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Research Article

Mathematics teachers' perceptions of socio-cultural diversities in the classroom

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Mathematics results in South Africa are of serious concern. The reports by TIMSS [Trends in International Mathematics and Science Study] prove that the teaching of mathematics remains a challenge in the South African schooling system. In their attempts to improve mathematics results and to cope with the many curriculum changes since the start of democracy in 1994, mathematics teachers are experiencing increased levels of stress and anxiety. Diversity is a critical issue in education and learners suffer the consequences if teachers do not recognise the importance of diversity. Democracy leads to curriculum change and causes socio-cultural diversity among the learners in a classroom. Mathematics teachers faced ousting of their power in the classroom through the learner-centred strategies that they were expected to implement. In this study, three semi-structured interviews and a focus group discussion were deployed to generate data. The dualistic theoretical lenses used in this paper are based on the theory of culturally responsive teaching and theory of cultural capital. The findings that emerged from the data show that mathematics teachers are ill-equipped to meet the needs of the socio-culturally diverse learners in their differing classrooms. Further research in exploring ethnomathematics as a culturally responsive teaching strategy will reveal new dynamics in socio-cultural deficit thinking.

Keywords: Socio-cultural diversity; Curriculum change; Mathematics teaching; Quality education

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1. Introduction

Globally, the focus has been on providing equal, quality education for all, resulting in an increase in work demands on all teachers. The common theme throughout UNESCO's ideals is to provide equitable and quality education that integrates all aspects of human development (UNESCO, 1989, 1991, 1993, 1995, 1998). Recently, the United Nations [UN] Sustainable 2030 Agenda for Sustainable Development was introduced to ensure inclusive and quality education for all and to promote lifelong learning (United Nations [g.4], 2011). The UN report exemplifies quality education, based on the fourth goal that endeavours to set "the foundation for improving people's lives and sustainable development". It is plausible that in order to create a sustainable world there has to be equity, inclusiveness, peace, social justice and cultural competence (Wulf, 2013).

With reference to the South African context, in 2008, a curriculum change, namely the National Curriculum Assessment Policy Statement [NCAPS] was introduced. It was reported in several

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educational studies that South African teachers did not make a pedagogical shift nor have the necessary knowledge and skills and were unprepared to teach culturally responsive classes (Braun, 2017; Govender, 2018; Hoadley, 2007; Meeran, 2017; Reddy, 2006). For almost three decades of curriculum changes, teachers were left behind, unprepared in applying culturally responsive pedagogies within the many diverse classroom settings. Furthermore, the South African education system was more focussed on the results-driven performance of grade 12 national certificate examinations as well as the TIMSS report [Trends in International Mathematics and Science Study] as the only forms of measurement in determining the quality of the education system (Luneta, 2015; Reddy et al., 2016; Visser et al., 2015). Meeran (2017) as well Govender (2018) argues that mathematics teachers were faced with a challenge to teach learners from multicultural, multilingual, and diverse socio-economic backgrounds because they were not trained or empowered to teach culturally responsive classes. With that being the case, it is crucial that mathematics teachers receive diversity training to ensure that learners get equal learning opportunities. Based on empirical evidence and TIMSS reports, learners are generally performing poorly in mathematics in South African classrooms (Hoadley, 2007; Pournara et al., 2015; Reddy, 2006). Furthermore, it is compounded that the changing mathematics curricula, teaching workload burdens and teachers' negative perceptions of teaching socio-culturally diverse learners have an influence on the performance of mathematics in South African schools.

The purpose, therefore, of this article is to explore whether there is a need for socio-cultural training for mathematics teachers and that such training could result in improvement of students results in mathematics. This has prompted an exploration into mathematics teachers' perceptions of teaching socio-culturally diverse learners. Therefore, the single case study methodology is used to investigate mathematics teachers' views on culturally responsive teaching and how they mitigate the phenomenon of cultural diversity in teaching mathematics. The research questions for this paper are:

RQ 1) What are Grade 10 mathematics teachers' perceptions of culturally responsive teaching?

RQ 2) How are mathematics teachers mitigating socio-cultural diversity in the particular subject?

2. Literature Review

2.1. A Synopsis of the Study's Theoretical Frame

First, this paper is partially underpinned by the theory of culturally responsive teaching by Ladson-Billings (1995) and extended by Gay (2010) as a notion that "encompasses curriculum content, learning context, classroom climate, student-teacher relationships instructional techniques, classroom management, and performance assessment (p. 33). A plethora of studies define "culture" as a societal way living in expression through customs, socially specific actions, and cultural processes. In every society, mathematics teachers and learners have a cultural reference which is unique to the society and context. Furthermore, scholars of culturally responsive teaching [CRT] argues that teachers are compelled to design and implement practices to support the cultural reference of learners which is unique of how they view the world and brings this frame of references into the mathematics classroom (Aguirre & del Rosario Zavala, 2013; Nolan & Keazer, 2021b; Tileston & Darling, 2008). Therefore, Presmeg (2007, p. 435) argues that mathematics as a "*cultural product with all its complexities and contestations*" which is vital for teachers to recognise, prepare and support for these cultural references of learners. These cultural references of learners can only be accommodated through culturally responsive teaching pedagogies. For example, all learners are taught using the same CAPS mathematics curriculum so as not to disadvantage one another in the South African context but teachers must be sensitive to each learner's cultural reference. Moreover, Boutte (2012) and Ladson-Billings (1995, 2009) stress that for a cultural response pedagogy to be implemented successfully, teachers need to have the knowledge, skills and even the dispositions to support the socio-cultural diversity in the classroom. Furthermore, school districts need to provide professional development training for

these teachers (Aguirre, & del Rosario Zavala, 2013; Bonner et al., 2018; Ukpokodu, 2011). South Africa shows a lack of support in presenting these professional development culturally responsive teaching workshops (Bansilal & Rosenberg, 2016). As a result, this lack of support to assist teachers to meet the needs of the diverse learners in the classroom will prolong the deficit thinking in teachers. There is, therefore, a need to explore mathematics teachers' perceptions of socio-cultural diversity as is relevant to mathematics teaching.

Second, the theory of cultural capital *is based on the seminal work of Bourdieu (1984) which reflected the theory of cultural capital. Bourdieu argues that this theory is driven by knowledge as the* "legitimate culture" contained within the community. Several studies advocate the same sentiments by Bourdieu – namely, that it is important for the teacher to use the very same cultural capital to teach, empower and advance the socio-culturally diverse learners in order to bring legitimate change within the classroom (Bonner et al., 2018; Walter, 2018). Studies reported that cultural capital is focused on the teacher as carrier of the cultural capital knowledge of each learner reflected as a unique socio-cultural human with specific strengths. Therefore, as custodian of the cultural capital carrier, the teacher that must be sensitive to advance the well-being of the learner by nurturing and promoting a cultural responsiveness environment (Boutte, 2012; Ladson-Billings, 2009; Soldaat, 2019; Walter, 2018).

The concept "cultural capital" is applied in this article to interpret the data collected to explain the socio-cultural perceptions of teachers pertaining to the diverse learners whom they teach. In addition, Deem and Lucas (2007) define Bourdieu's cultural capital as *"the educational qualifications and forms of cultural differentiation such as language, cultural dispositions and general proximity to and knowledge of cultural institution"* (pp. 118–119). We argue that mathematics teachers in this study are assumed to have cultural capital that may potentially influence their perception of socio-cultural diversity from a social status perspective. As a form of disciplinary knowledge, mathematics as a subject can be regarded as a type of cultural capital because it can be used as a resource that enhances social status (Strickfaden & Heylighen, 2010). Feza (2018) confirms that a subject such as mathematics is regarded as the domain of the elite. Hence, those who have the relevant cultural capital to succeed in mathematics will have access to better job opportunities. The cultural capital that people have is regarded as an asset which could enable them to acquire the desired power and status. Dumais (2006) found that teachers favoured learners who had the necessary cultural capital at their disposal. If learners have the necessary cultural capital in mathematics, participants may react similarly as in Dumais's (2006) study as it could also mean less work for them.

Mathematics as cultural capital does allow access to those who have it and seems to ignore those who do not. Democratic curriculum policies are formulated to give access to equitable education for all learners in the classroom. Bourdieu (1973) posits that education converts social hierarchies into academic hierarchies, perpetuating social norms in the process. Hence, as Bourdieu (1973) argues, education is steeped in cultural capital and is used to divide learners further. However, Stacey (2019) states that mathematics teachers are equipped to teach in diverse classroom settings. Furthermore, assumptions of mathematics teachers on how mathematics should be taught will not allow them to meet the needs of the diverse socio-cultural learners in their classrooms. There is also the burden of meeting the standards of globalisation through standardised testing such as the TIMSS (Carrim, 2017). Moreover, teachers are scrutinised according to their students' achievement (Beets, 2012; Hanushek & Rivkin, 2012). Teachers will, therefore, devote more attention to those students who perform better, thereby echoing the cultural capital of the dominant social class and determining how they would work with the different learners in the classroom.

While there are many roles that teachers are expected to play, dealing with the diversity of multicultural learners in the classroom can result in socio-cultural deficits (Chronaki & Planas, 2018; Stacey, 2019). In this regard, Bacchi (2009, p.1) defines deficit thinking as "all sorts of thinking for how the issues are thought about and for how the people involved are treated and are

evolved to think about themselves". In a study by Stacey (2019), for instance, the teacher blames his deficiencies on the poor intellect of his learners and the lack of guidance of school management. Clearly, it becomes the way such a teacher thinks and speaks. Furthermore, Chahine (2018) as well as Bonner, Warren and Jiang (2018) state that the beliefs and biases that teachers have when teaching diverse, multicultural students contribute to their deficit thinking. Soldaat (2019) relates this socio-cultural deficit in thinking to power relations between teachers and students.

2.2. Culturally Responsive Teaching-based Practices in Teaching Mathematics

2.2.1. Philosophical lens of culturally responsive teaching

As discussed earlier, Ladson-Billings (1995) coined culturally responsive teaching (CRT) as phenomenon based on learners' societal connections through cultures, languages and societal experiences as a frame of cultural reference. Extensive research had been conducted on CRT as phenomenon that activate students' cultural frame of reference, contextualised the learning space, building sound relationships, tapping into the students' cultural capital and setting-up an encouraging learning environment (Gay, 2010; Harding-DeKam, 2014; Setati, 2005). CRT occurs during the interactions of the teacher and the students. Hence, according to Gay (2018) teachers play an essential role through their attitudes, quality of instructions as well as their pedagogical skills to teach and assess the diverse learners in the classroom. Gay (2018, p. xxvii) proceeds to define CRT as teaching that "centres classroom instruction in multi-ethnic, cultural frames of reference".

2.2.2. Designing a conducive environment for a culturally responsive mathematics

There have been several international studies and guidance on culturally responsive teaching in mathematics (Nolan & Keazer, 2021b; Xenofontos et al., 2021). In response to mathematics education Keazer and Nolan (2021) as well as Nolan and Keazer (2019, 2021a) in their work in Canada and United States, have testified to commit to create a pedagogy that responds to the culture as well as the knowledge of students in Mathematics. However, they do allege that there are no particular tools that would support teachers in teaching in a culturally responsive way, hence they have attempted to provide a framework of reference for which mathematics educators could test their own cultural responsive pedagogies and allows them to examine their own socio-cultural awareness (Nolan & Keazer, 2021b). In providing a quality education to all the students in the classroom means meeting the diverse cultural needs of the students in the classroom. Hence, through the many studies they portray in their paper, Xenofontos et al. (2021) claim that mathematics instruction needs to take on a social justice stance to allow for the critical development of teachers in the United Kingdom to adequately cater for culturally responsive instruction in the classroom.

2.2.3. Implementation of ethnomathematics as a culturally responsive mathematics strategy

Teachers have an opportunity implementing CRT strategies in mathematics. While there are many strategies that are available for teachers to implement culturally responsive pedagogies. As has been suggested with the framework of reference by Nolan and Keazer (2021b), there still exists the issue of creating culturally responsive mathematics classrooms. One such culturally responsive pedagogy to meet the needs of the mathematics classroom is that of ethnomathematics. Ethnomathematics was developed and defined by D' Ambrosio (1984, p. 286) as:

> "… a result of the interaction of their individual, developed practices, knowledge and in particular jargons …. and codes, which clearly encompass the way they mathematise, that is the way they count, measure, relate, and classify and the way they infer. [We are] in the relationship between ethnomathematics and society, where 'ethnos' comes into practice as the modern and very global concept of ethno both as race and/or culture. This implies language codes, symbols, values, attitudes and so on, and which naturally imply science and mathematics practices".

In view of the seminal text of D' Ambrosio (1984), several ethnomathematics studies reported that it is a form of art or the technique of knowing, understanding, explaining and integrating culture and mathematics in diverse cultural contexts (Balamurugan, 2015; Davidson, 2000). For example, Mania and Alam (2021) reported that Indonesian mathematics teachers applied traditional meals and games in teaching mathematics concepts for cognition which is related to students' cultural reference. Based on the latter notion, ethnomathematics as a mathematics CRT strategy is the study of mathematics and culture which serves as a foundation for building cultural references amongst teachers-students. This CRT strategy enhances sound relationships, tap into the students' cultural capital, and encourage learning environment (Lubis et al., 2021; Mania & Alam, 2021). Hence, ethnomathematics allows for the teacher to take into account the cultures of the students while teaching Mathematics. The above statement is exemplified by Aikpitanyi and Eraikhuemen (2017) who argue that mathematics can be understood better if the mathematics that is used in daily lives of the existing cultures is brought into the classroom to improve student performance. Some strategies that can be used in ethnomathematics are cultural games (Riberio et al., 2020) as well as cultural artefacts (Garcia-Olp et al., 2022; Imswatama & Lukman, 2018).

2.3. Contextualisation of Mathematics Education within South African Schools

In South Africa, since 1994, curriculum policy transformation involved the adoption of equitable education policies (Meeran, 2017). Moreover, Carrim (2017) adds that this required teachers to fulfil multiple roles in keeping with the educational policies that centred on building a nation based on human rights. Although curriculum policy change to mediate learning did not specify any particular method, it embraced many progressive pedagogical methods (Can, 2021; Flanagan, 2014; Lekgoathi, 2010; Vithal & Volmink, 2005). In addition, Long and Nyoni (2021) argue that mathematics teachers need to change their pedagogical paradigms to be more inclusive and to be responsive to diverse learner needs and should apply progressive pedagogies and strategies for active engagement of learners. During the past decade, South African teachers experienced many CAPS changes which caused teachers, especially mathematics teachers, to resort to familiar teaching methods and teacher-centred approaches, as they were afraid to make the change from familiar to "banking methods". Adams et al. (2016) refer to the new progressive methods as culturally oppressive methods that do not cater for the needs of socio-cultural diversities of learners in the classroom to create meaningful learning.

South Africa is trying to improve the quality of mathematics education through quintile ranking, which is based on the socio-economic status of learners in the community. After all, those learners from poorer socio-economic backgrounds were non-English-speaking learners (non-ESL) who struggle with mathematics. A study by Reddy et al. (2016) confirms the findings revealed in the TIMSS report – that language is a major barrier to mathematics learning. Hence, the quality of mathematics education has not improved as teachers struggle to teach socio-culturally diverse learners with language barriers. Consequently, teachers' understanding of the socio-cultural differences between learners will influence how they teach them. Mathematics teaching in South Africa entailed many challenges, which resulted in the poor performance of South African learners (Hoadley, 2007; Reddy et al., 2016; Venkat & Askew, 2021). Similarly, Arends et al. (2017) allege that while there may be improvement in some areas of mathematics education in South African secondary schooling, the quality of mathematics education still has not improved. The authors believe that teaching practices where teachers interact with learners to help them understand mathematical concepts is the issue (as confirmed by Arends et al., 2017). In other words, teachers do not interact with learners enough for them to understand mathematical concepts. Bosman and Schultz (2018) extend the argument by citing that if South African learners are taught according to their learning styles, their academic achievements may improve. We concur with the latter – therefore, mathematics teachers in South Africa need to interact with learners enough for them to know their learning styles. For example, scholars stress that even with the culturally rich perspective of using cultural artefacts and community engagements such as

cultural games to learn mathematics in South Africa, there is improvement in mathematics results (Feza, 2018; Hoadley, 2007; Ogbonnaya & Awuah, 2019). However, Feza (2018) also acknowledges that these culturally profound mathematical engagements are seldom used because of the ideology that mathematics belongs to the elite and is the prerogative of the Westernised perspectives.

Mathematics teachers still opt for and use teacher-centred methods (Arends et al., 2017), which is a way for teachers to maintain their power as they assume that they are agents of knowledge. There is no doubt that the teacher-centred methods were applied with success, but a change in curriculum policy requires a different pedagogical approach – to teach for social justice in the mathematics classroom. A Canadian study by Varghese (2019) argues against a "no size fits all" approach but for a pedagogical paradigm shift in teaching mathematics to learners; a "holistic approach". This holistic approach is meant to advance non-English-speaking learners' mathematical understanding independently and cooperatively. Additionally, Pereira (2019) posits that putting into action the concept of social justice as is mandated by the democratic education policies to teach socio-culturally diverse learners in the classroom is a complex process. Consequently, teachers have to justify their work, which results in them laying the blame elsewhere when they are unable to meet the demands. The deficit thinking of teachers in diverse socio-cultural contexts becomes a problem as South African policies mandate that teachers are supposed to treat all learners equally (Department of Education [DoE], 2011a). Mathematics teachers' perceptions of the socio-cultural differences among learners can create this deficit thinking. Clearly, teachers need assistance to change their perceptions of diversity.

3. Method

3.1. Research Design

Qualitative case study methodology was used to gain deep insight into how mathematics teachers implement new curriculum policies when teaching socio-culturally diverse learners. Yin (2009, p.18) describes case study research as "*an empirical inquiry about a contemporary phenomenon (e.g. a case) set within its real-world context – especially when the boundaries between the phenomenon and context are not clearly evident*".

3.2. Participants

The geographical context of participants is the semi-rural areas of Tongaat and Verulam in Kwa-Zulu Natal, South Africa. Participants teach at secondary schools in the area which have diverse students from generally poor to middle class backgrounds. These schools are mandated to implement the CAPS curriculum.

The case study methodology allowed the researcher to study the case of mathematics teachers who teach Grade 10 mathematics. Purposive selection of participants was done to deliberately choose participants for the study (Cohen et al., 2018). These teachers were professionally trained at tertiary level to teach mathematics as a school subject. They had to have been trained in mathematics to observe whether their training influenced how they teach mathematics now. During the interviews, the participating teachers confirmed that they have been teaching the subject for a period ranging between twenty and twenty-eight years. The teachers started teaching before 1994, hence they were suitable participants as their years of experience through the changing curricula allowed me to perceive their attitudes towards mathematics teaching. Five of the mathematics teachers who were chosen for the study taught Grade 10 mathematics.

Table 1 presents the characteristics of the participants.

Table 1
Participant Information

Pseudonyms	*Designation*	*Years of service*	*Grades teaching*	*Subjects being taught*	*Qualifications*
Sagie	HOD	33	9 to 12	Pure Maths Maths Literacy	JSE (Mathematics, Accountancy) FDE (Computer Science
Mala	Educator	31	10 to 12	Pure Maths	JSEd (Mathematics, Accountancy) FDE (Mathematics) B. Ed (Hons), M. Ed
Khan	Educator	32	8 to 12	Pure Maths Maths Literacy	JSEd (Mathematics), BSc, B. Ed (Hons), M. Ed, Ace – Mathematics Literacy
Patricia	Educator	32	8 to 12	Pure Maths	JSEd (Mathematics), FDE (Mathematics)
Charles	HOD	33	10 to 12	Pure Maths	JSEd (Mathematics) FDE (Mathematics)

3.3. Data Collection and Analysis

The data collection methods used were individual semi-structured interviews and a focus group interview. Individual semi-structured interviews had the same set of questions, but the questions were sufficiently open-ended to allow for probing (Bertram & Christiansen, 2020). Examples of questions that were asked:

- Describe the work you do as a learning mediator with sensitivity to the needs of students. (Probes diversity and attainment in Mathematics)
- Describe ways you develop yourself professionally (probes opportunities for professional development and forms of professional development (workshops, studying, seminars etc.).
- What types of assessment is required from you and what types of assessment work do you engage in? (probes the different types of assessment and which types of assessment work is mostly used by the educator with reasons for choices, how remedial and enrichment is done)
- Describe how feedback is given to students?

Finally, a focus group interview was held with all participants, which allowed for a group interview based on interview questions that allowed for probing and open discussion (Cohen et al., 2018). These interviews were conducted to assess the perceptions the participating teachers had of the socio-cultural learner diversity in their classroom. Verbatim recordings of the accounts of participants' experiences were done with a digital audio recorder to ensure the validity and correctness of the captured data. The participants were also afforded an opportunity to validate that their views had been captured and reflected correctly. As the article is based on qualitative research, textual analysis was used to analyse the data – where large chunks of information are eventually coded into themes (Cohen et al., 2018). Firstly, the data was transcribed by the researcher to ensure that relevant information was not ignored. Member checking by fellow researchers was done to ensure that the researcher adopted a neutral view and that the data was trustworthy. Thereafter, participants were given the transcripts to read, to guarantee that their views were correctly recorded. The data was then scrutinised to look for data which the themes were based on. The themes corresponded to how mathematics teachers perceived learners with socio-cultural differences as they worked through the number of curricula changes. We applied a credible case study research method aligned to the research questions, the sampling, the data collection process and member checking of the data collected – and interpretations – as "thick descriptions of phenomenon to achieve data triangulation" (Connelly, 2016; Nowell et al., 2017).

This scientific process is based on how the authors complied and assured that the data collected are credible, transferrable, dependable, and confirmable as trustworthy and valid (Cohen et al., 2018). In this study, we employed principles of trustworthiness. The data collected from the participants is a "true reflection of participants' narratives" and the detailed description of how data was transcribed is aligned to the themes identified in the study.

3.4. Ethical Considerations

Before the study, ethical clearance was granted. Before and during the interviews, participants were informed that ethical clearance was obtained and that they were free to withdraw from the study at any time, should they feel uncomfortable. The university policy stipulated confidentiality and adherence to protection of participants' identity before, during and after the interview sessions. For ethical reasons and to protect the identity and confidentiality of the participants, pseudonyms were used, namely Patricia, Khan, Mala, Charles, and Sagie.

4. Findings

From the individual semi-structured interviews and the focus group interview with these mathematics teachers, four themes emerged:

- Language deficiencies create a barrier to mathematics learning
- Learners are apathetic towards mathematics
- Socio-cultural differences could be a hindrance to curriculum implementation
- Mathematics should be taught according to the ability of learners

4.1. Language Deficiencies Create a Barrier to Mathematics Learning

It is evident that all participants need assistance with teaching mathematics to socio-culturally diverse learners who are mostly English Second Language [ESL] students. All the participants indicated that English is the language of instruction in the schools where they teach. In particular, Patricia mentioned:

> Students find the abstract sections very difficult, especially when dealing with algebraic expressions, such as letters and numbers. They just cannot relate to it. We have students from poor socio-economic backgrounds with language barriers as well, so it is difficult to grasp abstract concepts.

This participant finds it difficult to teach abstract sections in mathematics to learners who have language barriers. She explained how language may create barriers to grasping abstract concepts. Most of the learners whom she teaches are ESL learners. Her perception is that learners who have language barriers are those who come from poor socio-economic backgrounds. In her interviews she repeats an issue of language with reference to the implementation of changing curriculum policies: "Language is a problem. I think, most of them are unable to interpret the questions, so I have to explain to them."

Khan agrees with her that language is an important dimension when teaching mathematics for understanding: "I have students in grade 10 who cannot spell words like house, home, are, correctly. This impacts on the understanding of maths problems."

With reference to the latter, problem solving is a criterium of democratic curriculum policies in South Africa. Subsequently, Khan experiences challenges when teaching problem solving because of language barriers in his mathematics classes. His statement also alludes to him needing culturally responsive education skills to help him cope with the language barriers.

According to another participant, Mala, the difficulties in English are the reason for her struggles to teach mathematics to learners from diverse socio-cultural backgrounds. She also alluded to the issue of understanding mathematical language through word problem exercises. However, her learners are able to understand and apply the mathematical language. She echoes sentiments:

> But with problem solving they find it difficult to interpret the problem but if I just gave them an equation and say solve for x, they would be able to. If I presented that in a problem form, where they had to work out what that equation is before solving, they cannot work out the equation. So, it is the translation from English to maths that they find difficult.

It becomes clear that the teaching mathematics, which is a language in itself as it has its own form of symbols, is more difficult with issues such as language. While she is able to identify where the issue is, Mala is unable teach problem solving to all learners as she has not yet found strategies to make problem solving easier for ESL learners to grasp. Hence, it can be assumed that teachers

require interventions to teach mathematics to ESL learners from socio-culturally diverse backgrounds in their classroom.

4.2. Learners are Apathetic towards Mathematics

The teachers who were interviewed strongly voiced their concerns about the apathy towards mathematics, which results in poor discipline of the socio-culturally diverse learners whom they teach.

Patricia in particular was outspoken about the discipline issues she experiences when trying to implement new curriculum policies in the classroom. She teaches culturally diverse students who come from very poor socio-economic backgrounds. In this regard, she stated:

> We cannot even mark students' books because when marking one book the other students cause a problem in the class. The students do not show interest, like if I try to motivate them for e.g. in a section on congruence which needs practical work where they need a pair of scissors for cutting, I will not do it in my class because of discipline problems.

To Patricia, implementing learner-centred strategies in her classroom is problematic. She attributes her inability to implement such strategies to the poor discipline of the socio-culturally diverse learners in her classroom – hence her perception that learners are apathetic to mathematics. Interaction is what Patricia needs is – and for her to be able to interact with the learners, culturally responsive training is required.

Khan also stated that "I have 40 to 45 students in a class. That is quite a number to teach and to control, especially, when you want to implement a new curriculum that asks for individual attention." This shows that he wants to implement the new curriculum and to provide individual attention; however, the large number of diverse learners in his classroom is a deterrent. As his statement clearly shows, Khan prefers a teacher-centred approach. There is, therefore, a suggestion that he should rather use teacher-centred strategies.

Mala stresses student apathy as her main issue when implementing new policies. She says, "They have already resigned themselves to the notion that this is a difficult subject." This teacher expresses her frustration with the apathy of the socio-culturally diverse learners in her classroom: "For me that is stressful as basic instruments, like a pencil, a child will not have. I am thinking that construction will be a nightmare to teach them without maths sets. It is quite clear that implementing new strategies in the classroom has become a trial for this teacher as her learners do not have the necessary equipment to carry out the lesson. Patricia agrees with Mala with regard to the discipline issues and the apathy that socio-culturally diverse learners display. She underlined that:

> I find it difficult to cope because it is too stressful. My health has deteriorated because of that. The teaching part of it is good but the kind of students we have, their attitudes, discipline, problems, I cannot cope with it. It's becoming too much.

For Patricia the situation has thus resulted in her being stressed and developing health issues. It can be assumed that what Patricia and the other participants need are strategies to work with diverse learners that would encourage the participation and enthusiasm of learners.

4.3. Socio-cultural Differences as a Hindrance to Curriculum Implementation

The participants believe that the multicultural and socio-economic home contexts that students come from influence the implementation of the democratic mathematics curricula. Mala's interview best reflects their views. Mala asserted that.

> As much as I try, it is difficult to bring in everyday problems into the curriculum. As for students, because of their different home contexts and their social backgrounds, it is not a universal thing like going for a holiday for e.g. and flying and this is what it costs for one person and two people. The African students are shy to bring something from their culture into the class, but I think that they think it is a backward way of thinking because they do not share it very easily.

Mala reveals her inability to create an environment which she believes meets the needs of the diverse students in her classroom. It is apparent that one of the needs of the democratic curriculum is to use the everyday knowledge of learners, which she tries to incorporate. She finds that African students are uncomfortable about bringing items from their culture into the classroom. She presumes that this is a backward way of thinking for the African learners. Mala's statement validates that she does not understand the socio-cultural differences of her learners. While she is trying to incorporate the culturally responsive methods of teaching in her classroom, it seems that she lacks the knowledge of how to do it.

In her interview, Patricia stated that:

> It is very difficult for us. Many students don't complete their homework. As a result, our syllabus is not completed timeously. So, we have to have afternoon classes for matriculants. Because students come from poorer backgrounds, we have to prepare more worksheets to meet their needs.

Patricia feels that teaching diverse socio-cultural learners, especially those from poorer backgrounds, has created more work for her. She is finding it difficult to complete the syllabi of new curriculum policies as she has to take more time for preparation to teach all the learners in her classroom.

4.4. Mathematics should be taught according to the Ability of Learners

All those interviewed seemed to value mathematics as a high-status subject that only a few learners have the ability to achieve in. Patricia asserted that:

> Well, basically I have to discuss all the rules and I do examples with them. Most of the sections are dealt with in this way which is teacher centred. We are not given enough time to do student centred activities. We have to prepare students for exams. I cannot manage to meet the needs of all the students in my class.

Learner-centred strategies are envisaged in all South African democratic curriculum policies for mathematics; however, these strategies seem to be neglected in Patricia's case in order to prepare her students for examinations. This suggests that the good performance of a few learners in mathematics is more important than meeting the diverse needs of all learners in the classroom. Patricia resorts to teacher-centred strategies. This choice of teaching method is also chosen by Charles. Interaction is clearly kept at a minimum. He stated that, "I cannot see why a child should build a bridge or even a cube and show me and get marks for it. It doesn't show me any mathematical knowledge at all." Charles is adamant that learner-centred strategies are not required in mathematics. He feels that the projects that students have to do in mathematics involve no mathematical knowledge. His perception of how mathematics is taught shows that Charles may require extensive training in meeting the needs of the democratic curriculum that requires learner-centred strategies directed at the needs of the socio-culturally diverse learners in his classroom. His perceptions indicate that he is book orientated and augments his belief that the outdated methods of teaching mathematics are still relevant in the new democratic South African society.

During his interview, Sagie highlighted that:

> We have to do specific learning like you know what we have to put all the high- fliers and teach them in one class. This is what we have to do. Otherwise we hold everybody up. Then the others who want to do maths and to stay there then you have to teach at their level to ensure that they at least pass. With the matriculation exams they can at least get their 30, 40, and 50%. You are teaching for them to get at least 60%. A distinction is out of the question. Therefore, as mathematics is important to many careers, we do not want students to drop mathematics and to retain, right through to matric.

Sagie was able to echo all the interviewees when he declared that mathematics is a high-status subject and that his duty is to groom students to get good results. He even suggested that students should be separated according to abilities. It suggests that Sagie is still steeped in how mathematics was taught previously. The suggestion is that the participants need to understand the

needs of the new curricula and they require adequate training to provide an equitable education to all learners.

5. Discussion

This section of the article comprises a discussion of mathematics teachers' views on culturally responsive teaching and how they mitigate the phenomenon of cultural diversity in teaching mathematics.

The first question was formulated to investigate the grade 10 mathematics teachers' perceptions of culturally responsive teaching. The results indicate that the participants in the study need to be empowered in culturally responsive education practices. According to the results, participants perceive the teaching of ESL in mathematics as a challenge. It is evident that the participants struggle to teach the abstract concepts and problem-solving sections in the CAPS mathematics curriculum because of the language barriers and their imposed perception that learners who have language barriers come from lower socio-economic backgrounds. This result has been verified by Ogbonnaya and Awuah (2019) and Reddy et al. (2016), who discovered that ESL students perform worse in mathematics than their English-speaking peers. Accordingly, Boute (2012) and Ladson (1995, 2009) stress that teachers need to have the knowledge, skills and even the dispositions to support socio-cultural diversity (which would include diversity of language) in the classroom. Mala agreed that it remains a challenge in teaching mathematics for students, because of their different home contexts and their social backgrounds. This view is also supported by the seminal work by Bourdieu (1973) which lays the foundation for these findings by suggesting that education converts social hierarchies into academic hierarchies, thus perpetuating the social norms. Furthermore, research has found that South African teachers are not sufficiently supported through professional development workshops (Bansilal & Rosenberg, 2016).

It therefore stands to reason that the teachers who participated in this study need the necessary skills and pedagogical knowledge to meet the language needs of the diverse learners in the classroom. The results revealed that teachers need to be professionally trained to handle such situations – they are not adequately prepared in this regard. South African teachers, according to Bansilal and Rosenberg (2016), lack the pedagogical capacity to deal with cultural diversity. From the perceptions of the participants in this study, it seems that socio-culturally diverse learners who have language barriers lack the necessary cultural capital to do mathematics. Hence, it can be established that there is a need for a culturally responsive education so that teachers understand and respond to the needs of the diverse learners in the classroom.

In summation, the results reveal that the participants perceive socio-culturally diverse learners, especially those who seem to come from different cultures and socio-economic backgrounds as that of the participants, as apathetic towards mathematics – and that this apathy results in poor performance. They use teacher-centred methods as it seems to be more convenient. Hence, there is limited interaction of teachers with learners, which Adams et al. (2016) believe is culturally oppressive. Participants are convinced that learners regard mathematics as a difficult subject. Moreover, they show deficits in pedagogical knowledge. A study done by Stacey (2019) showed the deficiency thinking of a teacher, which is similar to that of the participants in the study. He blames the insufficient abilities of the learners for the poor results. It is apparent that the participants in Stacey's (2019) study and the participants in this study need to change the way they think – and that could be done by implementing culturally responsive pedagogies using cultural knowledge to engage learners, which has been advocated by Bonner et al. (2018) as well as Walter (2018). Therefore, the argument is that for culturally responsive pedagogical training and other initiatives to be successful, there needs to be a change in the perceptions of teachers in the way they respond to culturally diverse learners. Teachers need to create equitable opportunities for learning for all learners.

The participants believe that mathematics is a high-status subject that is limited to only a few, according to the second question, which intended to establish how mathematics teachers mitigate socio-cultural diversity in the subject. Therefore, they concentrate on those few learners by resorting to teacher-centred, textbook-based knowledge. This is evident from what Sagie had said: "*We must do specific learning like you know what we have to put all the high- fliers and teach them in one class. This is what we must do. Otherwise, we hold everybody up*". Sagie even suggests separating students according to their abilities. It shows his deficit thinking as he wants to move away from a social justice curriculum that meets the needs of the socio-culturally diverse learners in his classroom, to one where preference is given to "high-fliers". It could be deduced that these teachers were pressed to cover the CAPS mathematics curriculum. Furthermore, interaction is kept at a minimum. One participant even resorts to separating learners according to their abilities. There seems to be a belief that socio-cultural differences influence the abilities that learners have in mathematics. The perceptions that teachers have of the learners whom they teach demonstrate their misconceptions of the learners who are not of the same culture and socio-economic background as them. One of the requirements of transformative policies is to use relevant, contextualised knowledge (DoE, 2011b), which Mala finds difficult to do. Socio-culturally diverse learners can identify with problems that are phrased this way – and understand the mathematical content better. Chahine (2018) as well as Bonner et al. (2018) mention that the beliefs and the biases that teachers have contribute to their deficit thinking. It seems that when the teachers struggle to meet the requirements of the democratic curriculum policy, they will, as Patricia says, "*… basically use chalk and talk to teach.*". These teachers go back to the teaching methods that they were most familiar with. It is also apparent that Patricia does not interact enough with her learners as she prefers the use of printed media. Arends et al. (2017) stress that there is not enough interaction between teachers and learners, and consequently the learners perform poorly in mathematics. It also shows the teacher's deficit thinking as she believes that printed media will take the place of direct interaction. Professional development is needed because, as Boutte (2012) and Ladson-Billings (1995; 2009) claim, the teachers in this study do not have the necessary skills to meet the needs of the socio-culturally diverse learners in their classroom. The teachers' cultural capital is evident here and shows how they perceive learners that are different to them.

This theme suggests that mathematics teachers perceive mathematics as a high-status subject and rely on performance, instead of focusing on the needs of the varied learners in their classrooms. As stated earlier, Patricia resorts to teacher- centred methods which she is familiar with, and which she had applied with success in teaching mathematics. Her statement suggests that for her, performance is most important. Perhaps the teacher's cultural perceptions of presuming that only certain learners who have the cultural capital can do mathematics (Bourdieu, 2007; Harding-DeKam, 2014; Lubis, et al., 2021), influence their performance in mathematics. In this way she is unable to meet the socio-culturally diverse needs of all the learners in her classroom. Furthermore, teachers are under pressure to complete the syllabus so that students can prepare for the examination. We now see that even though there are democratic curriculum policies, there is still a focus on completion of the syllabus for examination purposes. Quantity rather than quality seems to be valued here. Beets (2012) as well as Hanushek and Rivkin (2012) point out that teachers are accountable for learners' achievement. With the pressure put on them, no wonder teachers resort to the familiar "banking method" which ultimately pursues the goals of the dominant social class in possession of the necessary cultural capital. This depicts what Chahine (2018) and Bonner et al. (2018) found in their studies that teachers' beliefs and biases culminate in their deficit thinking when working with socio-culturally diverse learners who also have diverse academic abilities. It therefore becomes a power relationship, as pointed out by Soldaat (2019). It seems that the teachers in this study subscribe to cultural capitals that favour those students who have the correct status, culture and the ability to succeed (Bourdieu, 1977). Some CRT strategies that mathematics teachers can use are traditional meals and indigenous

games as ethnomathematics strategies (Riberio et al., 2020) as well as cultural artefacts (Garcia-Olp et al., 2022; Imswatama & Lukman, 2018; Mania & Alam 2021).

6. Conclucions

The aim of this paper was to explore the perceptions of mathematics teachers when implementing curriculum policies in their teaching of socio-culturally diverse learners. Their perceptions of learners' socio-cultural backgrounds emerged in the way the teachers perceive diversity, which should be considered. In this study, the mathematics teachers showed a socio-cultural deficit which is contradictory to equitable education prerogatives to provide a quality education that is inherent in the South African democratic policies.

The results of the investigation depicted the challenges that interviewees had in overcoming the language barriers of the diverse learners when new curriculum policies in mathematics were implemented. Furthermore, the teachers lacked adequate training in culturally responsive methods and their backgrounds allowed them to associate learners' poor understanding of mathematics with learner apathy. Additionally, participants blamed the cultural and socio-economic backgrounds of the learners for their failure in meeting the democratic policy demands. Finally, the mathematics teachers in the study perceived mathematics to be a high-status subject in which only a few learners will be able to achieve good results. Hence, the findings demonstrate that the perceptions of the mathematics teachers in the study on socio-culturally diverse learners influence how they implement the curriculum.

Although the findings of this small sample based only in Kwa-Zulu Natal cannot be generalised to all mathematics teachers in South Africa, further investigations can be carried out, with a bigger sample from other provinces. The recommendation is that policy makers and teacher education institutions should invest in professional development workshops in culturally responsive pedagogies for mathematics teachers to overcome their socio-cultural deficit thinking. With poor performance in mathematics being a general problem, if there is a development of an unbiased view that all learners can understand and pass mathematics, then mathematics results may improve. Further research in exploring ethnomathematics as a culturally responsive teaching strategy will reveal new dynamics in socio-cultural deficit thinking.

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