SCIENTIFIC CULTURE

www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 2.1, (2026), pp. 10079-10087
Open Access. Online & Print

DOI: 10.5281/zenodo.20023203

UTILIZING THE ISINDEBELE SCIENTIFIC LANGUAGE REGISTER IN THE NATURAL SCIENCES TO FOSTER MEANINGFUL LEARNING

Thuli Gladys Ntuli

University of South Africa, Pretoria-South Africa
Orcid number: http://orcid.org/0000-0001-8331-3018, entulit@unisa.ac.za

Received: 02/04/2026
Accepted: 23/04/2026

Corresponding Author: Thuli Gladys Ntuli (entulit@unisa.ac.za)

ABSTRACT

Conducted as a qualitative interpretative case study, this research explored the influence of the developed isiNdebele scientific language register for Natural Sciences on meaningful learning among learners. Data collection involved interviews and observations of stakeholders. The findings revealed a positive correlation between the use of indigenous languages and meaningful learning. Notably, when Natural Sciences was taught using the isiNdebele register, classrooms exhibited heightened interaction, contrasting with lessons conducted in English, where learners were predominantly passive. These outcomes underscore the importance of creating scientific registers in indigenous languages, advocating for their integration into teaching practices. The study recommends the incorporation of scientific language registers in indigenous languages to enhance meaningful learning and academic performance. By examining the impact on meaningful learning experiences, the article contributes valuable insights to the broader discourse on inclusive and culturally responsive pedagogical practices in science education. The findings underscore the potential of utilizing indigenous languages in science instruction to bridge linguistic gaps and promote a more accessible and enriching educational environment.

KEYWORDS: Isindebele, Scientific Language Register, Natural Sciences, Meaningful Learning, Indigenous Languages.

1. INTRODUCTION

Although language is acknowledged as the primary vehicle for communication and cognitive processes, its evolution is shaped through social interaction, as highlighted by Vygotsky (1978). Vygotsky further underscores the importance of language in the context of social constructivism, emphasizing its impact on learning through social connections, individual engagement with society, language acquisition, and cultural learning (Vygotsky, 1978; Mudau, 2013). Both Mudau (2013) and Vygotsky (1978) emphasize the crucial role of classroom and social interactions, along with language, as foundational elements for achieving meaningful learning. Meaningful learning is conceptualized as a dialogic process wherein diverse ideas are amalgamated and contemplated using language as a tool. Additionally, Mortimer et al. (2006) assert that interactions, discourses, and language play a fundamental role in meaningful learning, positively influencing learner performance. This study employs Mudau's (2013) Classroom Practice Diagnostic Framework (CPDF) as a guiding framework.

This article reports on a research endeavour that investigates the utilization of a developed scientific register in isiNdebele within the context of Natural Sciences and its impact on shaping meaningful learning. Prior studies have predominantly focused on the use of English and Afrikaans to teach African learners (Lepheana, 2021). Findings from these studies suggest that the use of English and Afrikaans impedes meaningful learning, placing learners in the challenging position of grappling with both language and scientific concepts (McKinney & Tyler, 2019; Mkimbili, 2019; Mweli, 2018; Msimanga et al., 2017). The ongoing debate among politicians and scholars revolves around how the use of these two colonial languages contributes to low academic performance among African children. Minister of Basic Education Angie Motshekga, addressing a parliamentary session on March 9, 2022, highlighted that poor reading comprehension skills among South African children are attributed, in part, to learning in a foreign language, specifically English (Writer, 2022).

While South Africa boasts eleven official languages, including nine indigenous African languages (isiNdebele, seTswana, sePedi, seSotho, tshiVenda, siSwati, isiZulu, xiTsonga, and isiXhosa), English remains the predominant medium of instruction, excluding the indigenous languages (Oyoo & Nkopodi, 2020). This linguistic diversity, coupled with the diverse cultural and ethnic groups in the country, contributes to a rich tapestry of languages that foster a sense of belonging and cohesion (Motloung et al., 2021; Gudula, 2017). However, linguistic diversity is not equitably addressed in educational settings, especially in rural schools where teachers are often compelled to use registers not written in either their or the learners' home language (Motloung et al., 2021; Ntuli & Mudau, 2025). This linguistic challenge makes the teaching process formidable, particularly when instructing learners in a language unfamiliar and incomprehensible to them.

The language issue extends beyond South Africa and is a subject of debate in other African, Southern African Development Community (SADC), and global contexts, such as Ethiopia, Mozambique, and China. Ethiopia, with over 20 indigenous languages, uses English as the medium of instruction, resulting in poor performance in subjects like mathematics and science (Getahun & Jibat's, 2018). Similar challenges are observed in Mozambique, where Portuguese, a non-indigenous language adopted from colonial rulers, serves as the official medium of instruction, leading to subpar performance in science (Mario & Nandja, 2005). In contrast, countries like China and Spain use their indigenous languages (Mandarin and Spanish) as mediums of instruction, contributing to meaningful learning and evident success in technological innovations, mathematics, and science (Mkimbili, 2019; O'Sullivan, 2018).

2. METHODS

2.1. The Study Group

This study adopts a qualitative research approach, a method of inquiry aimed at understanding central phenomena by examining participants within their contextual environment. Creswell (2017) underscores that a qualitative research design facilitates the exploration of phenomena in their real-life settings. Specifically, in phenomenological research, researchers refrain from making assumptions and instead seek to comprehend the experiences of the participants. Employing a multiple case-study design in this study was deemed appropriate, as the researchers aimed to delve deeply into the nuances of the explored subject (Nkanyani & Mudau, 2019). This design allowed for the individual treatment of each case, considering the diverse backgrounds and teaching experiences of the participants.

The selection of participants involved purposive sampling, a method described by Maree (2017) as ideal for choosing information-rich cases in an in-depth study, utilizing individuals with substantial knowledge of the phenomenon under investigation. Criteria for sampling were based on specific

considerations: teachers engaged in teaching Natural Sciences in senior phase schools, particularly within the Siyabuswa 2 circuit, and parents and learners affiliated with the selected school. The inclusion of participants was contingent on their willingness to participate in the study.

3. DATA COLLECTION TOOLS

Qualitative data collection in this study employed two distinct strategies. The initial strategy involved conducting one-on-one semi-structured interviews using a set of predetermined questions (Creswell, 2017; Maree, 2017). Interviews were conducted with two Natural Science teachers, two groups of learners, and two parents from selected schools, focusing on the inquiry, "Does the developed isiNdebele Natural Sciences scientific language register contribute to meaningful learning?" In these interviews, additional probing questions like "If yes, how, please elaborate?" were posed to elicit further clarification and gather comprehensive data.

Despite the perception of interviews as time-consuming and costly (Sahin-Topalcengiz and Yildirim, 2020), this technique was deemed most relevant due to the limited number of participants and the personalized nature of interview data. Interviews proved instrumental in gathering sufficient and pertinent information (Nkanyani & Mudau, 2019). Additionally, interviews yielded a richer source of descriptive information compared to instruments like questionnaires (Madueño Serrano et al., 2020). Participants were interviewed during their free time and after school, exploring how the developed isiNdebele Natural Sciences scientific language register influenced meaningful learning. The interview responses were recorded to ensure accurate capturing of participants' perspectives.

The second strategy, classroom observation, served as a valuable means of data collection, with teachers observed instructing Natural Sciences using both English and isiNdebele scientific registers. Continuous observations were conducted over a three-week period to enhance data validity. Each teacher underwent multiple hour-long observations, dedicating the first 45 minutes to teaching Unit 1 on separating mixtures using the isiNdebele scientific register and the remaining 15 minutes using the English scientific register. This allocation allowed for a comprehensive understanding of how classroom interactions and discourse varied with different language registers. The non-participant observer approach was chosen as it ensured the researchers remained uninvolved, minimizing influence on the dynamics of the setting.

Data triangulation was facilitated through interviews and observations, enabling the researcher to cross-verify participant responses obtained during interviews with observations from the classroom. This comprehensive approach contributed to the robust findings of the study.

4. DATA ANALYSIS

To analyse the data collected from interviews and observations in this study, a content analysis approach was employed. Audio-recorded interviews and observations were carefully examined by listening to them multiple times and then transcribing the content into a word document. Following the transcription of data from interviews and video recordings, the researcher revisited the audio recordings to cross-verify that the transcribed data accurately reflected the participants' responses. The transcribed information from both interviews and observations underwent a thorough reading, during which the researcher highlighted significant statements that offered insight into the participants. Themes and categories were then derived from these highlighted statements, aligning with the research questions (Creswell, 2017). Interactions and discourses emerged as a central theme for analysing the data in this study.

4.1. Data presentation and discussions

When implementing the register, I sought to gain insights from stakeholders, particularly teachers, regarding how the developed scientific language register for Natural Sciences in isiNdebele contributes to meaningful learning. Fana expressed that:

"Yes, I think it does influence, because the register is written in their home-language making it easier for learners to interact when they understand the language rather than when using English register where their participation is minimal"

Sfiso echoed Fana's sentiment by stating:

"Yes, sometimes when they have the language barrier, they do not really interact or ask the questions that need to be asked. Sometimes they keep quiet because they do not want to speak in the language that we are using for teaching. They decide to keep quiet and stay with the questions that they need to ask or rather they agree with you without understanding. But using the isiNdebele register will make them interact better and ask questions because they will be using their home language"

His earlier statement aligns with his responses during the interviews, where he emphasized that utilizing isiNdebele to teach Natural Sciences could

be a beneficial initiative. According to him, learners grasp concepts more effectively when instructed in their mother tongue compared to English. This viewpoint finds support in Adesemowo's (2017) observations, highlighting the advantages of using indigenous languages for teaching African learners. Adesemowo (2017) notes that learners can better understand and relate to concepts when instruction occurs in their own language and cultural context. The same question was posed to learners after providing an explanation of what a scientific register in isiNdebele entails. Some learners responded as follows:

"Inomthelela omuhle ma'am ngobanyana sizokukgona ukuphendula imibuzo lula ngombana sizobe siyizwisisa ngoba ingelimu lekhethu neehlathululo zingelimi lekhethu". (yes, it has a good influence because we can interact since the register is written in our mother-tongue) L1.

"Ma'am nasifunda nge register le siyakgona uku participator ngaphandle kokusaba ukuthi bazosihleka ngoba siberegisa sifunda ngelimilethu sikgona nokuqabanga msinya ngoba siyazwisisa". (when we learn using this register, we can participate without fear because we learn using the language, we familiar with and we able to think quickly because we understand better) L2.

"Ah ma'am I think ine influence ehle cause ngoba sifunda nge siNdebele and singa understand'a" (the register has a good influence because we are learning in isiNdebele and we have a better understanding of science concepts in our own language) L3.

Some of the responses from the learners align positively with their favourable perceptions regarding the use of isiNdebele for Natural Sciences instruction. However, there are inconsistencies with how they expressed their views during the interviews regarding their preferences for isiNdebele instruction. Initially, their perception was inclined towards English, influenced by their parents' desire for them to be fluent in it. Nevertheless, when specifically asked about the impact of the developed scientific language register in isiNdebele on their meaningful learning, their responses were positive, expressing support for its use. The conflicting nature of their responses may be attributed to the negative perception instilled by their parents regarding the use of indigenous languages as mediums of instruction, overshadowing their personal views (Tshotsho, 2013; Tembe & Norton, 2011; Kishindo, 2010).

Parents represent a crucial stakeholder group in the implementation of the scientific language register for Natural Sciences in isiNdebele. A number of parents expressed that:

"Yes, it can influence because I think if they can teach Natural Science with IsiNdebele, because all learners are going to understand very well. If the teacher is talking about the head, body, leg, anything or an animal or what, they are going to explain to the learners with isiNdebele. And I think all learners in the class they are going to understand everything, and they are going to participate." P1

"Well, Yes Madam. Our learners may be reserved. Reserved in the sense that they may not be able to present well. Though we've got good learners that will always interact with their teachers. But there will always be those that are feeling like to be reserved not wanting to interact because of not being certain of the language." P2

"Of course, it does. Sometimes most of the terms are terms in English now the learner must think and try to think in English and then also write in English while the learner understands these things much better in their home language. So, it becomes a barrier when it comes to interaction. Now the teacher must ask in English, the learner does not know some of the terms, but he knows what the teacher is talking about. So, when it comes to communication, replying, responding to the teacher, the interaction becomes in a way poor, compared to the language that they normally use at home". P3

Yes. Ok, so it does because sometimes they cannot express themselves fully. For example, if you ask a question in English, a learner can have an answer but answering you in English is a bit difficult because isiNdebele is the only language which they use in most cases and it is the only language they are perfect in. So sometimes it becomes difficult". P4

Like the responses from learners, certain parents' perspectives on how the developed scientific language register for Natural Sciences in isiNdebele influences meaningful learning align with their positive views on using isiNdebele as a medium of instruction for Natural Sciences. This consistency stems from the belief that learners grasp concepts more effectively when instructed in a language they understand and are fluent in (Msila, 2013).

The collective responses from stakeholders suggest unanimous agreement that the developed scientific language register for Natural Sciences in isiNdebele has the potential to foster meaningful learning. Their views are grounded in the perceived benefits of utilizing the mother tongue, which is believed to contribute to meaningful learning and subsequently lead to improved performance, as emphasized by Adesemowo (2017). Notably, political commentators like Dr. Somadoda Fikeni,

traditionalists such as Zolani Mkiva, and Historian and Cultural Analyst Professor Pitika Ntuli support the idea that learning in the mother tongue enhances learner performance. This sentiment is reinforced by the findings of Reis and Ng-A-Fook (2010), who highlight how the use of indigenous languages can enhance meaningful learning and yield better results.

To further validate and triangulate the data collected from interviews, the researcher observed teachers and learners in the classroom. This observational approach was crucial to capturing classroom interactions and discourse, as these aspects could not have been adequately captured through other methods (Nancy Carter et al., 2014).

During interviews, both Fana and Sfiso affirmed that the developed scientific language register for Natural Sciences in isiNdebele indeed contributes to meaningful learning. Subsequently, their classroom practices were observed as they utilized the isiNdebele scientific register to teach Natural Sciences. Notably, Sfiso initiated his lesson by assessing learners' prior knowledge of the topic, a practice deemed essential for meaningful learning, as highlighted by Keeley (2012). He indicated that:

"Ama metha neensentjenziswa! uqabanga ukuthi ama metha yini. Yini igama elifika'kothoma qhaza nje ngendlela obonangayo Noma ngiwuphi umbono wamukelekile, (what comes to your mind when you hear the word "Matter" Any view is acceptable?

Throughout his instructional session, Sfiso employed dialogic discourse, a practice referenced by Mudau (2013). Learners were afforded the opportunity to actively engage in discussions regarding the presented content. This is substantiated by the following excerpt, wherein they articulated their interpretations of the concept of "matter."

"I think matter is used to do something" L1

"matter is something that can take up space" L2

"Amametha zizinto eziphathekako (matter is something that can take up space)" L3

When Sfiso inquired about the nature of matter, he conveyed to his learners, "Noma ngiwuphi umbono wamukelekile," translating to any perspective being acceptable. This approach rendered his teaching interactive and dialogic, in accordance with the observations made by Mudau (2013) and Chin (2006). Learners were encouraged to provide any responses they had, with the emphasis not solely on correctness but on fostering participation and interaction, ultimately aiming for meaningful learning.

Furthermore, Sfiso's utilization of dialogic discourse persisted throughout the lesson, consistent with the insights of Mudau (2013) and Chin (2006). Learners actively debated and engaged in discussions about the feasibility of extracting salt from saltwater, exploring the isiNdebele term for this process. The subsequent responses from the learners corroborate the observation.

"it is possible through boiling" L1

"yes, through filtering" L2

"Siyokubilisa amanzi anetswayi bese amanzi azokutjha aphele bese kusale itswayi (we going to boil salt and water will evaporate and we will be left with salt)" L3

"Mr nelangeni singawabeka amanzi anetswayi, amanzi azokutjha kusale itswayi lodwa, mara lokho kungathatha isikhatho eside. (we can also put the mixture in the sunlight water will evaporate, though that will take time)" L4

"Iye indela yokuhlukanisa umvango loyo kukuwubilisa" (yes, we can only separate the mixture through boiling) Sfiso

Building upon the earlier observations, Sfiso not only utilized dialogic discourse but also employed an interactive-dialogic approach. During the lesson, learners actively proposed various methods for separating the mixture of salt and water. Despite some responses being incorrect, Sfiso did not dismiss them; instead, he acknowledged their input and provided the correct answers.

Continuously, throughout the instructional session, Sfiso posed questions designed to foster discussions and stimulate the thinking skills of the learners. This approach involved questioning that aimed to develop their cognitive abilities. An instance of this was noted when he prompted learners to identify and name mixtures and pure substances. This is validated by the excerpt below:

"Amadribe awomi siweko-amsulwa" (raisons are pure-substances) L1

"Irama-imsulwa" (Rama is a pure substance) L2

"Nami anginalo elinye igama engingabiza ngalo i Rama" (I do not know any other name that best describes Rama in isiNdebele) Sfiso

"Yibhodoro" L's

In the discussion between the teacher and learners, there was a debate over whether margarine is an English term, eventually reaching an agreement that it is referred to as 'yibhodoro' in isiNdebele. Contrary to merely posing questions to buy time, Sfiso posed thought-provoking questions that encouraged the development of thinking skills. This was evident as learners engaged in a debate about the meaning of "rama" in isiNdebele, a term unfamiliar to Sfiso. The learners collectively suggested a more suitable isiNdebele term, "yibhodoro," borrowed

from the Afrikaans "boter."

During the interviews, Sfiso expressed the view that the developed scientific language register for Natural Sciences in isiNdebele positively contributes to meaningful learning. He highlighted that utilizing the isiNdebele scientific register fosters improved interaction among learners compared to when using the English scientific register. Given his indications about the English and isiNdebele registers for Natural Sciences, I opted to observe him teaching the same topic using the English scientific register for natural sciences.

Contrary to authoritative discourses, as per Chin (2006) and Mudau (2013), Sfiso predominantly employed an authoritative approach from the outset. Learners were not given the opportunity to debate or discuss concepts; instead, Sfiso transmitted information using a question-and-answer teaching method, a practice discouraged by researchers who argue that it leads to passive and superficial thinking. Throughout the observation, Sfiso relied on the question-and-answer method, structuring questions to provide learners with answers. Following each answer, he posed the question "angitjho," meaning "right." This question did not appear as an authentic query with room for a negative response but rather seemed to coerce agreement from learners. Consequently, in each instance, learners echoed a unanimous "yes," and Sfiso proceeded to the next aspect.

"Why are you saying Tap water is a mixture? Because they use a chemical angitjho (right)? Sfiso

"Yes" L's

"So, we all are agreeing that tap water is a mixture?" Sfiso

"Yes" L's

In his instructional session, learners were deprived of the opportunity to actively participate, discuss, ask questions, or share their perspectives on the presented content. Sfiso solely disseminated information, and the learners assumed a passive role as recipients of that information, resulting in an authoritative discourse (Chin, 2006). The discourse pattern employed by Sfiso in his class adhered to the Initiation Response Feedback (IRF) model (Graesser et al., 2003). Sfiso was noted for initiating questions about mixtures and pure substances and subsequently providing feedback, as substantiated by the following excerpt:

"Milk is a what? Is a pure substance angitjho (right)?" Sfiso

"Yes" L's

"Another one" Sfiso

"Salt" L's

"Salt, it is a pure substance, right?"

"Yes" L's

In every instance, Sfiso refrained from initiating questions that would encourage discussions or stimulate higher-order thinking among learners. All the questions posed were straightforward, with predetermined answers, and at times, Sfiso provided the answers himself. Despite the extensive use of questioning in Sfiso's lesson, it was crucial to scrutinize the intent behind the questions asked. It became apparent that Sfiso posed questions for assessment purposes rather than to facilitate a deeper understanding.

Sfiso adopted an interactive-authoritative teaching approach, where interaction occurred primarily between the teacher and learners, with minimal interaction among the learners themselves. The authoritative aspect of Sfiso's teaching style manifested through dominant lectures and question-and-answer methods, leaving little room for learners to question or seek clarification on the presented content. Although Sfiso encouraged responses from learners, he often supplied them with answers even when they were capable of formulating their own. This observation is substantiated by the recorded instance below:

"Let us go to picture B. Picture B, what do you think of Picture B"? Sfiso

"(Mumbling)" L's

"You are not sure neh? But you can see different components there neh? There are some that is dark some that is white neh"?

"Yes." L's

"So, what you see there it is a mixture" Sfiso

The provided excerpts stand as testament to the authoritative style employed by Sfiso in his communication approach. If Sfiso had allowed learners to engage with each other and with the content without providing immediate answers, it would have provided them with the chance to develop various skills, including questioning and communication skills, as outlined in the NS CAPS document for grades 7-9. Consequently, it can be deduced that the lack of meaningful interaction between learners and the teacher was influenced by the use of the English register for Natural Science.

4.1. Findings

When employing the isiNdebele scientific language register for Natural Sciences, Fana embraced dialogic discourse, providing multiple opportunities for his learners to actively engage and discuss the presented concepts. Fana fostered an environment conducive to interaction, facilitating

ease of communication among learners and between them and the teacher. Despite occasional inaccuracies in responses, this practice aligns with Vygotsky's concept of meaningful learning (1978) and characterizes Fana's approach as interactive-dialogic. Fana utilized the question-and-answer method, posing questions aimed at developing thinking skills. Additionally, he incorporated the IRFRF pattern of discourse, offering feedback that stimulated learners' thinking processes and encouraged further discussion and improved feedback.

In contrast, when Sfiso utilized the English scientific register for Natural Sciences, there were no evident attempts at discussion between Sfiso and the learners or among the learners themselves. Sfiso assumed the role of an information transmitter, with learners primarily serving as passive recipients of information, resulting in an authoritative discourse. The application of the IRF discourse pattern by Sfiso limited learners' opportunities to employ skills such as questioning and scientific processes, as outlined in the CAPS NS policy document. Questions posed by Sfiso were primarily for evaluation purposes rather than to foster learners' thinking skills or to facilitate transitions between topics. The conclusion drawn from these observations characterizes Sfiso's communicative approach as "interactive and authoritative."

Based on these observations, it can be inferred that the developed isiNdebele scientific language register for Natural Sciences does indeed positively contribute to meaningful learning, potentially leading to improved performance in the subject, as suggested by Mortimer and Scott (2003).

5. CONCLUSION AND RECOMMENDATIONS

Derived from the perspectives of stakeholders, does the formulated scientific language register for Natural Sciences in isiNdebele contribute to meaningful learning? Stakeholders collectively expressed a unanimous belief that the register should indeed foster meaningful learning. Their arguments were firmly rooted in the notion that learners, when instructed in their mother tongue, wherein they possess high proficiency, would enhance comprehension, and diminish language barriers. Consequently, this approach is anticipated to improve learners' performance and engagement in the subject, as they would be focusing solely on grasping natural science concepts rather than grappling with the language itself. These assertions find reinforcement from influential figures such as Dr. Somadoda Fikeni, traditionalist Zolani Mkiva, and historian-cum-cultural analyst Professor Pitika Ntuli, all of whom advocate for improved learner performance through instruction in the mother tongue.

Observations during lessons conducted in isiNdebele revealed instances of meaningful learning in classrooms, characterized by active learner interaction and comfortable questioning. In stark contrast, when English was employed as the register, interactions were limited, with learners observed in a more passive role, either remaining silent or simply concurring with the teacher's statements without delving into the lesson. The observed disparities in classroom interactions and discourses between different registers lead to the inference that the developed isiNdebele scientific language register for Natural Sciences does indeed exert a positive influence on meaningful learning. This aligns with the study's findings, which indicate that incorporating indigenous languages in teaching positively contributes to meaningful learning, subsequently enhancing overall performance. Consequently, the recommendation is made to develop and integrate scientific language registers in indigenous languages into the teaching and learning processes in South African schools.

Acknowledgement: I would like to express my gratitude for the support provided by the NRF grant from the Competitive Programme for Rated Researchers (CPRR).

REFERENCES

Adesemowo, A.K. (2017). Multilingualism as a learning scaffolding element: Reflection on first-year Information Communication Technology networking students. South African Journal of Education, 37(1), 11-16.

Chin, C. (2006). Classroom interaction in science: teacher questioning and feedback to students' responses. International Journal of Science Education, 28(11), 1315-1346.

Creswell, J.W. (2017). Qualitative inquiry and Research Design: Choosing among five approaches. Thousand Oaks: Sage.

Department of Basic Education. (2010). The status of the language of learning and teaching in South African public schools: A quantitative overview. Pretoria: Department of Basic Education.

Feez, S., & Quinn, F. (2017). Teaching the distinctive language of science: An integrated and scaffolded approach for pre-service teachers. Teaching and Teacher Education, 65, 192-204.

Getahun, Z., & Jibat, A. (2018). An assessment of factors that affecting academic performances of students': the case of Assosa general secondary and preparatory school, Ethiopia. Int J Afr Asian Stud, 45, 16-22.

Graesser, A. C., Gernsbacher, M. A., & Goldman, S. R. (Eds.). (2003). Handbook of discourse processes. Routledge.

Gudula, Z. (2017). The influence of language on the teaching and learning of Natural Sciences in Grade 7. The Influence of Language on the Teaching and Learning of Natural Sciences in Grade 7; hdl.handle.net. http://hdl.handle.net/11394/5962

Keeley, P. (2012). Misunderstanding misconceptions. Journal of Science Scope, 35(8), 1-12.

Kishindo, P. J. (2010). Multilingualism in education and communities in South Africa. Studies in the Languages of Africa, 41(1), 148 -153. https://doi. org/ 10. 1080/ 10228195.2010.495495

Lepheana, J. (2021). Perceptions of learners, teachers and parents on integrating isixhosa within curricula and pedagogies in junior secondary schools in the Maluti District, Eastern Cape Province, South Africa. Indilinga African Journal of Indigenous Knowledge Systems, 20(1), 111-123.

Madueño Serrano, M. L., Márquez Ibarra, L., & Manig Valenzuela, A. (2020). The Engineering Professors' Teaching Identity Formation as University Teachers: A Process of Sociocultural Construction. Journal of Turkish Science Education, 17(4), 504-519.

Maree, K. (2017). First step in research. Pretoria: Van Schaik Publishers.

Mario, M., Nandja, D. (2005). Literacy in Mozambique: Education for All Challenges. Paper Commissioned for the Education for All (EFA) Global Monitoring Report 2006 "Literacy for Life". Paris: UNESCO. http://unesdoc.unesco.org/images/0014/001462/146284e.pdf.

McKinney, C., & Tyler, R. (2019). Disinventing and reconstituting language for learning in school science. Language and Education, 33(2), 41-158.

Mkimbili, S. T. (2019). Meaningful science learning by the use of an additional language: A Tanzanian perspective. African Journal of Research in Mathematics, Science and Technology Education, 23(3), 265-275.

Mortimer, E., & Scott, P. (2003). Meaning Making In Secondary Science Classrooms. McGraw-Hill Education (UK).

Motloung, A. N., Mavuru, L., & McNaught, C. (2021). Teachers' beliefs and practices when teaching life sciences using their second language. South African Journal of Education, 41(sup1), S1-S15.

Msila, V. (2013). In search of a liberating practice: Leadership, teacher commitment and the struggle for effective schools.

Msimanga, A., Denley, P., & Gumede, N. (2017). The pedagogical role of language in science teaching and learning in South Africa: A review of research 1990–2015. African Journal of Research in Mathematics, Science and Technology Education, 21(3), 245-255.

Mudau, A.V. (2013). A Conceptual Framework for Analysing Teaching Difficulties in the Science Classroom. Mediterranean Journal of Social Sciences, 4(13),125.

Mweli, P. (2018). Indigenous stories and games as approaches to teaching within the classroom. In I. Eloff & E. Swart (Eds.), Understanding educational psychology (pp. 94–101). Cape Town, RSA: JUTA.

Nancy Carter, R. N., Bryant-Lukosius, D., & Alba DiCenso, R. N. (2014). The use of triangulation in qualitative research. In Oncology nursing forum 41(50), 545). Oncology Nursing Society

Nkanyani, T. E., & Mudau, A. V. (2019). Natural Sciences Teachers' Experiences on Teaching Planet Earth and Beyond Knowledge Strand. Journal of Turkish Science Education, 16(4), 478-488.

Ntuli, T. G., & Mudau, A. V. (2025). Development of an indigenous African language scientific register for natural sciences: Focussing on challenges, opportunities, and perceptions. Perspectives in Education, 43(3), 37–47. https://doi.org/10.38140/pie.v43i3.6581

O'Sullivan, K. (2018). English – medium Instruction at University in China- A Case Study. Journal of Arts, Science & Commerce, 9(3), p 1-4.

Oyoo, S. O., & Nkopodi, N. (2020). Towards a policy on teacher use of language during science teaching and learning in South Africa. Social Dynamics, 46(3), 471-492.*

Reis, G., & Ng-A-Fook, N. (2010). TEK talk: So what? Language and the decolonisation of narrative gatekeepers of science education curriculum. Cultural Studies of Science Education, 5(4), 1009-1026.

Sahin-Topalcengiz, E., & Yildirim, B. (2020). Teachers' opinions about distance web 2.0 tools training and

teachers' in-class web 2.0 practices. Journal of Turkish Science Education, 17(4), 561-577.
Tembe, J., & Norton, B. (2011). English education, local languages and community perspectives in Uganda. Dreams and realities: Developing countries and the English language, 117-140.
Tshotsho, P. (2013). Mother Tongue Debate and Language Policy in South Africa. Vol. 3 No. 13 University of Fort Hare
Vygotsky, L.S. (1978). Minds in society: The development of higher mental process. Cambridge, MA: Harvard University Press.
Writer, S. (2022). Big language changes planned for schools in South Africa. Business Tech, March.10.