with me. Therefore, I ended up asking one of my colleagues to take photographs for me while I was busy moving around. The images showed me the learners’ actions and emotions through their body language. I saw how learners were busy talking with me simultaneously and assisting each other. In addition, I saw how learners were excited while they were pasting their charts (see Figure 4.3, Chapter Four).

Journal writing

Journal writing was one of my key self-study research practices. I wrote about and reflected on a) my personal history memories, b) my observations of the lessons on geometrical shapes, c) my supervisors’ and critical friends’ views and suggestions. Therefore, journal writing assisted me to reflect throughout my research journey. Journal writing involved writing about things that I remembered from the past. Similarly, Masinga (2012) explained how through journal writing she was able to discover herself as she was reflecting on the past through writing stories. In addition, while I was observing the learners in class, I was busy writing about their behaviour and interactions. However, writing about my lesson observations and learners’ participation was not easy because I was not used to it, but I tried my best. Sometimes I would find myself not knowing what to write and it took time for me to decide what was important and what it could mean. But, I did find that journal writing helped me to examine learners’ communication and behaviours during interaction in the mathematics classroom (Ramani & Eason, 2015).

I identified with Masinga (2012, p. 240) who stated that “we had to learn that writing in our journals was part of the learning curve we had to go through, as we needed to express our thoughts and feelings throughout the process”. I too found that I had difficulties in writing and expressing myself in the journal, as I was not used to it. Therefore, I kept the journal in my pocket to help me try to express my thoughts and feelings as they came throughout the research

journey. For instance, it happened one night while I was in bed, something came into my mind and I just woke up and wrote it down in my journal.

I ended up writing everything that was said by learners, my critical friends, and my supervisors that I thought would be helpful during my research process. It was not easy to keep track of everything they were saying but I found that combining journal writing and audio recording was the best means of documenting my research process and experiences.

Audio recording

Using my cellular telephone, I audio recorded five lessons on geometrical shapes (as described in Chapter Four). During these lessons, I audio recorded learners' discussions while they were doing classwork activities and outdoor activities related to geometrical shapes. The audio recordings assisted me in documenting my own teaching and learners' conversations while they were engaged in the classwork activities. Masinga (2012) highlights the significance of audio recording in that it helped her to keep on listening to what had been said during her meetings with her self-study research participants. Likewise, I also kept on listening to the audio recordings to gain insight into what had been said by learners and by me during the lessons. I also noticed that in these lessons, the learners did more talking than me. This talking gave me a chance of learning from them.

I also used audio recording during my discussions with critical friends and supervisors. These recordings assisted me to listen to and reflect on everything that we had been talking about. If had been no audio recording, I would have missed many points that were significant. For example, while we were discussing in our meeting one of the critical friends told me to make sure I made my own provisions for the materials for the tasks I was planning for my lessons on geometrical shapes. She reminded me that learners sometimes do not bring what they have been asked for and it delays the teaching and learning process.

Answering my research questions (data analysis and interpretation)

In my self-study, I worked inductively with data produced in response to each of my research questions to seek for associations, patterns, and meanings that would enable me to respond meaningfully (Nieuwenhuis, 2010). For my first research question, *What can I learn about learning and teaching of geometrical shapes from my personal history?*, I worked inductively with the account that I had written of my personal history, inspired by artefacts in keeping with my research focus on geometrical shapes (see Chapter Three). In reading and re-reading my

personal history account and sharing it with my critical friends and supervisors, I was aiming to draw on my past experiences in order to learn from them and develop new strategies for learning and teaching. As shown in Chapter Three, I focused on experiences of formal and informal learning in my personal history. From my personal history, I identified four key modes of learning I saw as influential in my own development: a) learning through making and hands-on learning; b) learning through storytelling; c) learning through exploring the surroundings; and d) learning through playing games. These learnings then informed my design of five lessons on geometrical shapes (as shown in Chapter Four).

In responding to my second research question, *How can I improve my teaching of geometrical shapes to Grade 4 learners?*, I created a collage to represent what I discovered through engaging my learners in my research (see Chapter Five). According to Butler-Kisber (2008), “collage is a process of cutting and sticking found images and image fragments from popular prints magazines into cardstocks” (p. 265). Creating a collage by selecting, cutting, and sticking images and words from magazines enabled me to demonstrate and communicate more than I could have said in writing (Van Schalkwyk, 2010). I presented my collage to my critical friends and my research supervisors and I was able to consolidate and extend my learning through discussing the collage with them (Van Schalkwyk, 2010). Presenting my collage to my supervisors and my critical friends helped me because they came up with ideas that assisted me to better understand my collage and supported me in order to grow and gain in understanding. Butler-Kisber (2008) highlights how viewers bring meaning to collages. Hearing how my critical friends and supervisors viewed my collage helped me to have a deeper understanding of my teaching and learning experience. I have learnt to create a collage to help to consolidate from my learning and analyse it. The collage assisted me to understand my learning and to be able to write about my learning.

Ethical issues pertaining to my self-study research

Ethical issues were very significant for me as a self-study researcher, to make sure that I adhered to ethical practices all the time (Samaras, 2011). First, I wrote a letter to the school principal, asking for permission to conduct a study in the school. The university ethics committee then approved my application for ethical clearance. I also obtained permission from the Department of Basic Education (DBE) to conduct my research in the school.

I asked the parents/guardians of the 50 learners in my grade 4 class for permission to use the learners’ classwork from the five lessons on geometrical shapes as data for my study. I sent

home an informed consent letter in isiZulu for parents to give permission for their children to participate in my research. The consent letter explained the intention and activities of my research.

I also explained to the learners about their role they would play and their involvement in the five lessons on geometrical shapes as part of my research process. Explanation was given to learners that they were free to ask questions using language that they were comfortable with. I further explained to the learners that I would use pseudonyms while writing about our class activities. I explained to the learners that if anyone did not want to participate in the research, he or she had a right to say “no”, although the teaching and learning activities would still be done as part of curriculum and assessment. All the learners in my class participated in the geometrical shapes class activities as these formed part of the usual scheme of work for the term.

Trustworthiness

Samaras (2011) highlights matters of trustworthiness in self-study research. Following her advice, I worked with critical friends, which helped me to get different responses and perspectives on my research process and data. Furthermore, I used five different research practices, namely, artefact retrieval, lesson planning and classwork activities, taking photographs, audio recording, and journal writing for data generation from “varied sources and perspectives” (Samaras, 2011, p. 226). To show my work was “well founded, just and can be trusted” (Feldman, 2003, p. 28), I have given details of each research practice I used. I have also given an explanation of what kind of data was generated in my study to gain multiple perspectives that could help me to improve my teaching practices.

Research challenges

I experienced some challenges while I was developing myself in teaching learners about geometrical shapes. As described in Chapter Four, some challenges that affected the lessons that formed part of my research included such as time limits, lack of learning and teaching materials, overcrowding and lack of space. One of the challenges was to do with a tension between the time limits imposed by the prescribed curriculum framework and the additional time that became necessary for my research lessons on geometrical shapes. For example, as explained in Chapter Four, in one of the lessons, learners spent a lot of time writing a story of a robot in English, to such an extent that learners did not complete their work. Therefore, it was

significant that I explained to the learners to write in the language with which they were comfortable. And, in another lesson, during the playing of games, learners spent a lot of time teaching other learners who were unfamiliar with other games. I ended up having to ask my fellow teachers to give me a few minutes of their time to complete my activities for my lessons on geometrical shapes.

Another limitation was a shortage of learning and teaching materials at the school, such as charts, pairs of scissors, and lead pencils and coloured crayons for drawing. I asked learners to bring waste material they had at home, such as cereal boxes, together with pairs of scissors, pencils and crayons if possible. However, many learners came to the classroom without the materials that I asked for. I had to improvise with other materials that learners would use while they were working without them causing disruption by walking up and down in the classroom begging other groups to borrow from each other.

Overcrowding in the classroom with 50 learners was another challenge because it affected the groups who were struggling because I was not able to move around easily to get to all of these groups in time. I ended up encouraging those who needed assistance to ask others who had knowledge and skills. Those who knew had to work independently and assist other groups to gain confidence. An added limitation was space for outdoor activities (as described in Chapter Four). When I was conducting the outdoor game activities there was a clash with the other Grade 5 learners doing Life Skill activities because we had to use the same playground together, which was impossible. Then I had to sit down with my fellow teacher to reschedule the outdoor activities.

Conclusion

My intention in undertaking this study was to enhance my teaching of geometrical shapes. In this chapter, I have identified and described the most significant features of my self-study research process. I have also explained my own understanding of this methodological approach and its suitability for the focus and purpose of my study. I have further described the research setting and research participants. I have elaborated on the research process, focusing on data generation and responding to my research questions. I have highlighted the trustworthiness and the ethical issues of this study. I have concluded by discussing the challenges that I had and how I overcame them.

What I have learnt from doing self-study research is that this methodology involves personal reflection to analyse what you know as well as what you do not know concerning the

phenomenon you are studying. I also learnt to reflect back on my past experiences in order to understand how I was taught, which might affect my teaching and offer ideas for developing my teaching. Furthermore, I learnt that in self-study you must be open to suggestions from critical friends with the aim of developing yourself.

In Chapter Three I consider the question: *What can I learn from my personal history about learning and teaching of geometrical shapes to grade 4 learners?* I give an account of my personal history, relating how my family, community, and school teachers and friends contributed to my upbringing and the roles they played in my development and learning. I also discuss what I have learnt from recalling and reflecting on my family, community, and school context that I could use in developing my practice in the learning and teaching of geometrical shapes.

CHAPTER THREE

LEARNING FROM MY PERSONAL HISTORY

Introduction

The focus of my self-study research was on my learning as a teacher. My intention in undertaking this study was to learn about improving my teaching of mathematics, specifically in relation to geometrical shapes. In the previous chapter, Chapter Two, I elaborated on my self-study research process. I identified some significant features of self-study methodology. I also explained how the self-study research assisted me to respond to my research questions. In addition, I discussed how I addressed trustworthiness and ethical issues, as well as challenges that affected this study.

In this chapter, I respond to the following question: *What can I learn from my personal history about learning and teaching of geometrical shapes?* Samaras, Hicks and Berger (2004, p. 911) state, “personal history self-study is about the self in relation to others in historical and social contexts that facilitate the educative experience”. Likewise, to respond to my first question, I had to step back by recalling my personal history relating to how my family, community, and school contributed to my own learning and development. In what follows, I start by giving an account of my personal history by relating how my family, community, and schoolteachers and school friends contributed to my upbringing and my informal learning and formal learning. I consider how these experiences can be related to the learning and teaching of mathematics and geometrical shapes in particular. I conclude by expressing my learning from my personal history in relation to my teaching of geometrical shapes.

My family and community context

The community that I grew up in was in a rural area. The majority of the community members were Catholics. It was a disadvantaged community wherein most people survived by having fields and cattle. The community planted many vegetables in spring. For example, they planted maize, beans, potatoes, sweet potatoes, pumpkins and yams. The community members made beds for planting different vegetables, which I can now see were in the shape of rectangles. They used traditional hoes, which were squares, they had to dig the holes, which were circles, and they made lines. In looking back, I can see that the community had useful indigenous knowledge about geometrical shapes, as well as patterns.

Playing games

During the weekends, community members, friends, neighbours, cousins, brothers, and sisters, would visit each other. When we visited each other, the children would play different games. Recalling indigenous games that we used to play showed me that we had knowledge of geometrical shapes that we used informally.

The most popular game was *ushumpu* (which is similar to a cricket) because both boys and girls could play *ushumpu* together. All we needed was a yard which was big like a sports ground. When we played *ushumpu*, we would draw a big rectangle that could be the size of the sports ground with two semi-circles facing each other and a line in the middle. Players that were needed had to be two groups of more than two. There was a ball and a stick for drawing a rectangle on the sand. One player pushed the ball with her or his hands from one group to the other group. One player from the other group would kick the ball. If the ball went far away from the sports ground, that particular group would get a chance to run from the semi-circle where they had been standing to the opposite semi-circle. Players would be counting how many times they ran, and then they had to kick the ball. If the ball was caught by the other group it would be their turn to kick again. If the ball rolled away, the group would count 20 times and they won and continued playing. From remembering this, I now realise that as children we had geometrical knowledge that we applied when we played indigenous games.

There were many creative games that we used to play, but for me the most interesting game was *arigogo* (see Figure 3.1). My grandmother told me that Arigogo was a traditional game that taught people how to hide when they come across animals in the forest. There are many people involved when playing arigogo because it could be played by boys and girls. To play this game we started by drawing with a stick on the ground. We drew a square with drew curves at the corners and a circle at the centre. Arigogo was a game of catch where hand-eye coordination was used between two players who threw a tennis ball facing each other. The player who was 'on' had to stand in a circle.

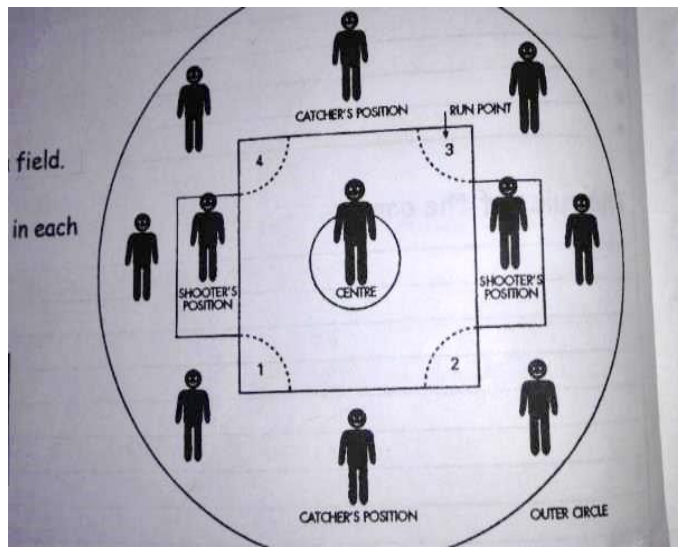


Figure 3.1 Arigogo.

Arigogo is still played by many children. A new name for it is Four Rings. It has slightly changed because instead of curves at the corners, there are circles. Four rings can be played by four players who will line up at the centre and take turns to run across from point one to point two, to three to four. They have to avoid being hit by shooters who try to hit them with the tennis ball or plastic ball. The runner who moves around twenty times without being hit scores one point is a winner. That player will continue playing until he or she has been hit. Teams change over once all players lined up have had turn to run.

Preparing and sharing food

I had that feeling of being loved by the community when others visited us at home. It was a cultural practice that if people arrived at one's home they must not leave without receiving food. Once we children had finished playing, we would sweep the yard. While we were sweeping my mother would be preparing *samp* (a dish made from dried corn kernels) with bones for us to eat. Especially on weekends, my grandmother would make a fire outside and cook food with big pots to feed all the visitors.

When the cattle produced calves, the community would get milk. The boys would pour milk into a traditional container called an *igula* (similar to the shape of a butternut). We had to dry the *igula*. Once was dry, the dry seeds had to be taken out from its mouth. The *igula* had a circle on top as its mouth for pouring milk. We poured milk inside the *igula* and put it outside to get heat from the sun. The milk would change into *amasi* (fermented milk). When was hot we would smell the sour Amasi. Because Amasi had that nice sourness, the taste buds would

automatically produce the saliva in the mouth. Amasi would be eaten with *uphuthu*. Uphuthu is made of maize meal, boiling water and a pinch of salt. Maize meal would be poured in boiling water with salt and mixed together with wooden spoon. We would close with the lid for few minutes and stir again. This would be done three times until it was fluffy and smelled nice, which showed it was well cooked. The uphuthu would be cooked in a three-legged pot with a lid. Looking back, I can see that the pot and lid had circle shapes. This showed me that there were containers at homes that had geometrical shapes.

In the afternoons, we would rush home from school because we knew very well that the traditional food would be ready for us. It was seasonal food. Sometimes it would be mealies and pumpkins, or yams (*amadumbe*) or sweet potatoes with chutney. Grandmother would cook in a big pot because she knew that we would come with our friends and even our neighbours would come to eat. When my grandmother got her old age pension grant, she would come back with beef bones, heads and feet of chickens and cabbage. The following day she would cook uphuthu (maize meal) with beef bones to make curry and cabbage.

Our living spaces

Most houses in our community were made of sticks and mud with corrugated iron on the roof. In our community, my grandmother's house was the only home that was built as a *rondavel* (a traditional circular African dwelling) with dried grass on the roof. Recalling the building of the rondavel shows me that although she was uneducated in terms of formal schooling, my grandmother had a working knowledge of geometrical shapes.

In the rondavel, there was a warmth, which people would not understand if they have never sat in a rondavel. We were able to sit together, sharing the incidents that had happened on that particular day and learning together collaboratively. My grandmother used to share ideas and we used to listen to her stories.

My family



Figure 3.2. My family photograph was taken in 1980 while we were sitting together on a Sunday.

My family was born and bred in my community. It was a big family of 25 people (see Figure 3.2). My grandmother had three children (my two aunts and my father) and a daughter in law, who was my mother. There were 20 grandchildren. My eldest aunt had ten children, seven girls and three boys. My younger aunt had three children. My mother and father were blessed with three girls and four boys. I was the third girl. Then there were four boys after me.

My grandmother had to look after all those grandchildren while our parents were at work. As we were Catholics, my grandmother played a crucial role in teaching us as a family about the principles of the Catholic faith and the rules of the family. For example, she taught us how to pray when we woke up in the mornings and in the evenings. There was a special morning prayer where we had to thank God for keeping us safe at night.

I chose a rosary (Figure 3.4) as a personal history artefact to highlight the role that was played by my grandmother while I was young. Before I started Grade 1, my grandmother would call everyone at six o'clock in the evening to go the rondavel where we would get together and pray. We sat on the Zulu mat called *ucansi*. Grandmother taught us how to pray the rosary by saying the "Hail Mary" prayer nine times and saying the "Our Father" prayer with the one bead that divided the other ten bead. From remembering this, I can see how we learnt how to count using beads.



Figure 3.3. My rosary.

Household chores

Once we were done with morning prayers, we girls were expected to go to the river to fetch water if we had not filled up the *imbiza* (clay water container) on the previous day. Each girl had to bring three buckets (Figure 3.4) to provide water that was needed daily. I think my grandmother was teaching us to be responsible. However, I felt very sad to wake up early in the mornings and fetch water although it was easy to fill up the *imbiza* because there was no queue in the morning. The *imbiza* contained 100 litres of water and so to fill the *imbiza* we had to fill up with five buckets if each one held twenty litres. All girls had to fetch water to fill up the *imbiza* as well as the water drum.



Figure 3.4. A water bucket.

We felt very excited if we had to go to the river after school because we would meet our neighbours and start playing and enjoying ourselves. I chose a water bucket (see Figure 3.4) as a personal history artefact because it reminds me of when I was a child going to the river to fetch water. There was nothing as nice as playing at the river while waiting for a turn to fetch water. Although, what we did not like was to have to wash babies, feed them and secure them on our backs with blankets (Figure 3.5) when we went to the river to fetch some water.

At the river, we would find that there was a long queue. We would put the blankets on the grass and let the young children and babies sit while we were busy playing different types of traditional games.



Figure 3.5. An old blanket

I chose the blanket as a personal history artefact because it symbolises a burden I had of carrying a baby on my back and fetching water at the river. This artefact is old because it was one that was used by my parents as part of a culture of building a relationship by paying *ilobolo*. Ilobolo is the money that a man pays to the parents of the woman when he proposes marriage. The blankets are the cultural gifts for building a good relationship with the families on both sides of the bride and the groom.

I also chose the blanket because it reminds me of the good memories I have from when I was a young child. My grandmother kept her blankets in her wedding kist (chest) to keep them warm until I and my cousins arrived from school.

My grandmother's wisdom



Figure 3.6. My Grandmother sitting in front of her house after church in 1982.

There was nobody who was left behind when we left for school because the grandmother would be in the kitchen checking that everyone was preparing to go to school. If you would think of not going to school, she would ask where the problem was. If you cried about stomach pains, she would just go outside and come back with the herb called *unyawo lwenkukhu* (meaning chicken's feet because of its shape). Traditionally, it is used for curing stomach pains. My

grandmother knew various herbs for treating different ailments. If it were a headache, the castor oil would be used because she had the belief that a headache was caused by too much bile.

I remember how one day a snake bit one of my cousins while he was coming back from the field. The other boys saw my cousin lying in the forest. They tried to carry him but they could not because they were too young. They ran to tell my grandmother who went to him and carried him back home. She took a razor and cut him with the blade next to the ankle where the snake had bitten him. The blood that came out was black which showed that there was poison in it. She bathed him with *umanyazini* (potassium permanganate). Then there were some traditional herbs called *izinsizi* that she forced him to eat them so that they would detox the poison in his blood streams and. My cousin slept on the Zulu mat and was monitored by grandmother. My cousin woke up the next morning and went to school.

My school context



Figure 3.7. A photograph of my former primary school, taken in 2016.

I started Grade 1 in 1970. Figure 3.7 shows my former primary school, which was opened in 1970. It was renovated in 2016 (as shown in Figure 3.7). The school is in a rural area and, in my schooldays, lacked resources such as books and infrastructure, such as tap water, electricity, and a tarred road. The school was made of asbestos from the walls to the roof. It was too hot during summer time and in winter, it was too cold because of the asbestos. Learners polished the floors with the cattle dung on Fridays.

As learners, we were coming from different backgrounds. As I explained before, our community was surviving through planting the fields and tending cattle. There was little income because most of the people were unemployed.

The school had five classes, from Grade 1 to Grade 5. Each grade had one classroom and one educator who was teaching all subjects. There were five educators, including the principal of the school who was teaching Grade 4. The principal was a woman who was a dignified person with no smile. I and other learners were scared of her. I never saw her smile.

I remember one day there was a girl who was absent from school. When she returned to school, the principal asked her, “*Yeyi wena ngane ubuloveleni?*” (Hey you, why were you absent?) The girl’s response was that she had washed her school uniform because it was dirty. The principal punished her in front of the learners with a cane instead of telling her to wipe the uniform with a cloth and not to wash it during the week because it was dark navy. I felt very sad together with other learners because we were not expecting that the principal would punish her and we knew that it might have happened that there was no soap at home.

Learning and teaching in the classroom

Teaching and learning was usually the first thing that would do after morning devotion. All the subjects were taught in isiZulu, for except English and Afrikaans. Once we entered the classrooms, we would recite the times tables until the teacher arrived in the classroom and stopped us. Teachers informed us as learners that we should know the times tables by heart. There was also a speed test that was done verbally. For example, the teacher would ask us to stand up and do a mental sum using addition, multiplication, subtraction, or division. A learner would sit down once he or she had the correct answer. I remember how I wished I could tell the answers to those who were standing because I was feeling sad as I looked at them.

I recollect that there were rhymes that we used to say in the classroom. For example, I remember one of the rhymes, *lethwese ihlobo*, (it is springtime). The rhyme spoke of how trees were blooming, the grass was wet and starting to be green from the heavy. Another rhyme was *izinyoni ezinhlanu ezazihlezi emthini* (five birds were sitting on a tree). In this rhyme, one bird asked, “What is that?” The other one said, “It is a man carrying a gun”. The other said, “Let us run away”. The other one said, “We are not afraid”. Suddenly they heard the sound of a gun. They all ran away. Looking back, I can see how we were learning to count from this rhyme. It was an informal learning of counting.

I will never forget the teacher who was teaching us Arithmetic in Grade 5. If she asked a question for example, $11+7$, a learner who failed to get a correct answer would be beaten with a stick and remained standing until break time. It was so painful looking at the learners standing because our levels of understanding were not the same.

Something that I enjoyed at school was the craftwork. Girls were weaving traditional mats using grass while boys were carving and sanding wooden sticks to make wooden spoons. This tells me that as learners we had a working knowledge of shapes.

Learning and teaching through play

There was no playground at this school. As learners, we played in the small area that was used for conducting an assembly, which was in front of the classes where we met with the educators to conduct prayers. Boys occupied half of the school assembly area playing soccer and the girls used the other half to play different games

During break time, girls would play games such as arigogo, and ushumpu. The boys would be playing soccer. Arigogo was the most popular game played by my classmates and me. Looking back, I can see how teaching and learning was happening outside the classroom because as learners we were learning about geometrical shapes while drawing the shapes for arigogo (see Figure 3.1).

I remember how I felt very excited and free when playing arigogo because I was feeling scared while I was in the classroom. While playing, I was de-stressing myself because I was stressed in the classroom. While we played, we would forget about food and going to the toilet. We would play until the bell rang. I wished I did not have to go back to the classroom, but I had no choice because the teachers would tell my parents if I skipped school. Once the bell rang, we would rush to the toilet and eat our provisions.

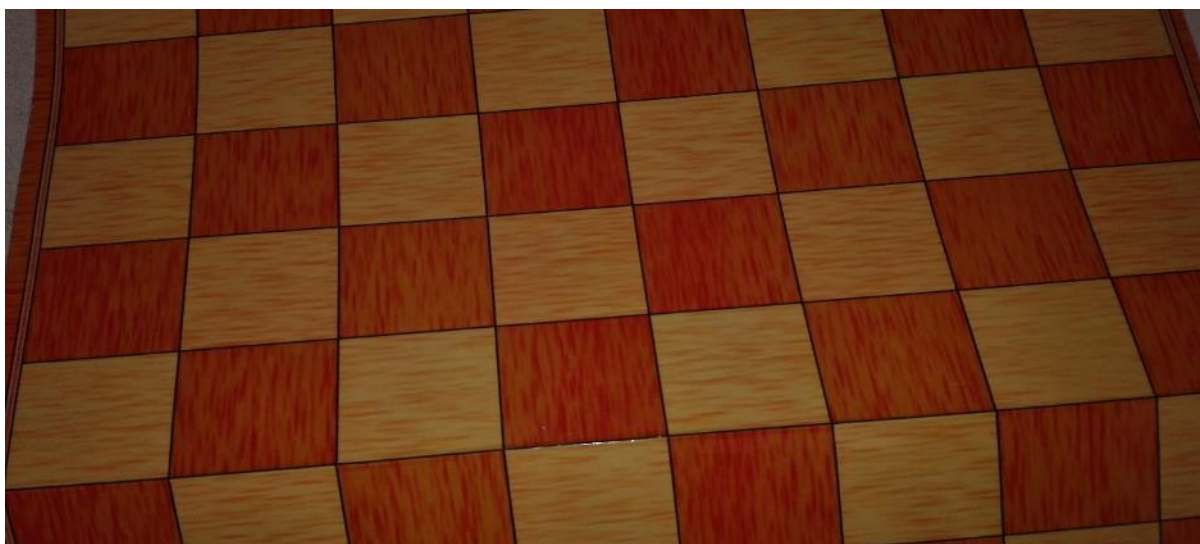


Figure 3.8. A floor mat representing the *umlabalaba* board game.

I chose the above artefact of a mat (see Figure 3.8) because it reminds me of the game of *umlabalaba*. Umlabalaba is a board game that we played in pairs at school. We used to draw the board for the game on a strong piece of cardboard. It was divided into squares painted with black and white colours. We used to play with bottle tops or stones. Umlabalaba was a game that did not cost even a cent. It was also easy to take that board game to my home.

Once the teacher moved out from the class, we would not hesitate. The majority of the class would stop what they would be doing and would start playing umlabalaba. When we played this game, there would be no noise in the classroom; only our hands would be talking. When the teacher arrived, he or she would not see that children were not doing the classwork. I have realised we as children were creative and that we enjoyed ourselves while playing. There was also peer learning that took place when we played umlabalaba.

Chores at school

On Fridays, we would start the day like other days. But, after the second break we would start cleaning. The girls would start by sweeping while the boys would be going out and looking for cow dung. Some of the boys would be cleaning windows. Once the boys found the cow dung, they would bring to the class teacher. The teacher would give it to the girls who would be instructed to smear it on the classroom floors. That was the most exciting moment we enjoyed as learners. Other peers would teach those who did not know how to polish using the cow dung. When we were busy polishing the cow dung I would feel the softness of it. The smell of the cow dung would remind me of home as we had cattle at home.

We would go home dirty on Fridays. On Mondays, we were supposed to come back with clean uniforms. However, some learners would come back with dirty uniforms. They thought the teacher would not notice because our uniform was dark navy. One teacher was particularly observant. Once she noticed that the uniform still had cow dung on it, she would call that particular learner and he or she would not go to the classroom and learn. I would feel sad for those learners who were short of soap at their homes.

Apparently, the principal noticed that the number of learners who did not wash their uniforms was increasing. Then she decided to take them to the vegetable garden to take out weeds. They stopped wearing the dirty uniforms but the majority did not care about that detention because they were used to working in the vegetable gardens at their homes. It was just like sport to them to go to the vegetable garden.

Learning from my personal history

Learning through making and hands-on learning

Recalling my personal history reminded me of the hands-on work my community used to do. For example, the community members would plant vegetables such as mealies, potatoes, and pumpkins. During their planting, they followed a certain pattern of holes such as digging circles for planting mealies. They also made beds, which were rectangles, for planting vegetables such as cabbages and spinach. This showed me that the community had a working knowledge of geometrical shapes.

Reviewing my personal history also jogged my memory of how on Fridays some boys had to go out to look for cattle dung to be used by girls for polishing the classroom floors while boys were cleaning windows. I had to teach other learners how to polish with the cattle dung due to the skill that I learnt from my grandmother while we were polishing the rondavel floor. In my community, my grandmother was the only one who had a rondavel where we used to polish the floor with cattle dung. I also recalled how we sat on the Zulu mat called *ucansi* as my grandmother taught us how to pray the rosary and how we learnt how to count in a hands-on way using the rosary beads.

I also remembered how we used to draw, make, and find materials for playing traditional games such as arigogo and umlabalala. To play arigogo, we started by drawing with a stick on the ground. We drew a square with curves at the corners and a circle at the centre. For umlabalaba, we used to draw the board for the game on a strong piece of cardboard. It was divided into

squares painted with black and white colours. We used to play umlabalaba with bottle tops or stones that we had collected.

Van Hiele (1999) highlighted the pedagogic value of engaging children in hands-on activities such as drawing, folding, and making, to enhance their understanding of geometrical shapes. Recalling how community members and I learnt to use mathematics and, specifically geometrical shapes, through making and doing, influenced me in designing a lesson on making a television picture using 2-D geometrical shapes to develop the learners' understanding of shapes (see Chapter Four).

Learning through storytelling

My personal history reminded me of the stories that my grandmother used to tell us while we were sitting in the *rondavel*. My grandmother would ask us to listen carefully because at the end of the story she would check whether we were listening. The most significant thing about each story was its lesson.

Building from these stories that grandmother told us, I chose to design another lesson that was influenced by my personal history. I realised that, as Hannibal (1999, p. 353) states, “there are specific ways to present developmentally appropriate activities designed to enhance children’s understanding of basic shapes”. So, I decided to think of developmentally appropriate activities I could use in learning and teaching about geometrical shapes. I saw storytelling as a potential strategy for “incorporating culture and language into mathematics teaching” (Battey, Neal, & Hundon, 2018). Therefore, I designed a lesson based on a story of a robot (see Chapter Four).

Learning through exploring the surroundings

In recalling my personal history, I remembered how we were surrounded by geometrical shapes in our homes. For example, the *uphuthu* would be cooked in a three-legged pot with a lid. The pot and lid had circle shapes. And my grandmother’s house was built in a circular shape as a *rondavel*. I also remembered the central role my grandmother played in supporting our schooling. Although she was uneducated in terms of formal schooling, my grandmother made sure all her grandchildren went to school every day. She also shared her traditional wisdom and indigenous knowledge with us as a key part of our informal learning.

I was influenced by my personal history to design a lesson of learning more ways to sort 2-D shapes (see Chapter Four). I brought in hands-on activity by asking learners to sort 2-D shapes and put them together according to squares, triangles, circles, and rectangles. After they

completed sorting the shapes, I gave learners homework to go and ask their parents or family members to take them out for a shape walk in order to assist in finding examples of 2-D shapes from their homes. According to Ramani and Eason (2015, p. 32), “teachers could include parents in a family game night at school and provide guidance for how parents can talk about math while playing games.” Therefore, I decided to let learners look for 2-D shapes through a shape walk in their environment to find geometrical shapes that were familiar to them. I also wanted to encourage parents and families to be involved in this learning, in a similar way to how my grandmother was involved in my learning as a child.

Learning through playing games

My personal history reminded me of the indigenous games that we used to play in the community and outside formal lessons at school. For example, arigogo was a most enjoyable game played by us as children. It was easy to draw on the sand with a stick. Arigogo was made of 2-D geometrical shapes such as a square, the curves inside the corners and a big circle at the centre. It was played by three or more players.

Recalling my own enjoyment of and learning through these indigenous games influenced me to design another lesson that was based on games (see Chapter Four). As Nkopodi and Mosimege, (2009, p. 380) suggest, “as people engage in any game, the language, vocabulary, mathematical skills and a variety of mathematical activities are generated.” I asked learners to mention the games they knew with 2-D geometrical shapes, and then made playing these games the basis of the lesson.

Conclusion

In this chapter, I have revisited my learning experiences from my personal history to understand better the strategies I can use to improve my teaching of geometrical shapes. I have considered the research question: *What can I learn from my personal history about learning and teaching of geometrical shapes to Grade 4 learners?* I reflected on my upbringing and learning, both informal and formal, in the context of my family, my school, and my community. These reflections assisted me to learn that I can draw from my personal history in seeking to develop my pedagogical content knowledge (Shulman, 1987), with a view to understanding how I might improve my teaching practices in relation to geometrical shapes. I drew four key learnings from my personal history that influenced me in developing my teaching of geometrical shapes. These were the following: (a) learning through making and hands-on learning (b) learning through

story telling (c) learning through exploring the surroundings and (d) learning through playing games. In Chapter Four, I demonstrate how I put these learnings into practice in my Grade 4 classroom.

CHAPTER FOUR

LEARNING FROM TEACHING GEOMETRICAL SHAPES

Introduction

I engaged myself in this self-study to comprehend how to enhance my own learning as a teacher. In particular, I wanted to explore how I might improve my teaching of geometrical shapes to Grade 4 learners. In Chapter Three, I reflected on my personal history in relation to how my family, community, and school contributed to my upbringing and my learning. I also considered how I could learn from my personal history to develop my future teaching of geometrical shapes.

In Chapter Four, I consider the following question: *How can I improve my teaching of geometrical shapes to Grade 4 learners?* To begin to respond to this question, I drew four learnings from my personal history: (a) learning through making and hands-on learning (b) learning through story telling (c) learning through exploring the surroundings and (d) learning through playing games.

Building on these learnings, I chose to design five lessons that were influenced by my reflection on my personal history, as well as by my reading on the pedagogic value of supporting learners' playful involvement, collaboration, and hands-on activity in learning about geometrical shapes (Yun & Flores, 2008; Van Hiele; 1999). In this chapter, I offer a detailed account of each lesson, highlighting learner contributions, and my observations and reflections. I illustrate my learning about improving my teaching of geometrical shapes.

Lesson one: Making a television picture

My first research lesson was based on the making of a television picture. I started by collecting charts that would be used by learners in making television pictures, especially for those who could not bring anything from home to make their television pictures. Before the lesson, I made my own television picture using coloured charts as an example for the learners. As suggested by (Ball, Thames and Phelps, 2008) teachers must be able to perfume the tasks that they give to learners to do. In designing this lesson, I was aware of Boaler et al.'s (2016, p. 1) argument that when learners "learn through visual approaches, mathematics changes for them, and they are given access to deep and new understandings".

Lesson presentation

It was on 1 March when I started by greeting learners. I introduced the lesson using a question and answer method in the classroom. As Hannibal (1999, p. 354) advises, “teachers need to uncover and use that initial knowledge of shapes that learners have when they enter the classroom.” Similarly Maupin (1996, p. 790) argues, “research shows that students arrive at school with a wide range of geometrical knowledge”. With this in mind, I asked learners to identify the 2-D geometrical shapes they had learnt about in Grade 3 that were around the classroom. I hoped to uncover the initial knowledge that learners had brought with them. Learners were expected to point at the shapes and name them in IsiZulu or in English depending on the language the learner was comfortable with. As previously explained, most of the learners had learnt mathematics in IsiZulu in Grade 1 to Grade 3.

The discussion between the learners and me began as follows:

Teacher: Could you please give me the shape that you learnt in Grade 3 last year?

Two hands went up.

Aphiwe¹: Triangle.

Teacher: Good Aphiwe.

I took the shape of a triangle and pasted it on the board. I took the word “triangle” and pasted it next to the shape of a triangle.

As Allen and Martinie (2006, p. 101) recommend, “in the middle schools, students should engage in activities that encourage them to look at the properties of the shapes and begin to develop understandings about relationships among properties”. Hence, I decided to ask the following question to inspire learners to look for properties of 2-D geometrical shapes.

Teacher: Why do we say it is a triangle?

Ngcobo: Three sides.

Teacher: Good Ngcobo. Class give him a round of applause.

Learners clapped their hands.

Teacher: What do we call a triangle in isiZulu?

¹ Names of all learners have been changed.

Learners could not wait to be pointed at. They shouted “*unxantathu*”. That showed me that learners were familiar with the Zulu word for “triangle”. Then I wrote the word, *unxantathu*, next to the triangle. I explained that triangles have three sides and three corners with all sides straight and all sides connected.

According to Maupin (1996, p. 790), in learning and teaching geometry in the middle grades, it is useful to emphasise to learners that “the world around them is geometrical in nature.” Therefore, I asked questions to encourage learners to explore geometrical shapes in the classroom.

Teacher: Could you please look around the classroom and show me anything that has three sides?

Tukulu: Roof planks.

Teacher: Good Tukulu.

I explained to them that triangles might differ in orientation, dimensions, and pointedness. Learners named other 2-D geometrical shapes in their home language, which they were more familiar with, such as *isikwele* (square), *unxande* (rectangle), and *indilinga* (circle). In reflecting on this, I was reminded of the value of creating “caring mathematical interactions” in the classroom through acknowledging “linguistic contributions” of learners (Battey et al., 2018, p. 435).

I placed my television picture on the board asked the learners to come, take the English names of 2-D shapes, and put them next to the relevant shape (see Figure 4.1a). Learners were excited looking at my bright television picture. Each learner came to me and took the word from my hands he or she had seen and then put it next to the 2-D relevant shape. I realised that although some of the learners knew the English words for geometrical shapes, most of the learners did not know them as they had been learning in isiZulu.

I then decided to ask learners to name the basic 2-D shapes in isiZulu because learners were familiar with the Zulu shape names. I asked the learners to give me the Zulu words so that I could write them on the board (see Figure 4.1b). They listed them randomly. Then I asked the learners to match the isiZulu words with English words and put them next to the 2-D shapes.

A few hands were raised. I pointed at the learners who raised their hands and who showed assurance and confidence on their faces. They were trying, but one learner wrote the word *unxande* (rectangle) next to the triangle. This told me that some were not sure of the names of 2-D shapes, even in isiZulu. They tried until all the flash cards were correct.

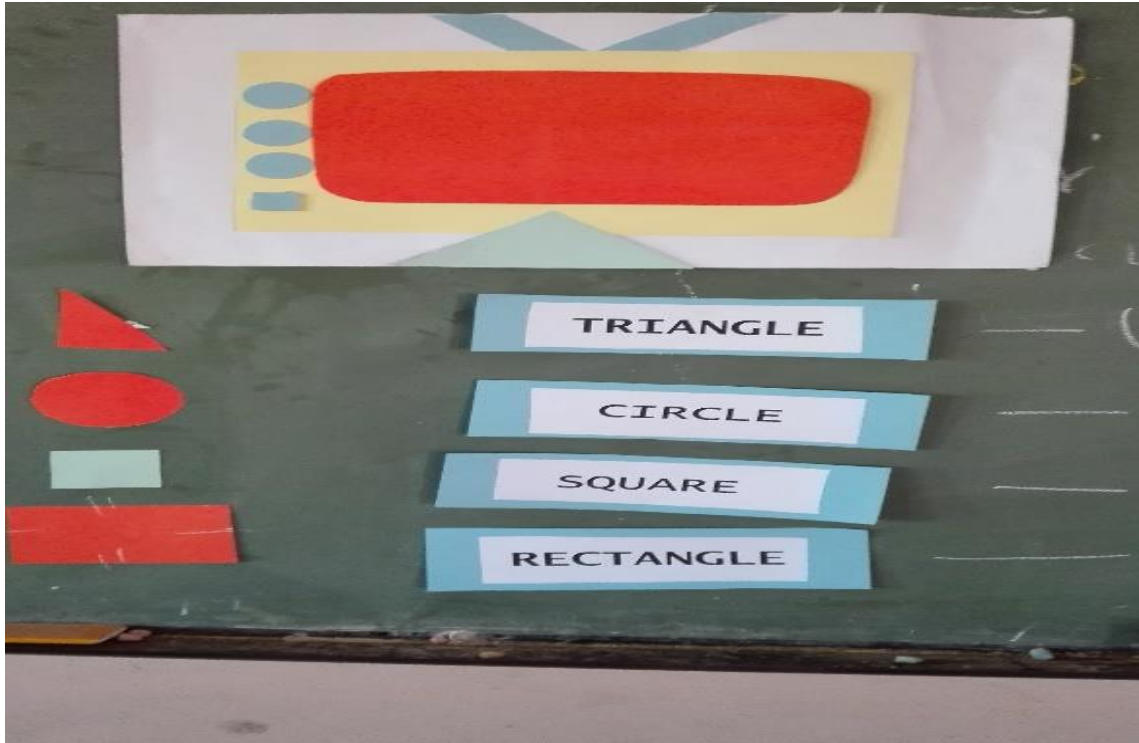


Figure: 4.1 (a). The Television picture I made with the English names of 2-D shapes.

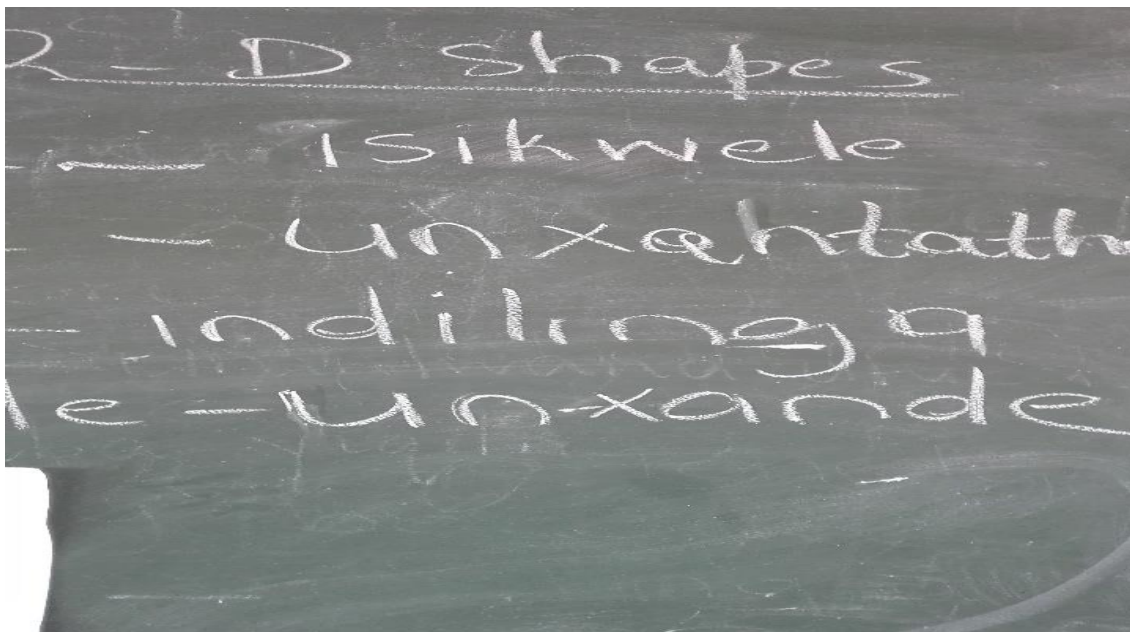


Figure 4.1(b): The IsiZulu names of 2-D shapes written on the board.

I proceeded by drawing the learners' attention to my television picture made from 2-D geometrical shapes (see Figure 4.1a). I asked them to explain what 2-D shapes are. One learner responded and said that a 2-D shape is a flat shape, but it was an incomplete definition. As Hannibal (1999, p. 356) stated, "teachers need to be intellectually honest and present mathematically correct definitions of shapes and shape sets". So, I explained to the learners that a 2-D shape is a flat shape with only two dimensions such as length and width. I also elaborated by showing them my television picture with the words written in English next to the relevant shape.

The learner activity process

To prepare for the lesson, I had organised 42 pencils, 42 glue sticks, and rolls of sticky tape, and 24 pairs of scissors, rulers, material and coloured charts. I brought these materials for learners to use when making their own television pictures. Then I gave each group the material and asked learners to make their own television pictures in groups of six. By looking at their facial expressions, I could see that learners became very excited on hearing that they would make their own television pictures.

I read the instructions for the learners in order to make sure that they understood what they were supposed to do. The learners had to read the instructions again after me as part of learning, developing their reading proficiency. I asked the learners to inform me once their group completed the activity.

The instructions were written like this:

Step 1: From the cereal box and charts, cut the rectangle for making the screen of a television, a triangle for making the stand, 3 circle buttons for opening channels and a square for on / off button.

Step 2: Fold for the centre of a rectangle to find a centre at the bottom. Paste the rectangle on the A4 charts. Paste the triangle at the bottom centre of a rectangle to make a stand. Paste the circle buttons for channels on the left hand side of a rectangle. Paste the square as an on/off button at the bottom of the circle buttons.

In order to give them some freedom of choice and to encourage them to think carefully, I ended up by telling them that the instructions given to them should not limit them.

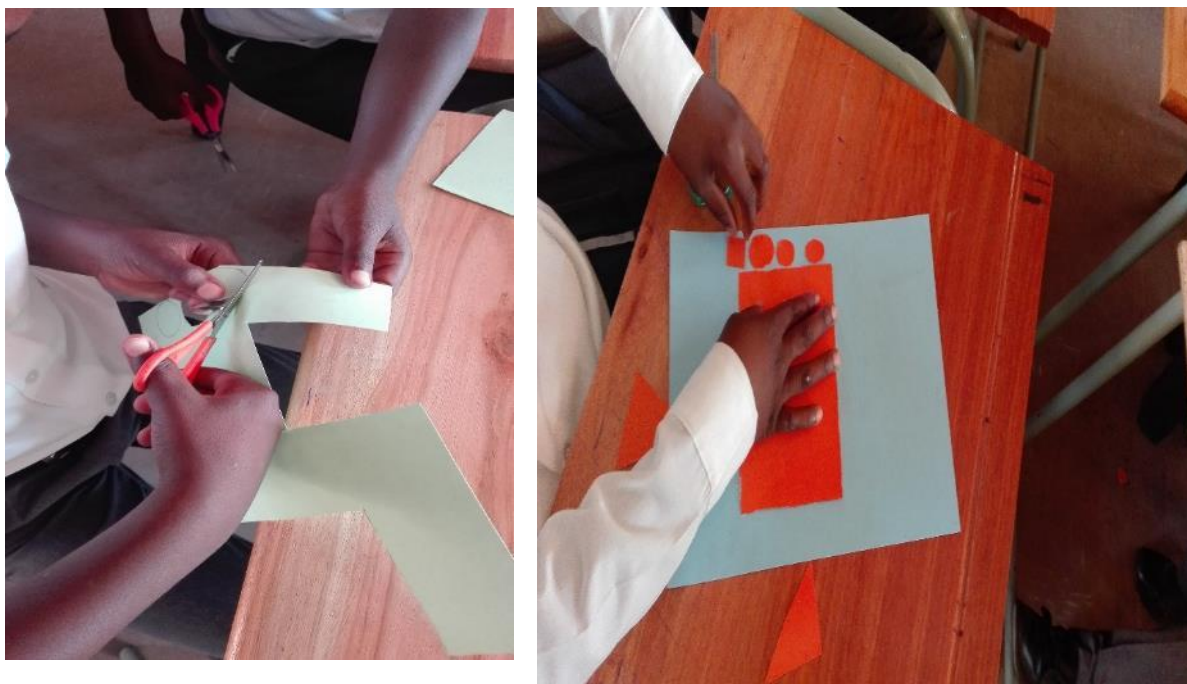


Figure 4.2: Learners cutting 2-D shapes and sticking them on the charts to make their television pictures.

Groups of learners started by cutting 2-D shapes and sticking them on the A4 paper to make their own television pictures. As Oslund and Crespo (2014, p. 565) advise, “photographs give support to collegial and professional conversations about what and how we notice in mathematics classroom.” Therefore, I took photographs (Figure 4.3) to show the exact work that was done by learners in the classroom and to support my own future reflections and conversations about my learning. The opportunity of pasting was given to the learners who did not do the cutting and they were also very excited while doing so (see Figure 4.3).



Figure 4.3: Learners are pasting their television pictures on the wall.

Lesson observation

Learners were sharing ideas with their groups and working in a hands-on way. Learners were actively involved and working collaboratively. I was moving around the classroom looking at the learners working with their groups so that I could see what were they doing. Learners made conversation about cutting and pasting 2-D shapes on the charts. After learners completed making the television pictures, they chose the learners who were going to paste their work on the wall, especially those who were shy, to build their self-esteem. Moving around the groups and listening to the conversations assisted me to understand learners' thinking while they were busy with the activity.

Conclusion to the lesson

After the learners completed their work, each group chose two learners to paste the work on the wall of the classroom (see Figure 4.3). Learners pasted their work with a smile on their faces. In my view, this helped the learners to themselves as special and helped to build their self-esteem. As Battey, Neal, and Hunsdon, (2018, p. 436) argue, “students’ views of mathematical abilities are also constructed in smaller moments through how teachers choose to acknowledge students’ contributions.”

I asked learners who had completed the work to draw the 2-D shapes, such as triangles, squares, rectangles and circles, in their exercise books using their pencils and crayons. Other learners drew the 2-D shapes during their spare time we only had one hour as the period for mathematics that particular day. Each learner tried to draw the 2-D shapes in her or his exercise book.

Challenges

Challenges are always different, but in this lesson, the main challenge was time management. According to the Department of Basic Education (DBE, 2011) CAPS document, the whole section on space and shape should take only four hours to complete. I supported the learners who were slower by encouraging them to use some extra time after the class that I requested from one of my colleagues.

Reflection

Learners came to school with initial knowledge, as they were able to see the 2-D shapes and use this knowledge while they made the television pictures. I learnt that collaborative, hands-on work through making could make learning and teaching interesting for the learners and for me as a teacher. I noticed the learners' pleasure and how fun became a platform of growth in this lesson. While they were sharing ideas in their groups, I learnt that some learners had been hiding their knowledge and seemed more easily able to share it in a group during a hands-on activity than during whole class lessons.

Lesson two: Story of a robot

In my personal history account, I recalled how my grandmother used to tell us stories as a key part of my informal learning at home. Those stories had lessons that had an impact on our lives as a family and the community. This influenced my design of a lesson based on telling a story of a robot.

Lesson presentation

On the day following the television picture lesson, I greeted the learners and told them that I had a nice story that I wanted to share with them. Learners opened their eyes wide, showing me that they were curious. I told the learners that they would listen to my story of a robot. I requested the learners to listen carefully because once I had completed telling them the story I would ask them questions based on the story to check their listening.

The story went as follows:

Teacher: Do you know the robot?

The learners responded loudly with a big “yes” to show that they were familiar with it and they liked stories.

Learners: Yes!

Teacher: The name of the robot is Bob. He is made up of 2-D shapes. His head and hands are circles. His eyes and neck are triangles. Bob’s tummy, knees and nose are squares. Bob’s legs, arms and mouth are rectangles. He loves to help people with their housework. He washes clothes with his tummy. Bob cooks with his eyes and makes cakes with his hands. But what he enjoys mostly is to slide with his legs to make floor shinny.

After telling a story in English, I repeated it in IsiZulu, otherwise some learners would be left behind if I told the story in English only. While I was telling the learners the story, their eyes were wide open, which showed me that they were curious to hear a story of a robot which was something new to them. Learners listened attentively and kept quiet as I told them that I would ask the questions based on the story. When I finished the story, learners gave a big round of applause, which showed me that they were excited.

I asked them the following questions about the story:

Teacher: How was the story?

Class: Nice.

Teacher: What is the shape of the eyes?

Lushaba: A circle.

What is the shape of a tummy?

Manxele: A rectangle.

Teacher: What is the shape of the nose?

Londi: A square.

Learners started responding with the appropriate answers, which showed me that the learners were listening to the story and they could recall the names of the 2-D shapes that they learnt in the previous lesson on making a television picture. I felt very excited about the responses of the learners.

The learner activity process

I proceeded by handing out the story of the robot to the learners and requesting them to paste it in their exercise books using a glue stick.

As Van Hiele (1999, p. 316) advised, if “the teacher presents tasks that can be completed in different ways”, this can enable, “children to become more proficient with what they already know”. So, I decided to give the learners some freedom of choice by asking them to build on the story of the robot by drawing anything they liked that was made of 2-D shapes. For example, it could be a dog, a car, a cow, a house, an aeroplane or anything else they liked. Once they had completed their drawings, then they would create their own stories and write them in their mathematics exercise books. My intention was to allow learners to build from the story of a robot and create their own drawings and written stories.



Figure 4.4: The drawing of a house with a story written by a learner.

Most learners drew and wrote stories about houses (see Figure 4.4), which suggested to me that they could most easily draw 2-D shapes in relation to something familiar to them (the image of a house):

The story of the house shown in Figure 4.4. was written like this:

Hi. My name is house. My house is made out of 2-D shapes. My windows made in squares. My door and roof made in rectangles. My grass made in triangle. My satellite dish made with circle. I love to help people to sit, sleep and watch the TV inside my house.

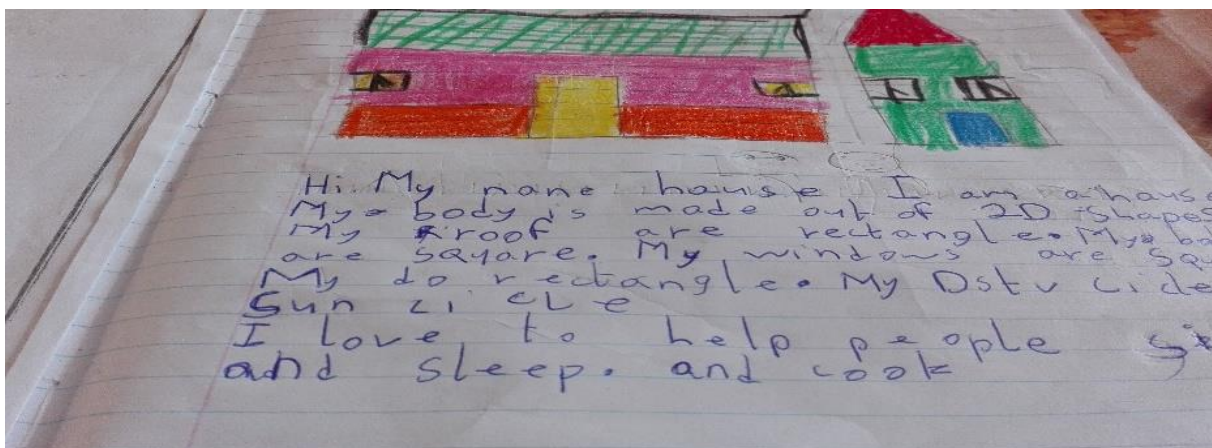


Figure 4.5: The drawing of a house with the story of another learner.

The story of the house shown in Figure 4.5 was written like this:

Hi. My name house. My body made out of 2-D shapes. My roof and my walls are rectangle. My windows are squares. My door is rectangle. My D.S.T.V. is circle. I love to help people sit, sleep and cook.

Lesson observation

Each learner was busy trying to draw her or his picture and to write a story. While I was observing, I realised that most of the learners completed their drawings but were still busy battling to write the stories to such an extent that they did not complete their work. I then requested those who faced some difficulties and had some challenges of writing in English to write in isiZulu, which was the language they were comfortable with. Unfortunately, I was left with very little lesson time. So, I decided ask those who did not complete the writing task to go home and ask for assistance from their parents to translate for them.

Challenges

Learners were all engaged in drawing their pictures, but some learners were battling to write in English. As explained beforehand, in the previous grades, they had been learning Mathematics and Life skills in isiZulu. In the end, I did not penalise the learners for writing in isiZulu because I realised that learners do not have the same levels of understanding of English. I followed Ladson-Billings's (1995) suggestion that learners must be given chances to respond

and express themselves in the language they are most comfortable with. Learners did not have time to present their stories to the class because of lack of time and because many did not complete their stories due to the language barrier. The lesson time was not enough for the learners and so many had to complete their work as homework. Learners asked their parents or caregivers to assist them in translating into English. On the following day, they came running in numbers and showed confidence with their stories written in English, which showed me that learners trusted their parents who assisted them in translation.

Reflection

I could have given the learners an opportunity from the start of the activity to write using the language that was most comfortable for them. This might have helped them to work faster and to be more confident to stand in front of others and present their stories. I believe if there were enough time for learners to start by practicing and presenting to their groups, they would gain confidence and be able to present in the classroom. .

Lesson three: Learning more ways to sort 2-D shapes and a shape walk with parents or family members

On the third day, I introduced my lesson by asking learners to put their homework books on their desks so that I could check the homework. Some learners had already approached me with big smiles showing me their homework, which was neatly done. Their homework was to write the story of their 2-D shape drawing in English. I asked the learners who had assisted them in doing the homework. They responded honestly that their parents or caregivers had assisted them to write in English. I found that all of them had completed the homework. I appreciated this and I thanked them for what they had done.

Lesson presentation

I divided the class into five groups of ten learners. I started by asking the learners a few questions in order to recap the previous work. The questions went as follows:

Teacher: Class can you identify the 2-D shapes around the classroom?

Learners: Yes mam.

Andile: The exercise book is a rectangle.

Teacher: Good

Learners identified 2-D shapes around the classroom by raising their hands. They were very excited and their participation was highly appreciated.

Teacher: Class, can you sort the 2-D shapes that are the same and put them together?

Learners: Yes mam! (*They screamed*).

The learner activity process

I gave the learners the following instructions:

Teacher: I will shuffle 2-D shapes in front of the group on the desk. The group will divide into pairs. The pairs will choose which of the 2-D shapes they will take. For example, each pair will choose squares, rectangles, triangles, or circles. Then the groups are going to sort the 2-D shapes by putting the same shapes together.

I paused to ask a few questions to review 2-D shapes. I held up the shapes and asked learners to name them.

Teacher: What shape is this?

Tukulu: A Triangle.

Teacher: What shape is this?

Lushaba: A circle.

Teacher: What the shape is this?

Ruby: A square.

Teacher: What shape is this?

Ayanda: A rectangle.

Teacher: Good Ayanda.

I proceeded by shuffling the 2-D shapes and gave each group the mixed 2-D shapes. I asked learners to sort the 2-D shapes and put them together.

They started sorting the 2-D shapes and put them together according to their shapes (see Figure 4.6).



Figure 4.6: Learners busy sorting 2-D shapes.

Lesson observation

There was a lot of noise, which was caused by arguments the learners had when they were busy dividing themselves into pairs and choosing who would be squares, circles, rectangles and triangles. I realised that this noise was part of the learning. The excitement was written on their faces while they were busy sorting the shapes.

Leaners were able to follow the instructions that were given to them (see Figure 4.7). After the learners completed sorting the 2-D shapes, I felt very excited and confident because of the 2-D shapes they had sorted, which showed me that learners were able to identify 2-D shapes. The learners also felt very happy about their sorting of 2-D shapes. Through looking at their facial expressions, I saw their happiness. They were busy calling me to come and look at what they had done. This made me feel that the learners knew that they could recognise the 2-D shapes. I felt very happy about the way they were collaborating and working hand in hand as a team.

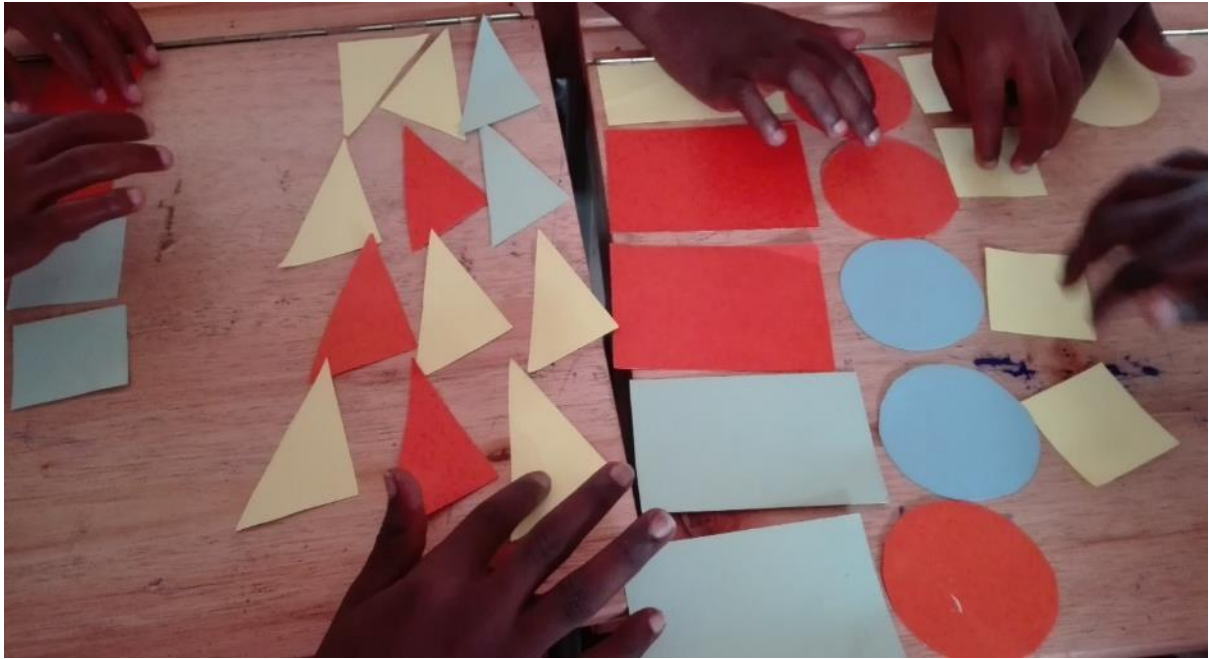


Figure 4.7: Learners are done with sorting the 2-D shapes

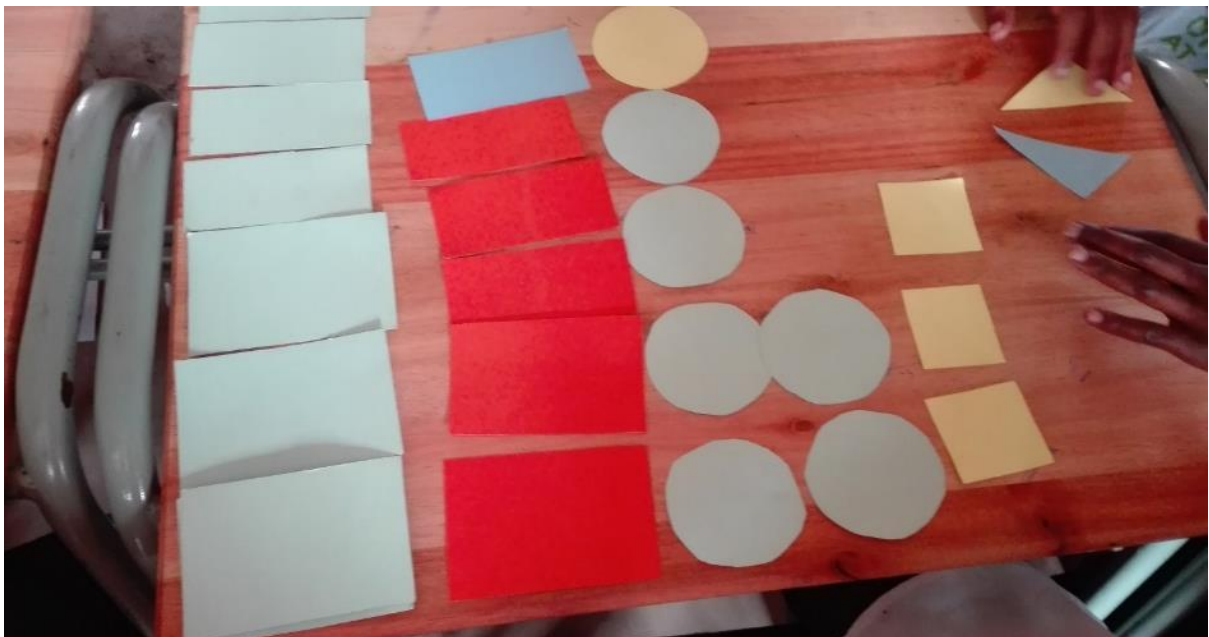


Figure 4.8: Learners' work sorted according to 2-D shapes.

Next, I asked the learners to take a circle and a triangle and observe them so that they could be able to identify the differences.

Teacher: What is the difference between a circle and a triangle?

Lushaba: A triangle has three sides and three corners. A circle is round.

Teacher: Look around the classroom. Which objects have shapes that are similar to the triangles?

Tukulu: The roof planks is made out of triangles.

Teacher: What is the difference between the triangles that are on the roof?

Tukulu: *Awalingani* (they are not equal).

Teacher: Why do you say they are not equal?

Tukulu: They have three sides and three corners that are not equal if I can measure them.

Teacher: Excellent Tukulu.

Teacher: Who can identify the triangles that are the same?

Owethu: The plank that divides the big triangles at the centre or in the middle that causes the shapes to be same.

Teacher: Good Owethu.

Teacher: Let us look at the triangle and a square.

Teacher: What is the difference between the square and a rectangle?

Lushaba: A rectangle has two opposite sides that are equal and a square has four equal sides.

Teacher: Good Lushaba.

Then, I asked the learners to compare a square and a triangle. Learners looked at the shapes that were sorted by them. They told me that the square has four sides and triangle has three sides. I asked the learners to count the sides of a square and sides of a triangle with me. When I asked for another difference, a boy did not wait to be pointed at and told me that the square has four corners and triangle three corners. I told learners to give him a round of applause.

Teacher: Class do you see the difference?

Learners: Yes (*they screamed*).

I proceeded, asking the learners questions:

Teacher: What is the difference between a rectangle and a square?

Andile: A square has four equal sides, the rectangle two long sides, and two short sides.

Teacher: If a person is facing you, what do we call that position?

They did not know. I tried to give them a clue that probe to an answer. I ended up explaining in isiZulu that they were sitting facing each other (*nibhekene*), which means they were opposite

each other. I explained that it meant that the opposite sides are equal. Some learners asked for a round of applause because they had mentioned that corners are equals.

For the next part of the activity, I pasted the chart on the board and then I distributed grid paper to the learners. I started by giving the learners the grid paper where they would draw the 2-D shapes such as a square, a triangle, a rectangle, and a circle. Then I asked learners to draw 2-D shapes on their grid papers as classwork. Then I asked the learners to give me the examples of objects that are squares, rectangles, triangles and circles.

I gave them an instruction of counting squares in order to get the same area. Learners started drawing by counting the squares that were taken by each shape. Only the circle was not easy for the learners to draw.

Working in groups worked well because the learners assisted each other and worked hand in hand as they were drawing on the grid paper. Learners seemed to enjoy drawing 2-D shapes on the grid paper (see Figure 4.9).



Figure 4.9: The 2-D shapes that drawn by learners on the grid papers.

Challenges

Learners found it difficult to draw the circle by using the squares on the grid papers (see the left hand side of Figure 4.9). Those who drew were tracing around cups or anything that is a circle. Following the given instruction did not work for the learners while they drew a circle

because the grid was something new to the learners. So I realised that I needed to teach the learners how to use the grid when are drawing the 2-D shapes and how to measure the area. Therefore, in future I will start by teaching them how to use grid paper.

Because they battled to use the word “opposite” in English, learners were unable to express that the opposite sides of a rectangle are equal. I explained the meaning of the word “opposite” in their home language (isiZulu). And I tried to make examples in IsiZulu of things that are opposite. For example: I asked learners to sit facing each other, then I told them that as they were facing each other with their partners it meant that they were opposite to one another. I decided to make more examples of things in the classroom that had sides that were opposite to each other such, as the chalkboard, the walls of the classrooms as well as textbooks. Then I explained to the learners all these examples were opposite to each other. As a teacher, I learnt that mathematics be can integrated with language (Battey et al., 2018).

The homework activity

At the end of the lesson, I asked learners to copy down the homework activity that they would do at their homes with the assistance of parents or other family members. As described in Chapter Three, in remembering my personal history, I recalled how we were surrounded by geometrical shapes in our homes. I also thought of the vital role my grandmother played in supporting my schooling. As Ramani and Eason (2015, p. 32) advise, “teachers can help parents find ways to engage children in playful math activities that complement the classroom curriculum”. Similarly, The Early Years organisation (2008, p. 1) highlights, “maths is everywhere in the home” and “with the support of parents, children can grasp many mathematical concepts through their play”. In keeping with this advice, I asked learners to divide a page of their exercise books into four columns. I explained that at home learners should ask their parents or other family members to help them while they moved around their homes to look for the objects that are circles, triangles, rectangles and squares such as plates, saucers, windows and trays. They would then try to draw those 2-D shapes in the appropriate columns in their exercise books.

Lesson four: Learning through playing games

On the fourth day, I started by greeting the learners as usual. I requested learners to show me the homework where they had to draw the 2-D shapes in their exercise books. The learners had

divided the exercise books into four columns. They had written the names of the 2-D shapes in each column. Then they had drawn particular objects in their homes to show their 2-D shapes.

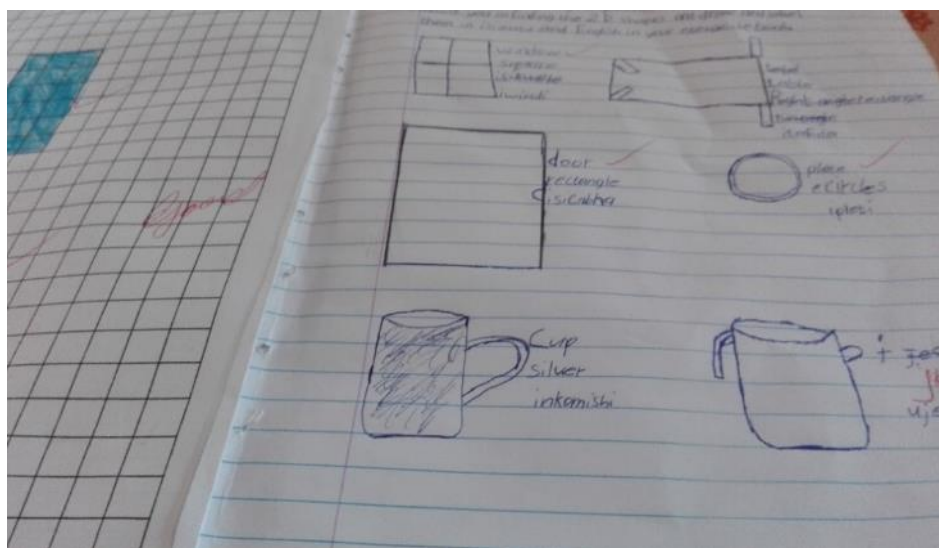


Figure 4.10: The learners' homework of 2-D shapes written in English and IsiZulu.

The learners told me how they had moved around their homes and looked for objects that have 2-D shapes, such as cups, round plates, windows, doors and houses. Learners drew the shapes of the objects (see Figure 4.10) in their exercise books. For example, plates were circles, aluminium windows were squares, and doors were rectangles. Triangles were shapes that were not easy for the learners to find unless they lived in those houses that do not have ceiling boards. Most of our learners stay in the government houses that have no ceiling boards and so it was easier for these learners to find triangles on the roof planks.

The learners' appropriate responses told me that parents' or family members' involvement is significant to the learners and that geometrical shapes can be found all over the home. I realised that parents and family members were familiar with 2-D geometrical shapes because the learners told me that they were assisted by them. I also realised that learners were enthusiastic about doing their homework because their parents or other family members were involved in their learning about 2-D shapes in a playful way.

I then asked the learners to work in groups to check and record what they had found in their homes. Each group chose someone who would present for the group to the class.

Lesson observation

Learners worked collaboratively and harmoniously as they were checking their homework. The first group started nicely by counting the number of doors, windows, houses and plates they found at their homes. By watching the first group, other groups realised that it was not difficult. Then they wanted to come and present as fast as they could without any fear. Some groups had arguments about who would present, but they came up with amicable solutions and chose a learner from each group who would present. I had learnt to be flexible by asking them to present in any language they were comfortable with because I realised some groups were afraid to present in English. I observed that learners realised that mathematics can be learnt while they move around their homes. Learners also felt very confident while they gave me their responses. I also felt overwhelmed and I was so proud of them.

After the homework presentations, we proceeded to the next lesson, which involved learning through playing games. Recalling my personal history had jogged my memory of the indigenous games that we used to play in the community and outside formal lessons at school (see Chapter Three). Remembering my own pleasure in and learning through these indigenous games prompted me to design a lesson that was based on such games. My intention in using games was to use them as a source of learning. As Nkopodi and Mosimege (2009, p. 378) advise, “the use of indigenous games in general in mathematics classrooms provides the learners with opportunity to relate experiences outside the classroom to mathematics concepts and processes encountered”. Similarly Ramani and Eason (2015, p. 31) point out, “play and games can give young children opportunities to learn and develop foundational math skills.”

The lesson presentation

The lesson went like this:

Teacher: Can you give me the names of games that you know that have 2-D shapes?

Learners: *Umlabalaba*, *gxum gxa* (hopscotch), *asha amabhodwe* (pots are burning), four rings, four rooms, *qhu ngiqhwebe*, *sheleni* (10 cents) donkey, *dambayi*.

(Some of the games did not have the English names.)

Learners showed their excitement by wanting to be pointed at first while I was asking them to give the names of the games that they knew that were made of 2-D shapes. Most of the games

were familiar to the learners. Some games were new to some learners and even to me as well. Overall, learners mentioned nine games. Then I had to divide the games by the number of groups. There were three groups of learners. I asked each group to choose its name (of a 2-D shape) and the games they would like to play. The first group chose to be called rectangles, the second group chose to be called squares and the third group chose to be called triangles. Learners then chose games for themselves.

So that all groups would be satisfied and happy, each group chose three games. The first group took a turn to choose the first game, then the second group did the same and the third group chose the next game until they were complete. The first group, the rectangles, chose to play umlabalaba, donkey, and qhu ngiqhwebe. The second group, the triangles, chose to play ushumpu, asha amabhodwe and four rings. The third group, the squares, chose to play ten cents (*sheleni*), *gxum gxa* and *dambayi*. I asked the learners to go to the playground quietly and play the games they had chosen. I wanted the learners to see that games can be part of learning, specifically in mathematics using mathematics concepts such as 2-D shapes. Similarly, Nkopodi and Mosimege (2009) highlight the importance of games in helping learners to understand that learning happens everywhere and not only in the classroom and to help learners to love mathematics. The excitement was written on the learners' faces while they were going outside.

I divided the playground outside the classroom into three columns so that each group could play without disturbing the other groups. I asked learners to start by playing the games that they all knew very well so that each learner would get a chance of playing the games. I invited them to use their home language of isiZulu. I decided to ask for learners who did not know the games to be assisted by those who knew the games and could teach them the rules using their home language. I also told each group that once they had completed playing they would teach other learners who did not know the games.



Figure 4.11: The group of triangles playing four rings.

The triangles group started with four rings (see Figure 4.11) and they were responsible for teaching those who did not know the game. While I was observing the group of triangles playing four rings, those who knew the game all wanted to be the first to start. I observed them making their own instructions. Learners formed a line so that everyone got a chance to play.

Four rings can be played by four players who will line up at the centre and take turns to run across from point two, to point three, to point four. They have to avoid being hit by shooters who try to hit them with the tennis ball or plastic ball. The runner who moves around 20 times without being hit scores one point. That player will continue playing until he or she has been hit. Teams change over once all players lined up have had turn to run.



Figure 4.12: The rectangle group playing umlabalaba using marbles and stones.

Umlabalaba is an indoor game played on a board or an outdoor game played on the sand. Umlabalaba is drawn on the sand using a stick. The players use marbles or stones when playing. Two or more players can play it. The player puts the marble on the line and occupies all the corners. The player that fills up with his or her marbles will be a winner. If both of them occupy the lines, they will start moving the marbles until marbles are on the same line, they will pick each other's marbles until someone picks up all the marbles. The learners explained the aim of umlabalaba; the winner collects all the marbles. The learners had fun with umlabalaba and asked "*sicela ukuqhubeka sidlale mam?*" meaning, "may we continue playing?".



Figure 4.13: The square group playing hopscotch (gxum gxa).

The square group started by teaching other members of the group that were unfamiliar with the game before they began to play. Hopscotch is drawn on the sand using a stick or drawn on tar using a chalk (see Figure 4.13). Each player must have a stone. Two or more players can play it. To start, the player throws his or her stone and the stone must land in one of the blocks. The player then hops on one leg when there is only one block, and jumps onto both legs where there are two blocks. The block with the stone in it has to be missed. It can only be picked up when the player comes back, hopping to the starting point. The fun part of the game is balancing. If the player over-balances onto the ground with the other foot, or any of the lines, he or she is out and has to try again.

Learners' intentions were to win and play several times. All the groups wished they could play hopscotch, as most of the learners were familiar with hopscotch.

Lesson observation

It was most enjoyable day for the learners because it was for the first time for them to go out and play with 2-D shapes. As a teacher, I learnt that children can learn more freely in an open space and that they like to change the scenario. I realised that learners can learn while playing and when playing they remain focused all the time. Those who came with new games would teach other learners who did not know the game. During my observation, I decided to let learners spend more time playing games to develop each other and because they were loving it. While the groups were playing, I played my role as a teacher and asked the learners questions such as what the intention of the game was. For example: The learners' intention in 4 Rings was to win once they had moved around 20 times without being hit. I also asked them what shapes they were using in 4 Rings. They told me that they used squares and circles (see Figure 4.13).

By looking at their facial expression, I could see that the learners felt very happy while playing. I realised that learners enjoy when they learn through playing. I also learnt that children like to be experts and to teach each other; this helps them to feel confident.

Unfortunately, the time allocation was not enough for them as the Grade 6 learners were waiting to use the playground.

Nkopodi and Mosimege (2009) highlight that the significant role of teachers when learners are playing games is to ask learners different questions because the levels of learners' thinking and understanding are different. I consolidated the lesson by asking questions until I finished observing all the games that the learners played. For example, I asked the learners the following questions:

Teacher: Which shapes did you use while playing hopscotch?

The triangle group: Circles and rectangles.

Teacher: Which shapes did you use while playing umlabalaba?

The rectangle group: A Square and triangles.

Teacher, "Which shapes did you use while playing four rings?"

The squares: Squares and circles.

Learners responded to my questions with great excitement, which showed that they were sure of what they were saying. I was so impressed and proud of the learners. I wished I had another lesson where they would play while they were learning.

The conclusion to the lesson

Learners played the various games until the bell rang. Learners were learning at the same time as enjoying themselves. As Ramani and Eason (2015, p. 32) explain, “the time children spend playing with peers, toys, and games can be time to learn new skills, practice their existing abilities, and build their interests, especially in mathematics.” The learners enjoyed themselves so much that they wished they could play for the rest of the day, which unfortunately was impossible. I asked the groups to go back to the classroom quietly because the period was over. This was a day that I would never forget in my life because of the excitement that was written on the learners’ faces. I also learnt from the learners.

Challenges

There were learners who did not have enough time to play their games because of the other grade doing Life Skills and wanting to use the playground. I had planned for my learners to use a double period and to have enough time to play three games. In order to have enough time for playing with learners, I should have checked the school timetable to find a double period that would not clash with another grade wanting to use the playground. Next time, I have to manage my time so that they can play all the games.

Some learners who were not familiar with other games did not have enough time to learn. Learners spent a lot of time choosing the games they would like to play. I ended up asking learners to choose one game per group and they all ended up with three games.

Lesson five: Making 3-D objects

In this lesson, which was at the start of the second term, I started by recapping what had been learnt in relation to 2-D shapes before moving on to the next section on 3-D objects. The key content of the lesson was how to make 3-D objects out of 2-D shapes. I wanted to see what the learners would remember about 2-D shapes from our four lessons in Term One.

I started by asking learners the following question:

Teacher: What is a 2-D shape?

Aphelele: A 2-D shape is a flat shape with length and breadth.

I asked learners to give Aphelele a round of applause because she responded correctly with confidence.

Teacher: Can you give me the examples of the 2-D shapes?

The majority of the class raised their hands. Others could not even wait to be pointed at and shouted out the possible answers.

Learners: A rectangle, a triangle, a circle and a square.

I felt very excited noticing that learners still remembered what they learnt in Term One in the previous lessons about 2-D shapes.

I asked learners to draw the 2-D shapes in the air.

They drew without hesitating.

The next step was to compare 2-D shapes and 3-D objects. I held a 2-D object, which was an A4 paper rectangle, in one hand and a 3-D object, which was a rectangular prism, in the other hand (see Figure 4.14).



Figure 4.14: The picture of a 2-D shapes and a 3-D object.

I asked learners to make a comparison between the 2-D shapes and 3-D object as seen in Figure 4.14. Then I asked them the following questions:

Teacher: What is the difference between an A4 paper and a box of matches?

Sfundo: An orange paper is flat with length and breadth. A box has length, breadth and height.

Teacher: Excellent Sfundu.

I requested the learners to give Sfundu a round of applause. I then asked them to show me other 3-D objects that were in the classroom. Learners pointed at the books, the steel cupboard, desks, the table, chairs and the chalk box. I told them that all the things they pointed at them are called 3-D objects because they have a length, breadth and height and are made of 2-D shapes.

The aim of this lesson was to recap 2-D shapes and check whether the learners could try to build 3-D objects from 2-D shapes. I asked learners to make 3-D objects from 2-D shapes. Boaler, Chen, Williams and Cordero (2016, p. 1) advised, “good mathematics teachers typically use visuals, manipulative and motion to enhance students’ understanding of mathematical concepts”. With this in mind, I provided learners with templates for cutting 2-D shapes and material for making 3-D objects.

The learner’ activity process

I gave learners the instructions to follow. For example, they had to cut six squares using templates to make a cube. They had to cut six rectangles to make a rectangular prism. They had to cut four triangles to make a triangular pyramid. They had to cut circles to make a sphere. The learners started working in groups without assistance from me. They were busy sticking the 2-D shapes together using tape. Learners built a variety of 3-D objects using 2-D shapes (see Figure 4.15). They built triangular pyramids out of triangles. They built rectangular prisms out of rectangles. They built cubes out of six squares.



Figure 4.15: The learners’ work of 3-D objects made by learners.

I proceeded, asking learners the following question:

Teacher: What do we call the 3-D object that you made out of 2-D shapes?

Each group responded in an appropriate way. I gave all the groups an opportunity to respond. For example, a group responded, “the triangular pyramid is made from triangles” (as shown in Figure 4.15). Another group responded, “The rectangular prism is made from the triangles”.

The conclusion to the lesson

I concluded by asking the groups of learners to display their completed tasks publically in the library so that other school learners could see them. I learnt that learners enjoy displaying their work and showing it to others.

Challenges

Some learners did not complete the task during the mathematics period. I supported those who did not complete the 3-D objects by giving them time during my Life skills period.

Reflection

Learners knew about 2-D shapes and they were hands on while they were cutting them as fast as they could due to the knowledge they gained from lesson 1 to lesson 4. As a teacher, I observed that learners were more confident than before. Learners showed me how they were so creative and showed their interest. They also showed me that they still remembered what we had done in the previous term.

What I noticed when learners were comparing 2-D shapes and 3-D objects was that learners were able to identify that the 2-D shapes have length and breadth. Then I explained that 3-D objects have length, breadth and height. Learners were able to make 3-D objects from 2-D shapes.

Conclusion

In this chapter, I described how I responded to my second research question by putting into practice my learnings from my personal history: a) learning through making and hands-on learning; b) learning through storytelling; c) learning through exploring the surroundings; and d) learning through playing games. I demonstrated how these learnings and my reading informed my design of five lessons on geometrical shapes.

I found that being involved in practical work made learning and teaching interesting to the learners and to me as a teacher. Furthermore, I learnt that learners' enjoyment can be enhanced when they work together in groups. I also found that learners can become fully engaged if they work together as a team. I also learnt that arguments and noise making are part of learning when learners are working together. Furthermore, I saw how education does not end at school; it is everywhere as learners can explore geometrical shapes in their surroundings. Learners can also learn while they are playing. They learn freely in an open space and. like to change their scenario.

In the following chapter, Chapter Five, I present images from a collage that I created to represent my learning from designing and teaching five lessons on geometrical shapes. I discuss five pictures from my collage that represent key aspects that I need to pay attention to in continuing to improve my teaching practice. I then go on to describe the change in my teaching practice that was brought about from this self-study research. I also consider the impact of my self-study research beyond my classroom.

CHAPTER FIVE

A REFLECTION ON MY LONG JOURNEY

Introduction

In this self-study, my emphasis was on my own learning as a teacher. I aimed to explore how I, as a Mathematics educator in a primary school, might learn to improve my practice of teaching mathematics. In particular, I want to explore how I could improve on the learning and teaching of geometrical shapes with my Grade 4 learners.

In this chapter, I continue to respond to my second research question: *How can I improve my teaching of geometrical shapes to Grade 4 learners?* I present images from a collage that I produced to represent my learning from designing and teaching five lessons on geometrical shapes (as presented in Chapter Four). I explore five pictures from my collage that represent key aspects that I need to pay attention to in continuing to improve my teaching practice. I then go on to describe the change in my teaching practice that was brought about from this self-study research. I also reflect on the impact of my self-study research beyond my classroom.

Creating a collage to consolidate my learning

As discussed in Chapter Two, I decided to create a collage that would represent my learning from designing and teaching the five lessons on geometrical shapes (Figure 5.1). My aim was to generate my ideas to assist me in consolidating my learning in response to my second research question: *How can I improve my teaching of geometrical shapes to Grade 4 learners?*



Figure 5.1: The collage that represents my learning from designing and teaching the five lessons on geometrical shapes

In what follows, I discuss five pictures from my collage that represent key aspects of my learning. First, I consider the family picture, which represents paying attention to the learners in the classroom. Second, I discuss the picture of an eye that represents stimulating learners' senses. For example, when they look at visuals and touch objects that arouse curiosity and stimulate interest. Third, I focus on the picture of floor tiles, which represents the challenge of lack of space in my school. Fourth, I discuss the image of a clock, which represents my struggle with time management in completion of tasks. The last image of a player represents the learners' enjoyment and learning through playing games.



Figure 5.2: The family picture represents learners in the classroom

The most interesting thing to me about the collage was the picture of a family that represented the learners in the classroom. In my self-study research, I discovered that collaboration between learners was a key part of the learning and teaching process. I also learnt to be hands on by monitoring and assisting learners where necessary.

I learnt that I should make sure that communication and sharing of ideas were part of the class activities. Learners must be given opportunities to be actively involved and participate in the learning process. Hence when deciding on the activities, I have to envisage what would grasp their attention and keep them interested (Ball, et al., 2008). Group work seemed to be very stimulating as they worked collaboratively and became actively involved. Those who were shy had a chance to do very well and this created positive feelings towards mathematics experiences with other learners. I have learnt that learners performed very well and enjoyed themselves when they worked in groups while they assisted each other. Learners work effectively and harmoniously if they understand what they are supposed to do. As a teacher, I should also work to cultivate supportive relationships amongst learners and try to let them solve their own problems if there is a need. I experienced that eagerness that was written on learners' faces after completing the activities together and I felt proud of them.

The learners' excitement was also written on their faces as I entered the classroom for the first of the five lessons on geometrical shapes. I introduced my first lesson by asking learners to show me the shapes they had learnt in Grade 3 that were around the classroom. Learners failed

to hide their excitement as I was asking them something they knew and had learnt in the previous grades, although they had learnt it in their home language.

I observed that learners were able to express their learning to each other in their mother tongue, which showed that they understood what they were doing. Some learners were struggling with answering in English to such an extent they did not connect words with the objects. For instance, learners pointed a shape of a triangle instead of pointing a shape of a rectangle. As a teacher, I learnt to make objects and put a word next to the object such as “*unxantathu*” (triangle) to connect isiZulu and English. I also learnt to make the mathematics more important than the language.

Emotions were also part of a learning process. I observed that learners were able to express their feelings such as happiness, sadness and inferiority.

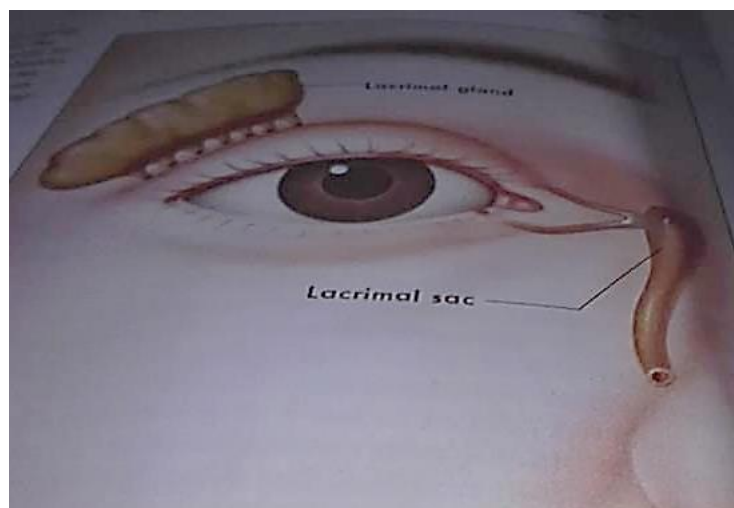


Figure 5.3: An eye represents senses.

Through my self-study research, I have realised that teaching is not just about standing in front of the learners and talking. I need to involve the learners' senses such as sight, touch, and hearing. For example, in my first lesson, I showed the learners a bright television picture that I had created. I could see that learners were excited looking at my bright television picture. By looking at their facial expressions, I could see that learners became even more excited on hearing that they would make their own television pictures. Moving around the groups and listening to the conversations as they were involved in cutting and pasting shapes to make their television pictures assisted me to understand learners' thinking while they were busy with the

activity. This concrete activity showed me that learners were able to see the 2-D shapes and use this knowledge to make the television pictures.

In my second lesson, I told the learners that they would have to listen carefully to my story of a robot because once I had finished telling the story I would ask them questions based on the story. Learners listened and when I finished the story, learners gave a big round of applause, which showed me that they enjoyed listening to the story.

In the third lesson, when learners were busy touching and sorting shapes, there was a lot of noise. I realised that this noise was part of the learning. Learners' pleasure was written on their faces while they were busy touching and sorting the shapes. After the learners finished sorting the 2-D shapes, they called me to come and look at what they had done. This made me feel that the learners knew that they could recognise the 2-D shapes.

For homework after the third lesson, I asked the learners to take a shape walk. I explained that at home learners should ask their parents or other family members to help them while they moved around their homes to look for the objects that are circles, triangles, rectangles and squares such as plates, saucers, windows and trays. They used their senses of sight and touch as they moved around their homes and looked for objects that have 2-D shapes.

In the fourth lesson, when the learners went outside to play games, they used different senses to set up and play the games. Learners were learning at the same time as enjoying themselves.

In the fifth lesson, learners built a variety of 3-D objects using 2-D shapes. They were busy sticking 2-D shapes together to make 3-D shapes. I found that being involved in this hands-on work made learning and teaching interesting to the learners and to me as a teacher.



Figure 5.4: The tiles represent the floor space

The lack of floor space was challenging in my school. Learners were overcrowded in the classrooms. For example, my wish was to let the learners sit down on a carpet while I told them a story of a robot, which was part of my lessons. However, due to the shortage of space I had to stand in the front of the classroom to tell the story.

I have learnt that as a teacher I need to be active and be hands on during the learning process. However, there was very little space for moving around in the classroom. I have realised that it can work well to take learners outside to give them more space to move, especially when they are playing games. However, I need to check the school timetable to find appropriate times to use the playground for my lessons.



Figure 5.5 The clock represents time management

Time management was challenging because learners often did not complete their tasks within the set period. For example, some learners were struggling to write a story in English. According to the Department of Basic Education (DBE) CAPS document, the whole section on space and shape should take only four hours to finish. However, I found that encouraging learners to work in ways that are playful, collaborative, and hands-on took more time than was stipulated in the prescribed curriculum. Therefore, I had to ask for extra time from my colleagues or use some time from other subjects, such as Life Skills.



Figure 5.6: A picture of a player represents the learners playing.

I have learnt that learners can learn while playing and that when playing they are engrossed in the task. By looking at their facial expressions, I could see that the learners felt joyful while playing. I realised that learners delight in learning through playing.

Through playing and teaching each other games, learners had a chance to interact with their classmates and to help each other. This helped them because this assisted them to develop their listening, and it encouraged learners to take an active role in their exploration. I noted that those who came with new games would teach other learners who did not know the game. From this, I learnt that children like to be experts and to teach each other; this helps them to feel confident.

I have learnt that it is important that learners have some opportunities to choose for themselves the games they want to play. Although learners had arguments when they wanted to choose the game they would play, I have realised that learners' arguments are part of learning.

I also learnt from the learners as I ended up knowing how to play games. I also realised that learners could also tell the intention of the game if were asked.

I realised that learning through playing games can be connected with ownership and collaboration. I found that teachers should provide learners more control of their learning and opportunities to work at their own pace with their peers.

My change in teaching practice

When I scrutinised my teaching of geometrical shapes, I found that it was not enough just to do what was written in the prescribed curriculum document. I also found that I needed to think beyond my own mathematical knowledge and consider the learners' own limitations and mathematical understanding (Ball et al., 2008). This can be achieved when we start to think about mathematics not just as a subject to know one's self, but to be able to teach someone else (Rowland, Huckstep, & Thwaites, 2005). Therefore, I decided to design more activities that would be fruitful for the learners. Thus, my practice has changed. For example, in Chapter Three I recalled the indigenous games that we used to play in the community and at school during break times. I utilised those games with Grade 4 learners for learning geometrical shapes. I have learnt that indigenous games can be resources for learning, as learners enjoyed playing while they were learning. I learnt to do different activities in different ways to bring mathematics into life for the learners.

I also learnt that the learners' home language could be a resource for learning. For example, learners used their home language while they were teaching those who were unfamiliar with the indigenous games. I also learnt that a mathematics teacher could also be a language teacher so that learners can understand mathematics. My role as a teacher is to use the indigenous games in classrooms as part of learning and teaching.

The most important change through my self-study was in the relationship between the learners and me. As a teacher, I have learnt to create a positive rapport in the classroom so that learners feel free and relax during the process of learning and teaching. I found that learners must be given opportunities to share their knowledge and ideas during the learning process. This allows learners to develop supportive relationships amongst themselves and they learn to listen to each other's ideas. They could also build friendships. As a teacher, I need to cultivate supportive learning relationships amongst the learners and with me.

I also realised that pleasure and fun are platforms of growth. I have come to understand that everything I teach should be interesting to the learners and to myself so that the learners and I enjoy the lessons. As a teacher, I must show enjoyment to the learners so that learners show enjoyment.

I wish I would have known before that learning does not take place only in the classroom and not just to follow the prescribed curriculum document. As a teacher, I can create new things that are relevant to the curriculum, as I did, and take decisions about what is best for the learners. The prescribed curriculum document is just the beginning of my lesson planning, not the end.

What I would do differently if I were doing this kind of research again is to teach English language together with Mathematics in order to assist learners in addressing the language barrier and learning to be independent. I would like to change learners' attitudes not to be scared of standing in front of other learners and expressing themselves in English. This would build the learners' self-esteem.

Impact of my research beyond my classroom

My research has had a positive impact with a novice teacher because I was able to share my new ideas with her and assist her in teaching mathematics. In addition, the school principal transferred me to teaching Grade 5 in the year following my research. This was due to her observation of my teaching, as she was so impressed by the way I was teaching and learners' involvement.

During cluster meetings with teachers from neighbouring schools, I shared my knowledge that I gained during my research. I have now been given an extra responsibility with the cluster to share my ideas on learning and teaching of mathematics. Other teachers were asking me to demonstrate to them on how I teach mathematics. They were listening attentively. Teachers showed interest in my teaching of games outside the classroom by looking at the photographs of learners playing. When I was at a workshop of neighbouring schools, I was asked to share my lessons on geometrical with the teachers.

I am now a source of information in my school community and in the cluster meetings as I share my experiences with neighbouring teachers and novice teachers in my school. This makes me feel confident and proud of myself.

Concluding thoughts

Overall, from my self-study research, I discovered that my own learning as a teacher could be enhanced by appreciating the contributions of my personal history and by listening to and respecting the contributions of my learners as active participants in learning and learning. Another key learning was to see space for teaching mathematics beyond the limitations of classroom. I also discovered that, sometimes as teachers we cannot be limited by the time constraints of the prescribed curriculum and school timetable. It is important that we allow learners' understanding and capabilities to determine the amount of time we need to spend on a concept.

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APPENDICES

1. Ethical clearance certificate
2. Informed consent letter

03 November 2015

Ms Jane M Makhaye 214581865
School of Education
Edgewood Campus

Dear Ms Makhaye

Protocol reference number: HSS/1266/015M

Project title: Teaching Geometrical shapes to Grade four learners: A self study.

Expedited Approval

In response to your application dated 07 September 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully



.....
Dr Shenuka Singh (Chair)

/px

cc Supervisor: Dr K Pithouse-Morgan and Dr L Masinga
cc Academic Leader Research: Professor PJ Morojele
cc School Administrators: Ms B Bhengu, Ms T Khumalo and Ms PW Ndimande

Humanities & Social Sciences Research Ethics Committee

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APPENDIX B**LETTER TO THE PARENTS/GUARDIANS**

Box 16, St Wendolins
3609

Dear Parents/Guardians

INFORMED CONSENT LETTER

My name is Miss Jane Makhaye. I am a Master of Education degree candidate studying at the University of KwaZulu-Natal, Edgewood campus, South Africa.

I am interested in conducting a study on Teaching Geometrical shapes to Grade four learners: A self-study. To gather the information, I will use learners' classwork on the topic of Geometrical shapes.

Please note that:

- The research aims at improving my Teaching of Geometrical shapes to Grade four learners.
- Your child's confidentiality is guaranteed as their inputs will not be attributed to them in person, but reported only as a population member opinion.
- Any information given by your child cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You can choose to allow your child's classwork to be used in the research. If you choose not to allow this, then your child will not be penalised for taking such an action.
- Your child's involvement is purely for academic purposes only, and there are no financial benefits involved.
- I will meet with parents/guardians to share the findings of the research.
- If your child is willing to participate, please indicate (by ticking as applicable) whether or not you are willing to allow the classwork activities to be recorded by the following equipment:

	willing	Not willing
Audio Recording of classwork activities		

I can be contacted at:

Email: jmakhaye@yahoo.co.za

Cell: 0825666059

Supervisor's details:

Dr. Kathleen Pithouse-Morgan

College of Humanities

School of Education

University of KwaZulu-Natal

pithousemorgan@ukzn.ac.za

Tel. No. 031-2603460

You may also contact the Research Office through:

Mr. P. Mohun

HSSREC Research Office, Tel: 031 260 4557 E-mail: mohunp@ukzn.ac.za

Thank you for your contribution to this research.

DECLARATION

I..... (full names of parent / guardian) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to my child/ward participating in the research project.

I understand that I am at liberty to withdraw my child/ward from the project at any time, should I so desire.

SIGNATURE OF PARENT/GUARDIAN

DATE

.....

.....

P.O BOX 16
ST WENDOLINS
3609

Mzali Othandekayo

INCWADI YESAZISO SABAZALI

Igama lami ngingu Miss Jane Makhaye. Ngingumfundi owenza iziqu eNyuvesi yakwaZulu-Natal kwiKhempasi yaseEdgewood South Africa. Ngithanda ukwenza uphenyo ngokufundisa ngama (kubafundi bebanga lesine (Grade4). Ngifunda ngani ukuze ngithole ulwazi ngizosebenzisa umsebenzi wabafundi kwisohloko sezimo zeGeometry.

Engicela nikwazi ilokhu:

-Uphenyo luhlose ekuzithuthukiseni kwami ekufundiseni abafundi bebanga lesine (Grade4).

-Imfihlo yomntwana wakho igarantiwe as their inputs will not be attributed to them in person, kodwa izobikwa as reported only as a population member opinion.

-Ulwazi noma iluphi engizolunikwa umfundi ngeke lusetshenziswe (against) kwakho; nokukolekwa kweData kuzosetshenziswa.

-IData izogcinwa kwindawo evikelekile bese ihlakazwe) emva kweminyaka emihlanu.

-Ungakhetha ukuba uvume umsebenzi wengane ukuba usetshenziswe kuphenyo . Mawungavumi, ngeke umntwana ahlawuliswe ngokuthatha kwakho isinqumo.

-Ukubamba iqhaza komntwana wakho kungenhloso yokufunda kuphela, futhi azikho (izi...) ezizotholakala ezimbandakanyisa imali.

-Ngizohlangana nabazali ukudlulisa imiphumela etholakele kuphenyo.

-Uma umntwana wakho efisa ukubamba iqhaza, khombisa ngophawu lokuvuma noma awuvumi umsebenzi () uqoshwe (audio-recorder) umsakazi.

Audio-recording ezoqhophisa umsebenzi owenziwa ikhosi ().

Ngingathintwa kwi:

Email: jmakhaye@yahoo.co.za

Ucingo: (0825666059)

Kathleen Pithouse Morgan

College of Humanities

School of Education

University of KwaZulu-Natal

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Inamba yocingo: 031-260 3460

Ungaxhumana nehovisi lophenyo no Mnu. P. Mohun.

HSSREC Research Office, ucingo: 031 260455

Email: mohun@ukzn.ac.za

Nginyabonga ngoku () kuloluphenyo.