

Using an Indigenous Language to Teach Natural Sciences and Technology: Opportunities and Challenges in Two Primary Schools

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Abstract

In 2018, the South African Basic Education Minister announced that a rollout of a decolonised education system would begin in the year 2019. Amongst others, this announcement intensified the debates around the effective use of local African indigenous languages as languages of learning and teaching (LoLT) in classrooms.

In this case study, the researcher interviewed and observed primary level teachers as he investigated the teaching of Natural Sciences and Technology through the language medium of isiXhosa. The findings demonstrate that teaching in local African indigenous languages require huge shifts in how teachers perceive teaching hence they would need to be supported. This process though is thwarted by the inadequate preparation of teachers to teach in African indigenous languages. The study also reveals that teaching black African learners in a combination of English and an African indigenous language opens up opportunities for multilingualism in classrooms.

Keywords: basic education, code switching, communication, multilingualism, translanguaging

1. Introduction: African Indigenous Languages for Learner Achievement

In Africa, various states are examining possibilities of utilising local African indigenous languages in classrooms after years of domination by Western education, which has exclusively used “Western languages” (Quane and Glanz, 2010). The languages of French in Francophone Africa, Portuguese in Lusophone Africa and English in Anglophone Africa have dominated over decades as languages of learning and teaching (LoLT) thus marginalising the local African indigenous languages (Adedeji 2015; Ndlovu-Gatsheni, 2018). In Nigeria, in 2015 and 2016, there were calls to use African indigenous languages as learners were losing interest in the sciences because foreign languages dominated teaching and they left learners confused (AfricaNews, 2017). In fact, in 2017 Nigeria announced that African indigenous languages would soon be used in teaching mathematics and natural sciences. Similarly, annually in South Africa there has been much concern expressed that black African learners in particular are failing mathematics, Natural Sciences and Technology

with several critics having found that language is among the obstacles that thwart the learners' progress in these learning areas (Makgato and Mji, 2006; Van der Berg et al., 2011; Prew, 2013). More experts have even claimed that the grade 12 results are exacerbated by English language as LoLT, because second or third language speakers of English have to grapple with understanding the English language before they comprehend the subject content (Makgato and Mji, 2006). The language issue has become a human right imperative because as long as the learners cannot have access to use their local African indigenous languages in classrooms, schooling will continue perpetuating inequality and social injustice to mother tongue speakers.

Furthermore, Van der Berg *et al.* (2011) point out that a large number of grade 6 learners have hardly mastered the most basic reading and numeracy skills. These authors also add that it is crucial to improve understanding of the language issues. Van der Berg *et al.* (2011) opine that, in addition to language, the learners' socio-economic status and school functionality have a negative effect on learners and the learning process. Van der Berg *et al.* (2011:17) claim, "those who learn in their second language also have a lower socio-economic status than first language English and Afrikaans speakers...second language learners are more likely to attend schools characterised by weak management...and the myriad of other factors associated with less well-functioning schools in South Africa". The two schools in this case study are such schools; they are both poor schools whose learners struggle academically. Furthermore, the schools have inadequate resources for Natural Sciences and Technology learning.

2. African Indigenous Languages for Learner Success

Neville Alexander (1999) whose voice had always been clear in language debates in South Africa has repeatedly pointed out that there can be no African Renaissance without African languages. African Renaissance is referred to as African rebirth, attained when African people overcome the African challenges and strive to achieve, cultural, scientific and economic renewal (Diop, 2000). Alexander (1999) protested about the elites and middle class for delaying the promotion of indigenous languages in South Africa. Furthermore, the new elite, black and white have maintained the old arguments for maintaining the colonial language as the only official language. Some like De Kadt (2005) argue that South Africa's language policies are not working and the modern effort to develop African indigenous languages has been limited. This limited development has not bettered the circumstances of the poor majority. Again, Alexander (1999) points out that the neo-colonial language policy is a middle class policy that which empowers the few against the interests and rights of the many and sustains a vicious cycle of poverty making the poor majority poorer. Schools should be the right institutions that break these hindrances and promote social justice through languages. The domination of English should be lessened and marginalised indigenous languages brought to the centre to coexist with English. The late Stellenbosch Vice Chancellor Botman (2012) spoke of the necessity for 'Ubuntu of languages'; the idea that a language is a language because of other languages. For decades, the African languages have existed on the margins with no hope of being brought to the centre to be equal with other languages.

The African indigenous languages need to be enhanced to become languages capable of science and social thought. The teacher as an intellectual contributor becomes critical here. Cheik Diop argues that we need the commitment from African intellectuals in developing African indigenous languages for Natural Sciences and Technology (Gellar, 2005). It should be the teachers' role to curb alienation in classrooms as they close the achievement gap with African indigenous languages. "There is a role for local science and technology and a people's knowledge base which focuses on local knowledge capabilities and a people's humanness" (Shizha and Abdi, 2014, 24). Shizha and Abdi (2014) maintain that science and technology in Africa should be studied through African indigenous languages. Furthermore, science and technology should be integrated in local knowledge systems. "Education must assist African peoples in a cultural rebirth that helps young learners attain cultural empowerment, reclaim their past history and provide lessons for the present and the future" (Shizha and Abdi, 2014: 24).

The idea of introducing African indigenous languages in South African basic education and higher education has been contentious with many maintaining that these languages are not ready for the rigours of academic engagement (Mkhize and Ndimande-Hlongwa, 2014). Yet others have advised that people should learn from the experiences of the development of the Afrikaans language that started as a university language only in the early 1900s (Prah, 2018). One can acknowledge that the route taken by the Afrikaans language to make it a language of learning and teaching was commendable. Yet the path to African indigenous languages has had many pitfalls. Among these are the reluctance of indigenous societies to engage with their own languages because the global world does not converse in indigenous languages but in exoglossic languages that include English and French. Secondly, many teachers may not feel competent in teaching in African indigenous languages and this may present itself as some form of resistance.

A South African education expert, Mary Metcalfe (2017), is quoted as saying that one of the major challenges in South African education is that children are not taught in their mother tongue. Furthermore, Metcalfe argues that from grade 3 to 4 learners from South African provinces with vast rural communities dropped in performance because at that level their subjects are taught in English (Times Media, 2017). Yet the main challenge the country may face is that there are few teachers who can competently teach in African indigenous languages. Chetty and Mwepu (2008) raise the language issue by stating that teachers should be adequately trained in teaching in African indigenous languages. These authors add that the teaching and learning resources will be enhanced by the mastery of teachers in the language of resources.

Various countries have experimented with the use of multilingual teaching that includes indigenous languages of the learners in natural science teaching and learning. The simultaneous use of multiple languages in Swedish classrooms has led to deeper knowledge of language as well as learning areas (Torpsten, 2018). Furthermore, Torpsten argues that classrooms need a strategic use of multilingualism because this promotes multilingual learners' identity and knowledge development. Multilingualism is critical especially when teachers think of how English words may change their everyday meanings in science classrooms (Oyoo, 2015). Furthermore, in studying the Swedish multilingual classrooms, Torpsten (2018) underscores the importance of the teachers' and learners' attitudes towards languages and learning for language acquisition. Additionally, learning in indigenous

languages followed a teaching strategy based on pedagogical principles on social justice which sought to break away from previous monolingual approaches (Torpsten, 2018). Teachers who use ecological approaches would be able to accommodate various languages in their classrooms. Ollerhead and Taylor-Leech (2019) argue that apart from supporting academic success, classrooms that promote multilingualism foster positive identities associated with the learners' home cultures and idea supported by Torpsten above. Yet Ollerhead and Taylor-Leech contend that there are few resources in other languages as many resources are prepared for English teaching around the world. Therefore, teachers need to develop these resources. Current research demonstrates that both pedagogy and language are major factors which need to be addressed in the education of bi-multilingual learners (Albertyn & Guzula, 2020). Albertyn and Guzula add that much of the failure rate in schools is due to that sudden transition to monolingual English education after three years of formal schooling in home languages. Researchers have assented that classrooms around the world need to be multilingual in preparation for a globalised world. Teachers need to be able to use flexible pedagogic approaches to be able to reach all learners. Garcia, Sylvan and Witt (2011) call for plurilingual approaches in classrooms with more translanguaging as a critical strategy so that learners can make sense of teaching and learning all the time. The plurilingual classrooms use more languages as they develop the learners' pluriliterate abilities and learners "become not only more knowledgeable and academically successful but also more confident users of academic English, better at translanguaging, and more plurilingual proficient" (Garcia et al., 2011:398). All these skills need empowered teachers who are able to utilise translanguaging efficiently.

The main question explored in this paper is, What effective role can isiXhosa language play in (Natural Sciences and Technology) classrooms where the learners are isiXhosa first language speakers?

3. Research methodology

A case study research design was used in collecting data for this study. There have been several calls to ensure that research fits into the context of South Africa specifically and Africa in general. Struwig and Stead (2004) write about a need for researchers to be cognisant of socio-historical, temporal and contextual factors and the role that they play in the research process.

Other people use case studies sparingly because they involve a small number of participants, although the focus is on arriving at a complete description of a situation (Struwig and Stead, 2004). The case study method was preferred because it is usually an in-depth type of study. There were six participants, three from each of the two primary schools. Both schools are in a historically black area and serve indigent black families. The six participants were all isiXhosa first language speakers who were selected using purposeful sampling techniques. In their initial teacher education programme they were taught to teach primary schools Natural science and technology learning areas through the medium of English language. Participant A and D teach grade 3, Participant B and E teach grade 4s and participant C and F teach grade 6s.

The researcher observed classes taught in isiXhosa and English where he was a passive observer. The researcher himself is an isiXhosa first language speaker. He used an

observation sheet to record what was happening in the classrooms, observing and noting the most critical moments in each class. Struwig and Stead (2004:122) point out that purposeful sampling “is not concerned so much with random sampling as it is with providing a sample of information-rich participants”. As was the case in this study, the participants demonstrated characteristics that the researcher was interested in. The grade 4 and grade 6 classes are intermediate classrooms that are taught mainly in English whilst the Foundation Phase class (grade 3) was mainly taught in isiXhosa. Interviews were conducted with individual teachers and lasted for seventy minutes each. Then after all were interviewed individually there was a focus group involving all the six participants. When conducted by well-trained researchers, focus group interviews may yield shared understanding and various perspectives on a given topic (Dilshad and Latif 2013). Focus groups enable homogenous groups to reflect on “high-quality data” as they provide a set of data about perceptions, thoughts feelings and impressions of people (Dilshad and Latif, 2013).

4. Findings

Much data was collected to constitute the mass of data before this was analysed to create patterns and meaningful insights. The mass of data is made of words, observations and images. For steps as highlighted by Bhatia (2018) (a) getting familiar with the data; (b) revisiting research objectives; (c) developing a framework and (d) identifying patterns and connections. All these were followed as I prepared the data for analysis.

4.1 Teacher Preparation in teaching science in isiXhosa

The focus group interviews elicited robust findings on the teaching of Natural Sciences and Technology in African indigenous languages. All the six teachers who teach these learning areas concur that utilising isiXhosa makes it easier to teach Natural Sciences and Technology, and easier for the learners to understand the content in these learning areas. However, these participants concur that they were never prepared to teach in isiXhosa in their initial teacher education programmes. Furthermore, they posit that it is quite challenging to devise effective strategies for teaching in a local African indigenous language. These six participants claimed, though, that teaching in the learners’ mother tongue in a learning area such as Natural Sciences and Technology makes sense, as it is a cognitively challenging learning area. Participant A appeared to summarise the beliefs of the group when she averred,

When you teach in mother tongue you feel like you are teaching the community, for the learners will readily identify with the content and be able to translate it at home in situations that will make the content more practical.

The participants maintained that the mother tongue was likely to be easily comprehended by the young learners whose second and third language skills are just developing. In addition, the participants pointed out that the learners appeared to identify relevant content and immediately apply it to their everyday experiences. They stated that mother tongue takes away the feeling of alienation as it highlights relevance. Participant C posited,

Many of us struggle teaching Natural Sciences and Technology in African indigenous languages but we have started experimenting with new isiXhosa concepts

and many learners find it fun learning (Natural Sciences and Technology) in their mother tongue. Even those learners who were withdrawn and inward looking now speak (with confidence) during class activities. With the language barrier removed and immediately we feel the difference.

The participants maintained that teachers would need to meet constantly as they bring in new concepts into the learning area. Some even highlighted that their teacher unions and other related bodies should help in enhancing their teaching. Participant B pointed out that the unions will have to seriously consider continuous professional development of their members and empower teachers in translating the resource materials. Additionally, participant F captured the challenge of mastery in the use of African indigenous languages in class succinctly when he stated that,

The learners are ready; the ball is in our court as teachers. We are still struggling formulating new terms in isiXhosa. But it can be done; it is a myth that we can teach Natural Sciences and Technology only in non-indigenous languages.

All participants agreed that there is a huge problem with poor schools and rural schools because there are frequently less qualified teachers in learning areas such as mathematics, Natural Sciences and Technology. In the focus group the participants pointed out that there is always a necessity to constantly train their members for continuous professional development. Yet, they applauded attempts to teach in African indigenous languages with some stating that this would not be beneficial to the learners only but to the teachers as well. They also concurred that teachers would be more likely to “shed alienation” in the classroom as the African indigenous language is more likely to bring the subject “to the teachers’ heart”. Three even alluded to the Annual National Assessment (ANA) coordinated by the Basic Education Department to check the level of numeracy and literacy nationally. They stated that the ANA results may be improved if black African learners were tested in languages they were highly proficient in and they emphasised that many learners were conversant in their mother tongue, which is isiXhosa in the case of the two sampled primary schools.

4.2 Introducing new Science Concepts in isiXhosa

There were several concepts they had to coin as they tried to develop Natural Sciences and Technology as a learning area that can be taught in isiXhosa. The following were some of the terms and several were directly translated from the English language:

Energy – *iEneji* others used *amandla* or *umbane* (when the latter referred to electricity)

Photosynthesis – *fotosinthesisi*

Chlorophyll – *iklorofili*

Other words though were easier to translate into isiXhosa:

Germination – *Ukuntshula*

Bread mould – *Ukungunda*

Habitat – *Indawo isityalo okanye isilwanyana esihlala kuyo*

The participants proclaimed that Natural Sciences and Technology are learning areas that make learners curious, and that “good teachers build on this curiosity”. Participant B, pointed out:

You can sometimes feel the frustration of the learners when they cannot express what they want to ask or explain in a Natural Sciences and Technology class. The learners

regard language as a barrier to understanding Natural Sciences and Technology concepts and make the learners to be alienated from the content. However, in this study it was found that the use of isiXhosa enabled learners to converse openly in class and all the participants argued that learning in an indigenous language enabled the learners to enhance societal development as espoused in the Curriculum Assessment Policy Statements (CAPS) documents. The use of isiXhosa enabled the learners to talk more about their communities as they related to what was learnt about their environment. Participants A and D teach grade 3 classes and pointed out how they enjoy the classroom discussions because their learners still learn in isiXhosa. The indigenous language element allowed them to see a connection between their everyday lives and the subject content in a way that the English language could not elicit. The mother tongue instruction brought excitement in the classrooms and this is the excitement that participants C and F talked about stating that whenever they codeswitch, they experience the involvement of almost all learners.

All the participants concurred that English made them use the telling method when teaching as many learners struggled to comprehend scientific concepts. The participants explained that the Natural Sciences and Technology learning areas are supposed to enable the learners to plan investigations, conduct investigations and communicate the findings. Two of the teachers, participants B and E organised the strands according to the following:

Life and Living - *Ubomi Nentlalo*

Matter and Materials – *iMatha nezinye izinto*

Energy and Change – *Amandla Notshintsho*

Planet Earth and Beyond – *Umhlaba Jikelele*

As pointed out above, the teachers struggled with certain concepts, and were always concerned about misleading learners by using wrong terminology.

4.3 The Challenges of Indigenous Languages and the Question of Resources

The participants shared their shortcomings when it came to facilitate learning in an African indigenous language. They contended that the continual challenge was their being uncertain in ensuring what concepts the learners would understand quicker for they “were wary of confusing the learners” through the use of unfamiliar translated concepts in isiXhosa. Yet, the participants declared that they felt more confident when they had met as peers before each lesson to discuss the various concepts and teaching strategies among themselves. They asserted that they were frequently unsure whether the learners would grasp the content when taught in isiXhosa. Participant B opined:

In the long run, teaching in African indigenous languages would help all because many of us as teachers are not even fluent in the English language, it remains a barrier to teaching and a burden to us too.

In a focus group discussion, the participants were concerned about the quality of Natural Sciences and Technology teaching in the poor schools. Whilst on the one hand they were always excited with the prospect of teaching in isiXhosa, on the other they felt restrained by the absence of relevant resources in African indigenous languages. Not only did they state that teachers needed constant professional development but that the laboratories needed more

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apparatus to augment learning and teaching of Natural Sciences and Technology. They also argued that district officials needed to help teachers compile a science as well as mathematics glossaries. The glossaries would assist teachers in translating the materials.

The participants assented that it was challenging having to work in schools when the Early Childhood Development (ECD) specialists from the Department of Basic Education did not support them. Participant C seemed to sum up what the others believed:

It is not easy to teach not only Natural Sciences but other subjects as well. We never see the subject specialists from the district offices. The curriculum is new and we need support from the specialists, but they never come. I do not even know how the subject specialist for science and technology looks like. I have been teaching at this school for three years now and I have never seen her.

Two Phase Heads (B and F) concurred with the above claiming that they themselves were not empowered to equip their colleagues with professional development skills. They affirmed that with no professional development skills they could not ensure that the teachers understood what they were supposed to do to improve their classroom practice. Participant F concisely put it:

Our children later struggle in Mathematics, Natural Sciences and Technology, and they later complain that these subjects are difficult because there are no early interventions. We have a problem now of children and their teachers in high schools registering to do Mathematics Literacy because they cannot cope with Pure Mathematics. But this short-changes them for they cannot do anything with Mathematics Literacy. Our children go to the world of work compromised because they did not do the Mathematics, which matters. It starts here at primary school. Our teachers need empowerment to equip the learners, especially through the use of the learners' home languages.

4.4 Observations, Learner Success and indigenous Languages

All the six participants pointed out that English language becomes the barrier in their classrooms when it excludes the learners' indigenous languages. The participants concurred that without the language barrier, many learners would be faring better in learning areas such as mathematics, Natural Sciences and Technology. The participants reiterated the potential of translanguaging and multilingualism. They argued that the success of the learners depended upon their total understanding of the lessons and classroom activities. Furthermore, the participants claimed that effective natural science classrooms are those where there are group discussions and cooperation. However, as participant E portrayed it:

You know frequently there tends to be silence in classrooms and we know that it is because of the language hindrance. The learners may have ideas but are unable to verbalise their interpretation of the lessons. This is frustrating not only for the learners but for the teachers as well.

By their nature Natural Sciences and Technology should be enjoyed by learners if there was collaboration and group discussions. The teachers maintained that indigenous languages and multilingualism are a determinant of success for all learners whose mother tongues is not English in South African classrooms. Participant B declared:

I agree with many who say that our grade 12 results for black learners would have been different if our learners wrote examinations in their mother tongue. This is the lesson we should learn from the grade 12 results. Before they even attempt to answer questions learners struggle with interpretation of the questions into their own indigenous languages.

The participants also concurred that learners who cannot engage with their content in a language that they understand can hardly learn for success. Participant E said:

The first time I taught grade 4 natural science two years ago I realised the dangers of monolingual classrooms. I got so frustrated to move alone in class because learners lagged behind because of the English language. As teachers we need to strategise how we use translanguaging in our classrooms. Unfortunately, we are not adequately trained to utilise multilingualism in our classrooms.

Yet it was clear when I observed grade 4 and grade 6 teachers trying to introduce multilingualism on a low scale, that there were no relevant resources. Observations in the study were used to triangulate what the participants had to say in the individual and focus group interviews. As a researcher, I was unobtrusive as I observed how the learners reacted to the teaching of Natural Sciences and Technology in the medium of isiXhosa especially by participants C and F who are teaching grade 6. The learners tended to ask extra higher order questions when teachers opened up for multilingual approaches, bringing their experiences from home to the classroom as they asked critical questions and engaged in discussions linked to their experiments and/or to similar activities in class. Whilst I was in the field two grade 4 classes (participants B and E) each wrote two tests and the differences were huge between the first and second test. The first test was written in English and the second test was written in isiXhosa. In one class, there was a rise in average pass percentage from 57% to 78% and in the second class, the pass rate rose from 45% to 69%. All the teachers pointed out that the language of teaching made a significant difference in the improvement of the results although the teachers maintain they still have to improve their own skills in teaching in

multilingual classrooms. The learners' practical assessment and written work improved immensely. What was clear in the classrooms were the enhanced discussions, a factor that was non-existent before, as far as the teachers are concerned. Of the six classrooms observed, the average number of learners in each was 48 learners. The grade 3 classrooms for example had 48 and 53 learners respectively. The teacher-participants pointed out that in an ideal situation they would have liked to have fewer numbers. However, the two schools service a sprawling poor informal settlement area that continues to grow hence the high numbers of learners.

5. Discussion

The study proved to have elements of both confirmatory and exploratory research. This study's findings confirm existing results. Therefore, confirmatory research tests the validity of already made hypothesis. Yet the exploratory aspect deals with a less researched area, which is teacher inadequacies in utilising language in classrooms. I tried to generate new knowledge by examining themes from date and making sense of the observations. Amongst the exploratory findings are that teachers not only the learners need to learn to unlearn the ways in which they were taught. This has deep implications for a new critical pedagogy in initial teacher education programmes. It was also clear that the medium of teaching has a close relationship with the teaching practice. The teachers in the study alluded to this when they pointed out that teaching in first language has a potential to boost their pedagogical confidence and enhance their subject mastery as they witness the growth in their learners' understanding. Pedagogical confidence refers to understanding and believing in one's professional ability as a teacher whilst the learners' understanding means the learners' ability to learn and apply the knowledge from the classroom through the advantage of first language teaching and learning. Discussion below is divided under three themes teased out during the analysis of results:

- Translation and the challenge of developing language for science;
- The teachers' understanding and facilitation; and
- The opportunity of multilingual classrooms.
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5.1 Translation and the Challenge of Developing Language for Science

The Natural Sciences and Technology learning area has various challenges, as spelt out by the six participants and union members; chief among these is knowing what to teach and how to teach it. Yet critical behind this is translating and using the correct science concepts when using African indigenous language. The language aspect requires an extra necessary but daunting skill from the teachers in the study. The teachers were aware that their teaching in isiXhosa would be as effective as their translation of content, for bad translation would exacerbate understanding by both learners and teachers. The teachers stated that whilst they were aware of the need to use well-translated materials, they were not always able to produce effective translation for their classrooms. Mbekwa (2008) underscores the importance of translation of concepts and learner support materials from English to isiXhosa when teaching mathematics. The role of the teachers can be critical in this regard. "Whilst language functions as a tool for understanding, it may also serve as a tool to sow confusion

and misconception” (Mbekwa, 2008). Furthermore, Mbekwa (2008) opines that the language of the teacher, the language of the learner and the language of instruction increase the complexity of the teaching and learning because the teacher’s language and that of instruction may be different from that of the learner. Yet language becomes an asset when the teacher shares same language with the learner. Teachers who are not first language speakers of English have an additional task to teach English and Natural Sciences to learners who are not conversant in English. Therefore, when teachers need to translate from English to isiXhosa they need to be able to translate well or at least use well translated materials.

The teacher-participants though concur that both the African indigenous language and the science content have an impact on their competence. In initial teacher education, they were trained to neither translate nor teach in African indigenous languages. Compounding this is the common gripe of all the teachers that there are not enough resources in African indigenous languages in their schools. The science teaching in South African primary schools is supposed to be constructivist in nature; the learners are supposed to discover knowledge during the learning process of discovery. In this study, teacher-participants highlight the challenge of developing the necessary science concepts. Teachers should be instrumental in the development of these concepts and may work with other role-players, including language experts. Mother tongue instruction is effective when there is adequate terminology for education purposes as well as resource materials (MoE, 2003). The Ministry of Education document spells out the advantages of first language teaching and the participants mentioned some:

First language:

- gives learners a stronger sense of identity;
- facilitates higher-level learning for students;
- has been proven, especially in the early years of a child’s education, to be more effective in the educational process than the use of some other language; and
- provides a positive and non-threatening environment for students.

(MoE 2003: 12)

The situation is comparable in the Intermediate Phase where teachers face similar challenges.

5.2 The Teachers’ Understanding and Facilitation

Facilitation in teaching through indigenous languages needs a shift in thinking and philosophy of teaching. This means seeing teaching and learning differently because language should be able to achieve some improvement in results. Owen-Smith (2012) points out that it is about not only effective communication but also language impacts on a child’s self-confidence and sense of self in society are undermined if the mother tongue cannot be used for learning and these may be exacerbated by the experience of repeated underachievement. “This disadvantage has cognitive, psychological, social and cultural aspects, all manifested in the ongoing failure of our education system” (Owen-Smith, 2012).

All the six participants pointed out that they always tried to use both English and isiXhosa in teaching science. They pointed out that sometimes not only are the children at a disadvantage in English usage but as teachers, they had shortcomings in teaching a learning

area such as Natural Sciences and Technology. The use of both languages frequently made facilitation of lessons “much better than when using English only”. Owen-Smith (2012) coins the term *multi-bilingualism* referring to it as an effective way of facilitation especially for teachers who want to overcome inequality in South African classrooms. Owen-Smith (2012) points out that multi-bilingualism involves the use of two languages for learning (a common medium plus every learner’s home language). Furthermore, Owen-Smith avers that three innovative multi bilingual methodologies and these are; learner talk, use of text and reading and the third one is linked to the teaching of teaching of reading in the early grades. It would enhance the facilitation if teachers in the science classrooms tried this multi-bilingual education as they promoted the African indigenous languages especially in the Foundation Phase classrooms. Owen-Smith was involved in what was referred to as The Home Language Project (HLP) initiated by concerned parents in a former model C school in Johannesburg. This can be invaluable to introduce confidence in many learning areas for learners who might struggle in classes where the language of learning and teaching is only English. Multi-bilingualism can minimise teacher anxiety as they attempt to use African indigenous languages in the facilitation of learning. The use of bilingual classroom should not be an end in themselves but should enable learners to learn in their indigenous languages.

This is in line with recent literature that points out that policy pronouncements need to incorporate indigenous knowledge in formal schooling for the current science learning area lacks indigenous knowledge content and is largely Western knowledge dominated (Katonga, 2017). Katonga maintains that the lack of indigenous language learning and teaching resources impacts on what is taught and how it is taught. Yet the teacher-participants maintained that the use of African indigenous languages should be supported in all learning areas. However, one of the major challenges was accuracy in translating the learning material for as teachers frequently tried code switching; it was not always easy to translate from English to isiXhosa. Muthivhi (2012) has argued how the practices of code switching or code mixing has been criticised for negative but unintended consequences on learners’ grasp of teaching and learning processes. As pointed above, effective translation is a skill teachers need in classrooms utilising African indigenous languages.

Yet, teachers who are trying to code switching should be careful not to misinterpret concepts. Muthivhi (2012) points out that this may lead to poor schooling. In his book, *Primary Education in Crisis*, Bram Fleisch (2008) found that poor children are usually trapped in schools where teachers misinterpret the new curriculum and utilise inappropriate teaching practices. This is compounded by the use of English where some teachers may not be fluent or competent. Learners are usually in classrooms where they cannot think critically because of the language barrier. Macedo, a Brazilian scholar refers to this as *literacy for stupidification*; this refers to the inability to read critically and separating myth from reality (Macedo, 1993). Teaching science in African indigenous languages by competent teachers can enable teachers to avoid what Macedo refers to as *Pedagogy of Lies*. Learners from poor families may be underperforming in learning areas such as Technology and Science because of this stupidification.

5.3 The Opportunity of Multilingual Classrooms

The study reveals several positive aspects about teaching Natural Sciences and Technology in African indigenous languages. In a multilingual country such as South Africa, teaching in an African indigenous language in addition to English content subjects such as Natural Sciences and Technology would enable teachers to use other languages besides English. In addition to this, the school system should enable learners to write examinations in African indigenous languages as well. These advantages can assist in promoting multilingualism and enable teachers to utilise code switching as well. Moreover, as reflected in this study, teachers usually have no resources to teach Natural Sciences and Technology although they may know how to engage learners in activities. In the case study, the researcher observed how poor English makes group discussions difficult and almost ineffective. Yet, schools desperately need teachers with the necessary skills in this learning area (Makgato, 2013).

Cooke (2013) cites Nick Taylor who posits that South Africa is failing education system is due to teachers who lack the teaching skills and whose curriculum understanding is questionable. Jansen supports this as he states that English is preferred because teachers do not effectively teach African indigenous languages (Cooke, 2013). Furthermore, Jansen points out that learning in one's mother tongue is not a guarantee of improved learning success in schools for the problem may be the actual teaching or the teacher's knowledge of curriculum may be a challenge. The arguments are reflected in the study because, by the participants' admission, they were not always certain as to how to teach Natural Sciences and Technology. Other experts have supported the use of multilingualism in science classrooms where African indigenous languages can be used at first and then towards the end of the lesson English can be introduced. Wababa's (2009) study found that it was useful to use a combination of both English and isiXhosa in primary schools where isiXhosa is the home language of the learners. That study's findings proclaimed that the use of code-switching like this is useful in mediating cognitively challenging subject content, particularly natural sciences concepts and terminology. Furthermore, Wababa's study concludes that the lack of materials in isiXhosa affects the learners' understanding of cognitively challenging materials.

6. Conclusion

The question posed by the study was the role that can be played isiXhosa as a language of learning and teaching. Whilst language of learning and teaching is critical, there are other factors that impact on teaching such as teacher preparedness, resources used and the socio-economic status of the learners. Yet language is a tool that is pivotal in the classroom and the use of the learners' mother tongue is as critical as the teachers using languages they are proficient in. The participants demonstrated that there is a huge potential in transforming teaching practice as well as learning of content by first language speakers of the African indigenous languages. As cited research shows above, language is a critical determinant of success in historically black schools where English is a second language. One has to be realistic though that introducing indigenous languages will not magically improve results but there will be improved aspects when learners learn in their mother tongue. Furthermore, a limited case study as this one will only make us understand the dynamics of one context.

Teachers and subject advisors should continuously empower teachers in translation as well as the use of novel strategies such as multi-bilingual and multilingual classrooms. IsiXhosa like all other languages can play an effective role if teachers and their learners know exactly how to use these effectively in classrooms.

The conclusions show that merely changing the LoLT from English to African indigenous languages will not totally transform the Natural Sciences and Technology classrooms. More is needed to improve teacher practice and content understanding because language medium is not independent of the teaching practice. The teacher limitations in such schools aggravate inequalities and social injustices in poor schools. It is apt to conclude this discussion by quoting Van der Berg *et al.* (2011,20) who posit, “Learner achievement data for South Africa suggest that particularly large inequalities are evident as early as the third grade and that the school system is not succeeding in closing such gaps thereafter. This points to the importance of early educational interventions”. A change to the utilisation of indigenous African languages would surely rate as one of the most critical of those interventions.

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