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Ubuntu in the Transformation of a Learning Environment for Effective Mathematics Teaching

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Ubuntu in the Transformation of a Learning Environment for Effective Mathematics Teaching

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Abstract

Teachers often supplement their regular approach to teaching of mathematics concepts to foster conceptual understanding through enquiry and dynamic visual representations. Mathematics teachers in the rural schools often rely only on prescribed textbooks, chalk and a chalkboard deliver their lessons in under-resourced, overcrowded mathematics classrooms. This article reflects on the findings of a study conducted with two grade 8 mathematics teachers in a district of the Eastern Cape in South Africa on how Ubuntu was used to transform those learning environments for effective geometry teaching. A multiple case study design was followed from an interpretive perspective paradigm. This was a qualitative study in which data was collected through classroom observations together with semi-structured interviews conducted with the teachers. Results revealed how the teachers transformed their approach to different mathematics topics using different models to build confidence for learners to discern critical features in understanding mathematics tasks while simplifying real situations in their environment. It was a continuous process of Ubuntu where the diversity in the classrooms was neutralized to bring each learner inclusively into understanding meaning in the interpretation of both geometric and algebraic terms with their application through a modified sharing and valuing of each learners' contribution in their classrooms.

Keywords: Ubuntu, mathematics, transformation, learning environment, teaching.

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Introduction

The importance of mathematics education cannot be overemphasized in the global economy. Within the South African context, the Curriculum Assessment Policy Statement (CAPS) prescribes the required knowledge, skills, understanding and in some cases examples of content competency required for mathematics in a particular grade. However, there is no prescription of how teachers should organize their students' learning and develop ideas of adjusting their classroom practice to ensure content understanding at particular levels (Hurrel, 2013). Ndlovu & Mji (2012) suggest that the South Africa's intended curriculum prescribed by CAPS should be modified and aligned with the Trends in International Mathematics and Science Study (TIMSS) curriculum, which is the most comprehensive international benchmark test. Mismatches identified by these authors include under emphasis of the cognitive domain categories of problem solving and reasoning in Number, Measurement and Geometry, together with basic facts in Algebra and Data (Ndlovu & Mji (2012)). According to (TIMMS, 2015) the most effective mathematics classrooms are places in which students have chances to interact with their teacher, their classmates, and the mathematics content. Moreover, the implemented mathematics TIMMS is the curriculum model that ensures the relevance for policy makers and practitioners with respect to intended curriculum as prescribed by the national and social educational context, the implemented curriculum by the mathematics teacher in a particular school context and the attained curriculum that is measured through student performance and characteristics (Kavli, 2017). In South Africa, the attained curriculum at all levels reflects underperformance in mathematics.

This could be associated with the fact that each mathematics classroom context is different with unique learners coming from diverse backgrounds and primary school settings. Grade 8 is the lowest grade in secondary schools in the school system in South Africa. Learners in this class are a combination of outputs from different primary schools who have undergone diverse mathematics teaching approaches from both qualified and underqualified teachers. The Eastern Cape province where the study was conducted continues to struggle to overcome the serious under performance in mathematics in the vast majority of the schools (Siyepu, 2013). Instructional practices are related to teacher quality because teachers who are highly qualified have strong pedagogical knowledge and strong mathematical knowledge. The South African Human Sciences Research Council (HSRC) (Reddy, V.; Zuze, T.L.; Visser, M.; Winnaar, L.; Juan, A.; Prinsloo, C.H.; Arends, F. & Rogers, S. (2015)) conducted studies in 1995, 1999, 2003, 2007, 2011 and 2015 to test learners at the Grade 8 level in mathematics and science. In addition, Reddy et.al (2015) report that the vast majority of benchmarked learners performed at the lowest level where only a basic knowledge of mathematics and science had been acquired. Reddy et. al (2015) further acknowledge that three quarters of South African learners had not acquired even the minimum set of mathematical or science skills by grade 8.

Due to the geographical location of Mt Ayliff district and socio-economic issues like poverty, low income capacity of parents in that community, learning materials other than a prescribed textbook for mathematics supplied by the Department of Education (DoBE), are scarce. In addition, the available textbooks are written in a language foreign to both teachers and learners (Setati, 2005). The schools are overcrowded, operating in less resourced classrooms with inadequate furniture and basically depend on the department for provision of both teaching and learning resources (Jojo, 2017). The teaching and learning of mathematics, in particular Geometry, presents challenges in these schools due to lack of relevant facilities for its teaching and learning. Methods employed by teachers to teach geometry in secondary schools are to a very large extent influenced by the kind of resources and facilities available in the school. This hegemony is challenged in this paper with a reflection of observations made with two grade 8 mathematics teachers who went beyond their call of duty to create classroom environments that favour learning of geometric concepts. Through Ubuntu those teachers managed to create an optimal classroom climate that was accommodative to allow learners to re-conceptualize and correct their understandings of concepts learnt in previous grades. A free environment that allowed learners to make mistakes without being ridiculed was created and it allowed learners to commit and invest effort in wanting to know and build confidence to know more.

Gade (2012) asserts that Ubuntu has different meanings best defined in terms of relations with other people. This concept has its roots in how one person behaves towards other people in given situations with an aim to better serve the community. Ubuntu as a philosophy, is a way of thinking about what it means to be human, and how humans, are connected to each other or should behave toward others. Tutu (2004, p3) says,

‘You can't be human all by yourself, and when you have this quality - Ubuntu - you are known for your generosity. We think of ourselves far too frequently as just individuals, separated from one another, whereas you are connected and what you do affects the whole world. When you do well, it spreads out; it is for the whole of humanity’.

When this philosophy is well explored and understood by a mathematics teacher, it culminates in the latter putting maximized effort to ensure that the classroom environment welcomes learners’ errors and questions while it also promotes engagement with problems posed and boosts their reputation. A critical question in this article is, how Ubuntu as an African indigenous epistemology and worldview respond to the transformation of learning environments for effective geometry teaching? In an attempt to answer this question, I decided to focus on Ubuntu in this article because of its teaching and learning capacities. Letseka (2000, p179) suggests that Ubuntu encapsulates moral norms and virtues such as kindness, generosity, compassion, benevolence, courtesy, respect and concern for others. It is from those moral norms that the mathematics teachers observed based their instructional principles. They forged, collaboration, empathy, compassion through reflections on their classroom practices in order to bring equality to the mathematically challenged students. In their zeal to strive for excellence, their challenge was students’ mathematics content gap. Waghid & Smeyers (2012) assert that through Ubuntu’s reliance on empathy and relational autonomy, it is an ethic of care that is also a persuasive approach. In addition, Metz & Gaie (2012) suggest that Ubuntu considers everyone to be potential members of an ideal family based on loving and friendly relationships. This is a theory that could then underpin the approaches used to teach mathematics in the most lacking and challenged rural environments.

Mathematics allows students to make sense of, participate in and contribute to a world characterized by numbers, numerically based arguments and data represented and misrepresented in a number of different ways (DoBE, 2012)). In this way, Mbugua, Kibet, Muthaa, & Nkonke (2012) assert that Mathematics is a foundation of scientific and technological knowledge that is vital in social- economic development of the nation. However, a massive decline in the number of learners enrolling for mathematics in grade10-12 in South Africa has been observed over the past five years. For example, 225000 learners were registered to write matric (grade 12) mathematics in 2011 compared to only 187 89 in 2017. This decline is a worrying trend for most South Africans in education, business and all mathematically related field specialists. This study was conducted in predominantly rural school settings characterized by scarce material teaching and learning resources and under-prepared learners. I owe this study to the reality I faced, having studied higher grade mathematics in a rural school taught by dedicated, committed teacher in his first year of teaching after completing his Bachelor of Science degree thirty years ago. The passion he showed for the subject mathematics made all the students in the class to share and work together and assist each other beyond the call of the syllabus. With this background, I thought it was possible to help teachers who handled mathematics teaching in rural schools to infuse Ubuntu to transform their classroom practices for better performance of learners in the subject. The study focused on the transformation of grade mathematics classroom practice in the teaching of geometry through the Ubuntu philosophy. The study used qualitative research methods to respond to the question, 'How can a learning environment be transformed through Ubuntu for the promotion of effective geometry teaching.

Literature Review

Hlalele (2012) recommends that teachers need to create inviting academic settings that help learners to feel more successful, that they can do better, despite previous experienced failures. Such failures include the different challenges experienced by learners from diverse backgrounds including under-preparedness to understand basic mathematics concepts. Hattie (2012) argues that when using visible learning, teachers' subject matter knowledge has little effect on the students' outcomes. The distinction is observed in the organization of mathematics content knowledge such that new knowledge is integrated and combined with learners' prior knowledge. In this way, a committed teacher recognizes the sequences of events occurring in the classroom and draws from many teaching strategies relevant to effect successfully the learning of a topic.

Despite the proliferation of poor performance of learners in mathematics, there remains no solutions to turn the situation around in the existing knowledge base. First most studies have argued within what would be called the effective ways of teaching mathematics. Some of those include using visual manipulatives to teach geometry (Moyer, 2014), using representations to conceptualize teachers' knowledge (Orton, 1998) and other ways. Nonetheless, most of their suggestions cannot be used in rural settings due to scarcity of basic socio-economic resources like electricity and technology. Second, while critiques abound, very few systematic and coherent attempts have been made to propose alternatives either within or outside of the effective mathematics teaching strategic paradigm. And third, much of the application of the effective mathematics teaching research outside of the urban settings has erroneously rested on fixed assumptions about mathematics teaching which cannot be practiced in rural under-resourced classrooms.

This paper is different from the existing reviews in that it (i) challenges the existing classroom practices used by grade 8 mathematics teachers in rural schools, (ii) examines the instructional designs crucial for successful teaching of mathematics in rural schools and (iii) proposes a transformation of the mathematics classroom practice through the framework of Ubuntu. Scheerens (2012, p. 134) proposes "the recognition of the importance of teachers as resourceful practitioners" who are committed and cooperate with the organizational needs. Commitment and cooperation are some of Ubuntu attributes. The teacher's consciousness of adjusting his/her instructional design for different lessons to ensure that learners are able not only to understand content taught, but can also connect and relate it to their existing knowledge. Gustafson (1996) describes instructional design as a process that involves (i) analyzing what is to be taught/learned; (ii) determining how it is to be taught/learned; (iii) conducting tryout and revision; and (iv) assessing whether learners do learn. The teachers, students, materials, and learning environment all form components of a systematic process that is important for successful learning. Parker, Bartell & Novak (2017) note that when the teachers have engaged in inquiry-based practices related to the role of culture in mathematics teaching and learning, they may be able to continue developing their knowledge and skills related to culturally responsive teaching on their own. However, culture in the rural areas where the study was conducted informs and plays a significant role in how the activities are done in and outside the classroom. For example, it may be easy for learners in the classroom to interact with each other or respond correctly in a whispering tone to questions, and refuse to openly pronounce the response out of respect for the teacher. This has its roots in the fact that at home due to the scarcity of living rooms, although children share the same living space as their parents they are not allowed to comment or be part of discussions or engage openly with adults. This is re-created in the classroom where this cultural norm practiced at home plays itself out as fear for learners to speak out on what they think or contribute to the learning process. This therefore culminates to a dysfunctional learning process in which the teacher-learner interaction is minimal. This hegemony is being challenged in this paper to expose how the philosophy of Ubuntu was displayed to transform classroom practice for improvement of performance in mathematics.

Amongst the many attributes of Ubuntu commonly practiced by the participants in this study was showing care for their learners. They cared for the under preparedness state that revealed a knowledge gap in basic mathematics terms. The development of learners' mathematical knowledge according to Hackenberg (2005) is conjoined with developing learners as people, caring for them such that they get motivated and perform better in mathematics. Gay (2010, p31) suggests academic achievement of learners in mathematics improves when ''they are taught through their own cultural and experiential filters''. This involves using the learners' cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them. Teachers therefore need to understand the culture and background of their learners in order to adjust their teaching approach and control how they choose contextual examples that embrace students' culture.

In order to transform a teaching practice in the mathematics classrooms, each of the participants had to create environments that enabled learners to be active, while it foster a respectful, engaging, and cooperative atmosphere for learning (National Board for teaching standards, 2012(a)). In addition, those teachers helped the learners to unleash their intellectual skills and risks wherein students feel safe to communicate different their points of view, conduct explorations on presented challenges, make mistakes, and admit confusion or uncertainty in some instances in order to learn. The challenge was to create an environment that boosted learners' work ethics and prompts them to own and be responsible for their learning, so that a culture of knowledge sharing becomes a norm in and outside the mathematics classroom. It took each teacher's patience, dedication, commitment and moreover a need to transform existing monotonous mathematics classrooms that ooze fear of students' self-expression to a well-pleasing destination where every learner would like to be. An observed growth in learners' active participation in classroom escalated to knowledge sharing where students who understood some concepts assisted the others to understand. This was possible because the teachers used a variety of flexible instructional methods with a skill of good judgment and planning with adjusted discretions to deliver their geometric lessons.

Theoretical Framework

Various issues of classroom practice were considered in the teaching and learning environments in which the participants in this study found themselves. Those included the physical and social environments in which underprepared learners sought to learn mathematics. Of importance in such disabling environments is the role of the teacher in making it a priority for effective of mathematics to be accomplished while their passion in mathematics teaching is developed. Transformation refers to change. Most often an environment in which a teacher presents an example on the chalkboard, calculates it with emphasis on the procedures followed, is a common practice in most mathematics classrooms. This is usually substantiated by instructions for learners to do certain problems on their workbooks for classwork and or homework without certainty on whether the learners understood the content dealt with or not. Mezirow (1985), defines learning as a process that involves use of previous experiences, and prior interpretative meanings to construct new and/or revised interpretations and meanings of such experiences to guide future action. Mezirow, (1991) proposes a transformational learning experience that requires the learner to make an informal and reflective decision prior to his/her engagement with the activity. Such meta-cognitive processes as problem-solving strategies, problem-posing questions, communicative dialogue and discourse with self and others allow one to move to increased awareness and become more critically reflective on prior assumptions and beliefs, to negotiate one's own purposes, values, and meanings, rather than to simply accept those of others. The perspective of transformation underpinned this study while it challenged the teachers' personal development and growth. Teachers were challenged to tap into innovative ways of teaching that elicit caring, compassion, and empathy to diagnose and close mathematics knowledge gaps identified with the grade 8 geometric concepts. Through the incorporation and application of those Ubuntu attributes, the observed teachers' practice changed. Their habits of expectations when they taught basic mathematics concepts like geometry were challenged such that they modified their routine lesson deliveries. This was done to enhance and ensure learners' construction of mathematics meaning together with their interpretations through integration of familiar cultural contexts that were familiar to the learners. This provided a safe, flexible, and supportive environment that had a commitment of effective and meaningful learning (Good and Brophy, 1994). Its characteristics were student centered, constructivist and social in form, while dynamic in nature.

Methodology

This article reports specifically on the data collected during the second year of a three year, longitudinal project conducted with fifteen schools in a district in the Eastern Cape of South Africa. Those were the only secondary schools in that district that had the 8th grade as their lowest class. The other secondary schools' lowest was the grade 10 and were therefore not participating in the project. A case study was deemed appropriate as research strategy that helped the researcher to do qualitative enquiry on the participants' classroom practice on how they transform their learning environments for the promotion of geometry teaching.

This empirical study was made up of three phases. The participants were fifteen grade 8 mathematics teachers, six males and nine females of ages ranging from mid-thirties to late fifties. The first phase entailed familiarization with context in which the researcher visited the participants' schools to observe their classroom practice whilst teaching grade 8 mathematics. Baseline tests on basic geometric concepts were administered to a total of 993 grade 8 learners housed in 15 secondary schools across the Mt Ayliff district. Data was analyzed through the use of central measurement tendency and yielded a very low standard deviation which indicated that the learners' scores in the test were clustered below 10%. The interpreted data revealed the poor performance and under preparedness of those learners with regards to the understanding of mathematics basic concepts.

During the second phase, a workshop was conducted with all the fifteen grade 8 teachers in which they were introduced and exposed to innovative ways of teaching mathematics and improvisation in environments where resources are lacking. In those sessions teachers were introduced to examples that can be used to promote mathematical thinking and problem solving. They were also taught how to outsource relevant images from the internet using available technology. Data in this phase was collected for an exploratory study in which a sample of 13 grade 8 mathematics teachers from the rural schools of a district in the Eastern Cape Province in South Africa participated. Questionnaires, classroom observations and semi-structured interviews with the teachers on a participatory action research conducted in two cycles were used for data collection. In that study it was found that 92% of teachers changed their classroom environments by modifying instructional strategies, learner-interactions, and engagements, but could not change how they managed the classrooms due to some factors related to power dynamics and the education policy (Jojo, 2017).

The third phase on which this article reports, conveniently sampled two teachers as participants. The two teachers were sampled because they had continuously participated in the project. The other teachers had either lost interest in the study since they taught mathematics in higher grades 9-12 while others had relocated to other districts and provinces. The two teachers were also sampled because of observed changes that favored successful teaching of geometric concepts. After classroom observations with the two participants, semi-structured interviews were conducted with each of them on observed practices. The interviews were conducted immediately after each observation and their duration was about thirty minutes. They were conducted in the school's science laboratory since this served as an available private space where the teachers could prepare for their lessons without disturbance as they did not have personal offices. With the study centered around the interpretive paradigm, it focused on two individuals. The intention was to find categories of meaning from the individuals' observed practice. The lessons observed were video- recorded without showing the learners' identities as per stipulations of the UNISA issued ethical clearance certificate. The video clips captured the teaching practice which evolved in the classroom.

This was a qualitative study conducted within a case study design in which data was collected through classroom observations together with semi-structured interviews with a convenient sample of two teachers. During the interviews the teachers looked back on their journey of growth in the teaching of mathematics during the intervention programmes conducted by the university lecturers and reflected on what worked best in the challenging environments in which they executed their practice.

Findings and Discussion

The observation schedule was an adopted tool (Bell, 1982a) that sought to monitor how the participants (i) selected instructional materials, (ii) set the environment for learning, (iii) used instructional activities, (iv) provided an opportunity for learners' participation, (v) individualized instruction and (vi) provided feedback to learners' responses. Semi-structured interviews were then conducted with each of the teachers on the basis of their classroom performance in those lessons.

Observed Practice 1

The first teacher taught mathematics in a congested classroom with 108 grade 8 learners in an overcrowded classroom lacking in furniture for them to sit properly whilst learning mathematics. Figure 1 attests to the experiences of learner occupation of the classroom.

Figure 1. *Grade 8 Learners in a Classroom*

Clearly with such congestion it was hard for both the teacher and the learners to engage in classwork. The teacher had to be innovative, compassionate and show empathy in order to facilitate productive learning. When the teacher wanted to introduce patterns and shapes to grade 8's, she chose an example of a honeycomb. She learnt that walker bees could use triangles or squares for storage. They don't leave gaps. But the hexagon is the strongest and most useful shape in the honeycomb. This aroused much interest to the learners as there was a common practice in the area to trade on honey extraction. So immediately learners saw the picture in Figure 2, their interest was aroused. They started brainstorming about everything they knew about honeycombs. Nonetheless, the challenge for the teacher was to redirect the discussions to be productive and reward mathematics thinking amongst the learners. He then immediately probed questions that enabled learners to reveal that the unit basic structure of a honeycomb is a hexagon. In geometry grids are tessellations of original 2-D shapes. This was followed by a discussion of features and characteristics of a hexagon. This was facilitated through a reduction of Figure 2 to Figure 3 and Figure 4 where the discussion was extended to the introduction of other shapes like triangles, pentagons, regular and irregular figures together with differences between 2-D and 3-D shapes.

Figure 2. *A Honeycomb* **Figure 3.** *Honeycomb Grid*

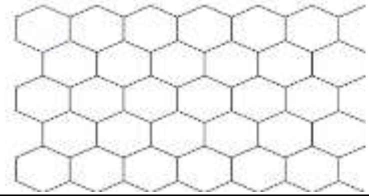

Figure 4. *Isolation of 2-Dshapes*

Source: www.wikipedia.com

The learners in this lesson used their previous experiences with beehives and honeycombs to construct new and revised interpretations and meanings of geometric shapes (Mezirow, 1985). The interpretations of characteristics of each shape discussed in class guided their future understanding of geometry. Through this exercise, learners were led to the third level of van Hieles' levels of abstraction and finding relationships between the shapes (van Hieles' 1986). This occurred after they had recognized and analysed the characteristic critical features and differences between hexagons, pentagons, triangles and other shapes. This resulted from a communicative dialogue and discourse created by the teachers from a context familiar to the learners. After the productive discussions, the teacher gave learners homework with instructions on how to draw a regular hexagon using their mathematical instruments. During semi-structured interviews the teacher indicated that this exercise would consolidate the work done in the classroom and affirm learners' confidence.

Teacher: '*They will gain experience and excitement that will also test their accuracy in creating geometry*.'

When she was asked on the choice of example he used for his lesson, she said,

Teacher 1: *I had to use a context familiar to the learners. You know in this area there are social and economic ways in which people make a living, they sell honey and sell peaches from their gardens. I therefore felt it relevant to use the honeycomb for my geometry lesson*.

Observed Practice 2

The second teacher was observed teaching mathematics in a rural, well-resourced recently refurbished school and a classroom equipped with whiteboard. Although the facilities were provided by the department, the teachers had not been trained on using them. The lesson commenced when the teacher projected a picture of an old dilapidated round hut. Figure 5 represents the projected round hut.

Figure 5. *Round Hut*

There was an immediate giggling and laughing reaction from most of the learners in the classroom. The teacher also smiled and enquired from the class: Why are you laughing? What's funny about my round hut? Because she was gentle and empathetic, many of the learners' hands went up, for attention.

> Response 1: '*Excuse me teacher, the hut is not round' 'Also the door has no real shape.'*
> Teacher: *Oh yes, have you ever watched how a hut is built? How can we ensure that the hut built will be round*?

There were now very few hands raised, learners wondered but their interest was so drawn because there are huts at their homes. The context created was familiar to them. The process of building a hut was described by the teacher putting emphasis on the identification of the centre first, and how wide the hut would be. After the identification of centre which was indicated by a point on the floor first and then on the chalkboard, a stick would be plunged on that point with a measured rope tied to it. She used the chalkboard compass with a certain radius to draw a circle. Geometric concepts like the circumference, centre, radius, and circle were explained. Thus the learners were able to establish that the hut in the paper was not round because the radius length was not consistent, it waived and hence an irregular shape resulted. This meaning was constructed through discussions and discourse that ensued in the classroom. The next feature of the hut that was discussed was the shape of the door frame. It was supposed to be rectangular. The teacher requested one of the learners to draw a rectangle on the chalkboard after which critical features of what makes a shape a rectangle. In addition, other rectangular shaped objects in and outside the classrooms were identified. It was also interesting to note that for some learners, the facts that 'a square' is some form of a rectangle, could not resonate well with them. These discussions consumed a lot of time and ended just before the discussions of the cone shaped roofs of the hut. During interviews with the teacher after the class, it was of interest to me to know how the teacher would continue with the lesson.

> Teacher 2: *We are still going to engage with this theme for almost a week and beyond, I mean 'the hut'. I have realized that there is a lot of other geometric concepts that we can explore using this theme. For example, we will talk about different hut decorations. In our culture we usually do those decorations on the walls with a mixture of mud and water. We will also explore the length and movement of the shadows formed at different times of the day around the hut. This is some of the indigenous knowledge that was used by our uneducated parents to detect time.*
>
> Researcher: Oh wow! This is a huge source of geometric thinking. Tell me, do you think your usual classroom practice was transformed? If so, How?
> Teacher 2: *Oh yes, to a large extent. You know what as a teacher, I am human. I have been in the same situation as my learners in the past. All I knew in geometry was triangles but I could not relate or connect them to any of the concepts I knew. So it did not make any sense.*

> *But I thought I would try and make things simple for my learners so that they understand geometry.*
> Researcher: So how can you reflect on your practice now?
> Teacher 2: *Yhoo a lot, you know what? I have realized that through these innovative illustrations learners interact, play, and are interested in my lessons. My instruction became effective since learners now play around with their compasses and produce drawings that develop and engage their geometric thinking.*

The use of real world problems acted as a resource that brings to the forefront mathematical qualities in indigenous knowledge systems whose immersion experience allowed the teachers the opportunities to explore a broader conceptualization of what counts as mathematics. Also the use of tasks that come from everyday contexts enabled both the teachers and students to discern the relevance of mathematical concepts and discouraged the students from being trapped in routine step by step geometric challenges. This honor of classroom diversity and respect of cultural heritages that promote the view that all people are capable of doing mathematics in their own unique and personal perspective, is attributed to the principles of Ubuntu used by teachers in this study.

Conclusion

This study confirmed some issues from literature that suggest that a warm, safe, and caring environment allows learners to "influence the nature of the activities they undertake, engage seriously in their study, regulate their behavior, and know of the explicit criteria and high expectations of what they are to achieve" (Jannarone, 2014, 5). Some Ubuntu principles emerged from the findings as both teachers noted that the traditional approaches did not work. They used examples suitable to reinforce the visualization of abstract mathematics information made concrete like the extraction of hexagonal shapes from a context friendly honeycombs. This linked new ideas to the students' existing prior learning experiences to enhance visualization.

This paper exposes the teachers to effective instructional approaches that can promote learners' interactions while they construct mathematical meaning and engage in geometric experiences using familiar contexts. When teachers imagine themselves in their learners' space, they can be able to understand their feelings, desires, ideas and actions. Through Ubuntu, teachers in under-resourced schools can acquire techniques where they by way of introjection get involved in manipulating issues of teaching material lack while they impart mathematics skills to ungrounded learners. It takes Ubuntu to be able to offer and master that aesthetic experience. Also in compassion teachers can help to close the gap in learners' pre-requisite background mathematics knowledge such that they do not suffer the consequences as they pursue mathematics in higher grades. Ubuntu can also equip mathematics teachers to exercise patience while they modify their instructional approach to afford learners to ask different questions and present their work in different ways.

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