African Perspectives of Research in Teaching and Learning Journal
Issue 1, Volume 8, 2024
ISSN Print: 2521-0262
ISSN Online: 2662-012X
ORIGINAL RESEARCH

Forms of translanguaging in Zimbabwe's classrooms: Are the practices useful or useless in the teaching and learning of STEM subjects?

Paul Svongoro[1] and Wellman Kondowe[2]

[1]*University of Western Cape, Republic of South Africa.*
[2]*Mzuzu University, Republic of Malawi.*

***Corresponding author**:4080786@myuwc.ac.za*

Abstract

Although translanguaging is a growing discipline in the field of education in other parts of the world, it is still under-researched in Zimbabwe. However, Zimbabwean teachers often use various forms of translanguaging to engage their students and help them use their full linguistic resources in academic subjects. This study aimed to explore the various forms of translanguaging used by STEM subject teachers in Mutare, Zimbabwe, assess their effectiveness, and propose the most useful form(s) based on the learners' level and the language demographics of their classes. Data for the study were collected through observation of STEM classes at selected schools and tertiary institutions in Mutare, Zimbabwe, and three Focus Group Discussions with 29 STEM subject teachers and lecturers from 11 institutions from Mutare Urban District. The collected data were analyzed using Makalela's (2016) Ubuntu Translanguaging Pedagogy (UTP). The study found that most STEM subject teachers have embraced translanguaging as a normal practice in multilingual classrooms. Furthermore, the study established that instructors at different levels are beginning to appreciate that translanguaging is a strategy they can use to help students draw on all their linguistic resources when reading, writing, and discussing academic subjects in a new language. STEM teachers adopted different forms of translanguaging for different learners. The conclusion the study makes is that, when STEM subject teachers use translanguaging, a student's home language can serve as a scaffold for learning additional languages and academic content in the new language, leading to better engagement and involvement of learners in subjects often perceived as difficult.

Keywords: bilingual classrooms, STEM subjects, translanguaging, Zimbabwe.

Introduction

The question of which language(s) to use for teaching and learning has dominated academic discourse in bilingual and multilingual contexts such as Zimbabwe. In most African countries with a history of colonialism, this question has continued to pre-occupy many governments after the countries gained their independence. The sentence does not read well. Although some countries have made significant strides towards addressing this question (e.g., Tanzania and Nigeria), it remains unanswered in the majority of African countries.

English is still used as the primary language in schools in countries where bilingualism is not addressed, posing challenges for both learners and teachers. This issue is particularly pronounced in township, rural, mining, and farm schools where students only speak their mother tongue. Despite years of training, teachers in South Africa still struggle to teach in English or effectively communicate with bilingual learners (Ngubane, Ntombela & Govender, 2020). As a result, they often employ translanguaging as a communication strategy.

According to García (2011), translanguaging is the process in which bilingual learners and teachers engage in multifaceted conversational or dialogic practices that embrace all language practices of learners in order to build new language practices for meaningful learning in the classroom. Translanguaging therefore, affords teachers and learners in multilingual classrooms an opportunity to access their various linguistic

repertoires for different communicative purposes (Baker, 2011; Makalela, 2014).

Translanguaging is gaining prominence globally, but its research in Zimbabwe is still underdeveloped. Zimbabwean teachers often use various forms of translanguaging in their teaching, both consciously and subconsciously. Research shows that good teachers, whether bilingual, English as a second language (ESL), or mainstream teachers with emergent bilinguals, help students use their full linguistic resources in academic subjects (Garcia, Johnson & Seltzer, 2017). Teachers teaching STEM subjects often have to assist learners and students in using their cognitive and linguistic resources to learn academic English and academic content in English.

The language situation in Zimbabwe's education system

Zimbabwe is a multilingual nation with a constitution that recognizes 16 official languages, with three being the dominant ones, Shona, Ndebele, and English. Other minority languages include Kalanga, Chewa, Chibarwe, Koisan, Nambya, Ndau, Shangani, Sign language, Sotho, Tonga, Tswana, Venda, and Xhosa, spoken by about 10% of the population (Constitution of Zimbabwe Amendment Number 20 of 2013). The Constitution also allows Parliament to prescribe other officially recognized languages and languages of record.

However, Zimbabwe, like many African countries, has a policy of using the former colonial language, English, as the official language in parliament, trade, industry, mass media, and education. Although Shona and Ndebele are now accepted for use in certain domains, English remains the national official language. The latest Education Act (1987, as amended in 1990 and 2016) states that English remains the dominant language in education. The latest Education Act (1987, as amended in 1990 and 2016) makes the following key pronouncements:

(1) The three main Zimbabwean languages, Shona, Ndebele, and English, will be taught in primary schools starting from first grade. Shona and English will be taught in areas where the majority of residents speak Shona, and Ndebele and English will be taught in areas where the majority speak Ndebele.

(2) Before fourth grade, the medium of instruction can be chosen from either paragraph (a) or (b) of Sub-section 1, based on the most commonly spoken and understood language among the pupils.

(3) Starting from fourth grade, English will be the medium of instruction, with Shona or Ndebele taught equally as the English language.

(4) In areas where minority languages exist, the Minister may authorise the teaching of such languages in primary schools in addition to those specified in sub-section (1), (2) and (3). (Part XI, Section 55, p.255)

The Act emphasizes English as the primary language in Zimbabwe's early primary school instruction, despite other languages having a small degree of prominence. English is considered the language of power and economic wellbeing, but many children start school with low or no English proficiency, leading to concerns about difficulty in learning and detracting from previous mother tongue knowledge, affecting teachers and parents (Nhongo & Tshotsho, 2020).

The implementation of the Act in Zimbabwe faces challenges due to a lack of proficient teachers in minority languages and the failure to consider the lower primary medium of instruction. English remains the dominant language, with a minimum pass level of five "O" level subjects, including one English subject, and indigenous languages like Shona and Ndebele not acceptable substitutes.

Regarding the teaching of Shona as a subject, Chiwome and Thondhlana (1990) found that some teachers prefer English for Shona teaching at university level, while some students prefer writing essays in English. Research shows code switching between languages (Chitiga, 1994, Nhongo & Tshotsho, 2020; Charamba, 2020). The significance of this practice is yet to be determined. Another problem is that, bilingualism in Zimbabwe and other African countries is criticized for denigrating indigenous languages' socio-cultural attributes, leading some educated Africans to abandon their mother tongues (Sure & Webb, 2000; Poza, 2016; Charamba, 2020).

Zimbabwe's education system continues to favour English, largely due to a lack of conscious efforts to enhance students' cognitive, affective, and social skills in their mother tongue (e.g., Nhongo & Tshotsho, 2020; Charamba, 2020; Dlodlo, 2021). This dominance is attributed to a lack of efforts to promote the use of the mother tongue in technological and intellectual discourse, as well as a negative attitude towards work, loyalty to one's country, and tolerance for diversity (Charamba, 2020; Dlodlo, 2021). This results in a lack of understanding and appreciation for the importance of language in education.

Research objectives

In the light of the background provided above, this study sought to:

(i) explore the various forms of translanguaging STEM subject teachers use to engage their learners and students;

(ii) assess the effectiveness of the different forms of translanguaging used by teachers and;

(iii) propose the most useful form(s) of translanguaging teachers can adopt based on the level of the learners and the language demographics of their classes.

Literature review

To situate the study in its proper context, the researchers conducted a review of the available literature under the headings below.

An overview of translanguaging

As already alluded to, in Zimbabwe, English is taught as a second or third language in primary schools, with Shona, Ndebele, and English taught in areas where the majority of residents speak Shona and Ndebele (Zimbabwe's Education Act (1987), as amended in 1990 and then 2016). STEM classes are typically bi/multilingual contexts in Zimbabwe, as learners and teachers can speak their home languages and English as a second language. Similar experiences are found in other subjects like English, Literature, Geography, and Agriculture where English is used as the medium of instruction.

According to García (2011) and further supported by Makalela (2014), translanguaging, coined by Williams in 1996 in Wales, is a powerful learning tool for multilingual classrooms. It allows students and teachers to use both English and Welsh for meaning-making and deep understanding of concepts. Scholars have adopted this term for pedagogical purposes in multilingual academic contexts, enhancing learning experiences and identity development (Baker 2011; Garcia, 2011; Garcia & Wei, 2014, Wei, 2016).

According to Baker (2011), translanguaging is a process where bilingual or multilingual learners and teachers integrate multiple languages to enhance understanding and knowledge. It involves organizing and mediating mental processes for communication and learning (Canagarajah, 2011). In a translanguaging classroom, teachers and learners strategically use their home language and the language of instruction for communication, contradicting monolingual ideologies that traditionally promote separate language use for educational purposes (Makalela, 2015).

In short, translanguaging in educational settings facilitates a seamless transition between languages, enhancing learners' comprehension, affirming their multilingual identities, and promoting multilingualism (García & Wei, 2014; Makalela 2019; Maseko & Mkhize, 2019). This phenomenon is not exclusive to Zimbabwe but is universal, particularly in situations where teaching and learning occur in teachers' and learners' second languages, especially in multilingual societies.

Translanguaging research in different parts of the world

Renowned academics like Garcia (2011), Wei (2011), Canagarajah (2011), Lewis, Jones, and Baker (2012), have influenced the field of translanguaging research being conducted in Europe and the USA. These academics have added to our knowledge of translanguaging in classrooms by elucidating its history and emphasizing its advantages. Translanguaging, as demonstrated by recent studies, improves students' comprehension of the material being learned and helps teachers and bi/multilingual learners improve their weakest languages.

Canagarajah (2011) synthesizes research on translanguaging across various academic fields and social contexts, highlighting the need for more than just communication and competency. The review also highlights the lack of instructive translanguaging procedures and the need for further research and development in teaching strategies for co-construction of meaning. Canagarajah (2011) highlights the applications of translanguaging in academic reading, internet communication, youth conversation, hip hop, children's interactions, street signage, and indigenous literacy. While Canagarajah's assertion points to the many applications of translanguaging, this article focuses on the literature related to translanguaging in academic settings.

Translanguaging is gaining interest from teachers in classrooms and social settings, but its practical and theoretical aspects remain unexplored. A study in South Africa's township schools found that bilingual teachers use translanguaging practices for pedagogical and pastoral purposes, enhancing learners' cognition of writing concepts and stimulating active participation (Ngubane, Ntombela & Govender, 2020). It also serves as a useful learning resource in multilingual contexts where English is an obstacle, restoring bilingual learners' identity. Similarly, Mbirimi-Hungwe's (2020) study on translanguaging in South African classrooms found that it improves students' comprehension of academic concepts. The study involved five first-year medical students and found that translanguaging helps them understand difficult English concepts. The findings suggest that multilingualism can be leveraged by using translanguaging in multilingual classrooms, utilizing students' linguistic resources to enhance understanding.

More relevant to this study is Charamba and Zano's 2019 study which investigated the impact of translanguaging in a South African Chemistry classroom. The research aimed to understand the role of language in the academic performance of science students taught in a different language. The study used a mixed-methods design, with 30 tenth-grade students surveyed on the role of language in their Chemistry education. Data from three tests and interview responses revealed a significant difference in academic achievement between the two groups in the post-test.

The increase in research on translanguaging shows that deliberately replacing input and output languages in Chemistry students' home languages is an essential instructional approach. This aligns with previous research, which supports the use of students' mother tongue as a social practice beyond the classroom walls, as per Charamba and Zano's (2019) findings.

Research on translanguaging as a teaching strategy in Zimbabwe

While there is a rich body of translanguaging literature on South Africa as indicated above (see for example Makalela, 2016 & 2019; Ngubane, Ntombela & Govender, 2020; Charamba & Zano, 2019; Mbirimi-Hungwe, 2020)., translanguaging research in Zimbabwe in very recent phenomena. To the researchers' knowledge, translanguaging practices in the Zimbabwean contexts have been by a handful of researchers including Nhongo and Tshotsho (2019), Dlodlo (1999; 2021) and Charamba (2022) just to name some of the few studies that have focused on translanguaging in STEM subjects.

A study by Nhongo and Tshotsho (2019) in Zimbabwe's STEM classrooms examined translanguaging practices in STEM subjects. English is the sole language of instruction, and the study found that while teachers and linguists are aware of the cognitive benefits of including learners' first languages, perceived inadequacy in African languages terminologies and fear of isolation remain hindrances. The study suggests that if African languages are included through translanguaging, fears of isolation and misconceptions of inadequacies in terminologies would be conquered. The study concludes that the inclusion of African languages in STEM subjects should not be seen as a complete dislodge from English.

Charamba's 2020 study also found that using a different language of instruction, such as translanguaging, significantly impacts students' academic underachievement. The study involved 40 fourth-grade Science and Technology students from Bikita district, Zimbabwe, who were

randomly assigned to either a control or experimental group. The experimental group received translanguaging-informed intervention, while the control group followed a traditional monolingual approach (Charamba, 2020).

Finally, Dlodlo's 2021 study explores the use of European languages in Sub-Saharan African education, particularly science teaching, despite political independence (Dlodlo, 2021). Despite studies showing children learn best in their mother languages, countries like Zimbabwe continue to offer monolingual teaching. Dlodlo proposes translating science terms and concepts into indigenous languages, using quantum mechanics and his mother tongue, isiNguni, to improve science literacy and interest. He recommends revising African countries' language and education policies to ensure the maximum use of indigenous languages in science and technology.

However, despite the recommendations made by these researchers regarding the importance of translanguaging pedagogy, policy makers and stakeholders seem to have remained stuck in monolingual pedagogies as they regarding a move towards translanguaging as a move aimed at dislodging the privileged position of English in Zimbabwe's education.

Methods

This qualitative case study used two methods of data collection: non-participant observation of STEM classes at selected schools and tertiary institutions in Mutare, Zimbabwe, and observation of 11 lessons from 11 institutions in Mutare Urban District. This enabled the researchers to collect naturally occurring data during STEM subject lessons (Cohen, Manion & Morrison, 2011). The observations included Grade 7 Maths classes, 35-minute Ordinary level Physics, Maths, Computer technology, and Chemistry classes, and one-hour lectures for first-year college/university students in Maths, Biology, Physics, Engineering drawing, and Fluid Mechanics.

The researchers chose to observe lessons and lectures at the back of the classroom, assuming a non-participant observer role. The researchers were not involved in classroom activities, but their presence was noticeable, especially at primary and secondary school levels. Teachers and lecturers did not consent to being video-recorded, so lessons were audio-recorded and transcribed verbatim. Observation notes were also used to complement the audio-recordings. The researchers' presence was unnoticed, especially at primary and secondary school levels where learners are familiar.

The study involved 11 institutions from Mutare urban district, selected using convenience sampling method. The participating institutions included three primary schools, four secondary schools, and four tertiary institutions. Seven STEM subject teachers participated from three primary schools, nine from four secondary schools, and 13 from 13 tertiary lecturers. Four tertiary institutions were public and private universities. Three Focus Group Discussions (FGDs) were conducted, organized according to the levels of teaching. A total of 29 STEM subject teachers and lecturers participated in the discussions. The convenience sampling method ensures data collection from convenient population members (Lewis & Thornhill, 2012). The study highlights the importance of convenience sampling in research.

The study analyzed STEM lesson observations in schools and tertiary institutions, revealing that none of the students and teachers were first language English speakers. However, language differences were observed as students moved from primary to secondary and tertiary institutions. At primary and secondary schools, learners and teachers had almost homogeneous language backgrounds, while at tertiary level, they had more heterogeneous backgrounds. Teachers and learners also used a township variety of Shona for communicative purposes, known as Shona slang.

However, tertiary institutions often have a diverse range of first languages among lecturers and students, with the majority speaking Shona and Ndau, and a significant number speaking Ndebele. This is due to the fact that these institutions enroll students from all over the country, unlike primary and secondary schools. The private institution in the study, which has staff and students from 29 African countries, had eight dominant languages, including ChiShona, French,

Portuguese, Ndebele, Swahili, Kenya-Rwanda, ChiNdau, isiZulu, Nyanja, Tonga, Chewa, and Lingala.

The study analyzed participants in tertiary institutions who spoke different first languages but were not grouped by their first languages. Instead, they were observed using translanguaging practices during STEM subjects to understand the interrelatedness and fuzzy boundaries of languages. This was based on the assertion of critical poststructuralists who advocate for treating languages as interrelated entities that form a single linguistic repertoire, rather than separate entities (Makoni & Pennycook, 2007; García & Wei, 2014; Makalela, 2016; Wei, 2016). The collected data were analysed systematically from a critical poststructuralist perspective using recurring themes from FGDs and from lesson observation notes.

Theoretical framework

The study is situated in the critical post-structural turn, which contrasts with monolingual ideologies that view languages as separate entities, as articulated by Makoni and Pennycook (2007), Garcia and Wei (2014), Wei (2016), and Makalela (2016).

Makalela (2016) argues that the term "language" was a colonial invention, disrupting the linguistic ecosystem by European missionaries' efforts to standardize languages. He argues that monolingual ideologies were created for selfish reasons and Africa's inheritance of one-nation-one-language ideologies permeated European thinking until the 19th century (Heller, 2007; Makoni & Pennycook, 2007). Makalela proposes Ubuntu Translanguaging Pedagogy (UTP) in South Africa as an answer to monolingualism, highlighting the use of monoglossic language "policing" as an example (Makalela, 2016).

Makalela (2016) argues that South Africa's multilingualism can be traced back to the 10-13th century AD in the Limpopo valley. Despite their linguistic differences, the people of the region had a worldview of belonging together (Ubuntu), which guided their interactions. This concept, known as the UTP concept, is an educational approach that acknowledges language alternation as a norm in multilingual academic settings. Ubuntu, an African word, signifies the connectedness between people, allowing them to recognize the loosely defined boundaries of languages and live in harmony. This concept is crucial in understanding the dynamic multilingualism of South Africa.

Unfortunately, as Makalela (2016) rightly speaks, the interconnectedness of languages and African sense of belonging have been significantly impacted by colonialization and linguistic monopolization by colonial settlers. These settlers assigned multilingual resources into monolithic entities, labeling them as first and second languages, and relegating African languages to separate entities (Makoni & Pennycook, 2007). English became the dominant language for business, government, and education, while African languages were relegated to the periphery (Makalela, 2016). Thus, using Makalela's UTP framework, the current study sought to find out teacher's perceptions about the use of translanguaging during their lessons in STEM-related subjects in Zimbabwe.

Ethical consideration

The researcher first explained the purpose and the process of the research to the participants. Participants then voluntarily consented to participate in the study by signing consent forms. As participating teachers at all levels refused to be video-recorded during lesson observation and FGDs, the researchers respected this choice and had to rely on audio recording and notes taken during lesson observations and FGDs. The research was approved for ethics by the lead researcher's institution. The institution which granted ethics approval was also investigated in this study.

Findings and Discussion

As explained in the methodology above, data for the study were collected through observation of STEM-related lessons and focus group discussions (FGDs) with STEM subject teachers at different levels in Zimbabwe's education system. The collected data were analysed systematically according to the recurring occurrences from the researchers' observations of

STEM classes and dominant views that emerged from the FDGs with STEM subject teachers.

Findings from observation of STEM subject classes

Researchers observed that quiet learners in STEM classes at primary and secondary school levels actively participated in the lesson when English questions were paraphrased in Shona by the teacher. They participated more freely in group discussions in their home language. When solving problems in groups, they used their first languages to assist each other, resulting in intimate participation with peers. Additionally, learners and students at all levels showed better or increased understanding when a teacher paraphrased English questions in Shona or another language. Learners and students showed this understanding by making utterances such as: Oh I see, Now I get you, Ohh that one, I now understand. How come I was lost all along? These confirmations were not made when the teacher initially made his/her explanation in English.

Apart from the above findings, the study found that when a teacher paraphrases in another language, learners show more participation in the classroom, either by answering questions or seeking clarification. This participation is not observed when the teacher uses only English. The researchers also found that flexible translanguaging approaches were more interesting, active, and interactive than rigid monolingual approaches. For example, when teachers used standard Shona and Shona slang, learners became more excited, connected, and involved in classroom activities.

Findings from FGDs with STEM subject teachers

From the FGDs with STEM subject teachers who taught at different levels, the following were identified as the dominant issues.

(a) Teachers who rigidly used the fixed monolingual approach

FGDs with primary, secondary, and tertiary level teachers in Zimbabwe revealed that a significant number of them use a fixed monolingual approach, rigidly using English as the language of instruction. This is due to the prescribed education policy or university policy, as Zimbabwe's Education Act prescribes English as the language of instruction from Grade 4 upwards. Most tertiary institutions also stipulate English as the language of instruction in their language policy documents.

Apart from the above, the teachers also indicated that the lack of equivalent scientific terms in Shona forced them to stick to English as the language of instruction during their classes. However, to address this challenge, Dlodlo (1999; 2021), has since shown that there is potential in translating scientific terms across European languages into African languages such as Nguni languages. Previous researchers have since argued that, rather than teaching learners in a language that neither themselves nor their teachers master, it is important to use the learners' first language (L1) in the teaching of STEM subjects for better outcomes (Brock-Utne, 2012; Nomlomo & Mbekwa, 2013).

When university instructors were asked the questions regarding whether they used translanguaging during their lessons, the majority indicated that because classes were far more heterogeneous in their composition, the use of English as the sole language of instruction as opposed to translanguaging was necessary. Under such circumstances, translanguaging would be seen as giving a few students an advantage over others. This was a reasonable step to take considering that, at one of the universities studied, students and teachers spoke different African and European languages as their first languages.

Finally, in response to the questions regarding whether they used translanguaging in their lessons, a few teachers indicated that they chose not to and instead opted for the rigid monolingual approach. Their reasoning was that they feared backlash from English language teachers who considered their efforts at teaching the language as not being supported by teachers who used translanguaging during lessons especially in situations where some schools especially primary and secondary schools had some NO Shona speaking rules. The teachers therefore feared to contaminate their colleagues' English and violate NO SHONA speaking rules.

(b) Teachers who used the flexible multilingual approach

During discussions with primary, secondary and tertiary level teachers, the second group of teachers indicated that they used a more flexible, multilingual approach in their classes. Teachers who used this approach indicated that there were instances when they found it necessary to use culturally relevant content, examples and situations in their teaching. For such teachers, translanguaging therefore helped them disambiguate ambiguous situations, demystify some concepts and made abstract concepts more real. One of the strategies used by the teachers who used the flexible multilingual approach was to find equivalent terms in their learners' and students' first language(s) to replace scientific terms in their subjects.

Below are some examples of STEM subject concepts that have equivalent terms in the L1 of teachers/learners which were used during lessons/lectures.

Table 1: STEM subject concepts and their equivalences in learners' and students' L1

STEM CONCEPTS IN ENGLISH	SHONA EQUIVALENCES	NDEBELE EQUIVALENCES
force	simba	udli
power	simba	amandla
acceleration	kumhanya	isiqubu
length	urefu	ubude
width	upamhi	ububanzi
speed	mamhanyiro	ijubane

When teachers used the above L1 equivalences to explain, illustrate, paraphrase and pose questions during their lessons, learners showed a better appreciation of the concepts being dealt with during a lesson. When asked to solve a Mathematics or Physics problem in small groups for instance, the learners and students also used L1 equivalent concepts as they shared solutions with their peers.

Apart from using first language equivalent terms of STEM concepts, teachers who used the flexible multilingual approach were also found to use another form of translanguaging. This form of translanguaging involved the use STEM concepts directly borrowed from English and localized into teachers'/learners' first languages. In Table 2 below, the researchers illustrate some of these borrowed concepts which were localized into the learners' or students' first languages.

From the few examples shown in Table 2 below, teachers reported that when they speak in their learners' or students' first languages using words borrowed from English which have been localized into the learners' first languages, this form of translanguaging encouraged their students who were usually quiet in class to participate by using any of their linguistic resources.

In a similar fashion to the above, where lecturers did not speak the same languages as their students, they allowed their students' repertoires to enter the classroom discourse e.g during break-away sessions during online and blended learning and during group discussions. However, after engaging in group discussions in the first languages, the learners and students reported their findings to the class in English which is the prescribed language of instruction. The teachers were surprised by how well this approach worked.

Finally, where the language backgrounds of their learners were similar especially at primary and secondary school levels, teachers also indicated that using learners' language improved their relationship with their learners especially when the teachers used Shona slang alongside mainstream Shona. This approach is what Pennycook (2010) terms metrolinguistics. Metrolinguistics captures the fluid and hybrid language practices of the youth in the city.

Table 2: STEM concepts directly borrowed from English and localized into teachers'/learners' L1

STEM CONCEPTS IN ENGLISH	LOCALIZED SHONA CONCEPT	LOCALIZED NDEBELE CONCEPT
electron(s)	erekituroni/maerekituroni	i-elekthoni
photon(s)	fotoni/mafotoni	ifothoni
neutron(s)	nyuturoni/manyuturoni	inutloni
proton(s)	purotoni/mapurotoni	iplothoni
vector(s)	vhekita/mavhekita	ivektha
molecule(s)	Morikuru/mamorikuru	imolenkulu

From the few examples shown in Table 2 above, teachers reported that when they speak in their learners' or students' first languages using words borrowed from English which have been localized into the learners' first languages, this form of translanguaging encouraged their students who were usually quiet in class to participate by using any of their linguistic resources.

In a similar fashion to the above, where lecturers did not speak the same languages as their students, they allowed their students' repertoires to enter the classroom discourse e.g during break-away sessions during online and blended learning and during group discussions. However, after engaging in group discussions in the first languages, the learners and students reported their findings to the class in English which is the prescribed language of instruction. The teachers were surprised by how well this approach worked.

Finally, where the language backgrounds of their learners were similar especially at primary and secondary school levels, teachers also indicated that using learners' language improved their relationship with their learners especially when the teachers used Shona slang alongside mainstream Shona. This approach is what Pennycook (2010) terms metrolinguistics. Metrolinguistics captures the fluid and hybrid language practices of the youth in the city.

Forms of translanguaging teachers and learners used

During observation of STEM subject lessons and also confirmed by STEM subject teachers during FGDs, teachers, learners and students used different forms of translanguaging. One common form of translanguaging among teachers was asking a question in one language and then rephrasing it in another. The few examples below were taken note of during observations of Ordinary level Mathematics lessons involving three-dimensional shapes.

Table 3: Translanguaging by way of paraphrasing the language of instruction into the learners' L1

	ENGLISH ONLY VERSION	PARAPHRASED VERSION IN LEARNERS' L1
Teacher 1	A sphere is a three dimensional solid shape which is round, has no edges.	*Sphere ishepi yedenderedzwa ine masaidhi matatu asi isina mativi akapinza sezvakaita girobhu rekuGreography kana bhora ramunotamba panze.*
Teacher 2	A cone is another three dimensional geometric shape, has a flat base, curved surface and a point called the apex or vertex on top.	*Koni yandiri kutaura nezvayo ine mativi matatu, iri furati pasi, yakada kutenderera ichindopinza kumusoro kwacho sezvakaita denga redzimba dzedu dzekumusha.*

Another form of translanguaging used in a similar way to the above was code mixing and switching by teachers and learners. From Table 3 above, two examples can be drawn to illustrate code mixing in which English and Shona words were used in the same utterance. Note that the

italicized words are the Shona words and the words not italicized are the English ones.

(a) Sphere ishepi yedenderedzwa… (A sphere is a round shape…)

(b) …sezvakaita girobhu rekuGreography… (…just like the globe you use in Geography…)

Thirdly, teachers observed that students frequently engaged in thought processes in one language and expressed their ideas in another, as they discussed and recorded ideas in their first language and presented them to the class in English using a translation method, confirming the students' continuous communication and understanding.

During FGDs, teachers confirmed that they frequently engaged students by incorporating cultural objects into their teachings about shapes, volume, density, and other shapes like cones, pyramids, and cubes. In Figure 3 above, the teachers tried to make their learners imagine what kind of shapes the sphere and the cone were by making reference to the learners' contextual or word-view and cultural references as shown in the examples below:

(a)…***girobhu rekuGreography*** kana ***bhora*** ramunotamba panze. (…the globe you use in Geography or the ball you play outside).

(b)…sezvakaita ***denga redzimba dzedu dzekumusha***. (…just like the roof of our huts in the rural areas)

By making reference to the sphere using Shona equivalences of 'a globe used in Geography or the ball the learners play during their free time', the teacher was trying to demystify the shape called the sphere by using names of objects the learners are more familiar with. Similarly, when the teacher also referred to 'the roof of the village hut' as the cone, he was also trying to make the learners understand these objects in the context of their own culture.

Researchers also observed that some university students alternated between languages during class, with some taking notes in French and English, while others took notes in Portuguese and English, as shown in the following examples.

(a) **Student 1: Taking notes during a lesson on volume using Portuguese and English:**

a quantidade de espaço que uma substância an object occupies, ou que está fechado dentro de um recipient

(b) **Student 2: Taking notes during a lesson on cerebral malaria using French and English**

Paludisme cérébral: Swelling du cerveau ou des lésions cérébrales peuvent survenir, dans certains cas de paludisme. Le paludisme cérébral malari may cause coma.

(c) **Student 3: Taking notes during a lesson on urine analysis using French and English**

Urine analysis includes divers tests pour examiner le contenu de l'urine à la recherche d'anomalies indiquant une maladie or infection.

From the three examples above, it is evident that STEM classes are translanguaging environments, with students using translanguaging to engage with subject content. This is evident in code switching between European languages and African languages like Shona and isiNdebele, which are widely used in Zimbabwe for STEM-related topics. This localization of vocabulary helps students better understand and engage with the subject matter as shown in Figures 1, 2 and 3 above.

When the students cited in the above examples were further probed regarding their choices of code switching, one student responded:

It saves me time. Instead of worrying about the terminology the professor is using in English, I make my notes in my own language. I also find it helpful for modifying my notes. That is why I translate using a technique that allows me to flip between French and English frequently.

In view of the three examples and student's response presented above, the researchers agree with previous studies that there is no justification for believing that English is better for

learning STEM than other languages, as English is considered the language of science and technology (Charamba, 2020; Dlodlo, 2021). They argue that engaging with local language and knowledge is necessary for effective teaching and learning.

Finally, teachers also confirmed that university students often translate texts into their first languages, such as French or Portuguese, before reading them in English. This method, which can be time-consuming, enhances their understanding of English-based subjects, which is often their second or third language. This form of translanguaging, which was confirmed during FGDs, was found to be beneficial for students studying for courses.

Conclusion

The study investigated the use of translanguaging in STEM subjects in Mutare, Zimbabwe. It aimed to assess its effectiveness and propose the most useful form based on learners' level and class demographics. The data shows that most teachers are embracing translanguaging as a normal practice in bilingual classrooms. Thus, teachers at different levels are beginning to appreciate the strategy, as it helps students use their linguistic resources during group discussions. The study established that teachers and learners adopt different forms of translanguaging for different learners, such as using Shona and English or Shona, English, and Shona slang or using English and other European languages such as Portuguese and French.

This study confirms that teachers in Zimbabwe, at all levels, use translanguaging to help students make meaning and learn, despite the prevalence of monolingual instruction and language separation in language education programmes. Translanguaging transforms actions and leads to substantive teaching and learning. This aligns with previous research in Africa, which has shown that monolingualism is ineffective in enhancing school experiences or providing necessary pedagogic and cognitive support in multilingual classrooms (e.g., Makalela, 2016 & 2019; Mbirimi-Hungwe, 2020; Charamba, 2020)

The study's conclusion is that teachers should adopt a translanguaging model of teaching STEM-related subjects at the primary, secondary, and tertiary levels. This model involves not only using English, which is the prescribed language of instruction, but also using all other languages that are available to them in order to improve the teaching and learning processes. This is because languages have no fixed boundaries and are therefore, not compartmentalized. Teachers should also let their students and learners make use of all the language resources available to them. Teachers of STEM subjects can employ translanguaging to help students acquire academic content in a foreign language while also using their home language as a scaffold for language acquisition. Nonetheless, the researchers concur with Nhongo and Tshotsho's (2019) assessment that translanguaging should be seen as a valuable tactic rather than as a step toward substituting African languages for English as a medium of instruction in STEM fields.

Acknowledgements

The National Institute for the Humanities and Social Sciences (NIHSS) and the Andrew W. Mellon Foundation (AWMF) provided support that allowed this work to be completed. All of the writers' opinions, results, conclusions, and suggestions, however, are retained in this paper. In this regard, neither the AWMF nor the NIHSS assume any liability.

ORCID

Paul Svongoro: https://orcid.org/0000-0002-3186-339X

Wellman Kondowe: https://orcid.org/0000-0002-2500-4580 .

References

Auer, P. (1999). From codeswitching via language mixing to fused lects: Toward a dynamic typology of bilingual speech. International Journal of Bilingualism, 3, 309– 332.

Baker, C. (ed.) (2011). Foundations of bilingual education and bilingualism. Bristol, UK: Multilingual Matters.

Blommaert, J. (2008). Grassroots literacy: Writing, identity and voice in Central Africa. London: Routledge.

Brock-Utne, B. (2012). Language policy and science: Could some African countries learn from some Asian countries? International Review of Education, 58, 481-503.

Canagarajah, S. (2006). The place of World Englishes in composition: Pluralization continued. College Composition and Communication, 57, 586–619.

Canagarajah, S. (2011). Code meshing in academic writing: Identifying teachable strategies of translanguaging. Modern Language Journal, 95(3), 401–417

Charamba, E. (2020). Translanguaging: developing scientific scholarship in a multilingual classroom, Journal of Multilingual and Multicultural Development, 41:8, 655-672.

Charamba, E & Zano, K. (2019). Effects of translanguaging as an intervention strategy in a South African Chemistry classroom, Bilingual Research Journal, 42(5), 1-17

Chiwome, E. & Thondhlana, J. (1990). Sociolinguistics and education: A survey concerning attitudes on the teaching of Shona through the media of Shona and English. In R. K. Herbert (Ed), Language and society in Africa (pp. 247- 263). Cape Town, South Africa: Witwatersrand University Press.

Chitiga, L. (1994). Codeswitching in the classroom. Unpublished MA thesis, University of Zimbabwe, Harare, Zimbabwe.

Cohen, L., Manion, L., & Morrison, K. (eds). (2011). Research methods in education. London: Routledge.

Cope, B., & Kalantzis, M. (eds.). (2000). Multiliteracies: Literacy learning and the design of social futures. London and New York: Routledge.

Creese, A., & Blackledge, A. (2010). Translanguaging in the bilingual classroom: A pedagogy for learning and teaching? The Modern Language Journal, 94(1), 103–115.

Dlodlo, T. S. (1999). Science Nomenclature in Africa: Physics in Nguni. Journal of Research in Science Teaching, 36(3), 321-331.

Dlodlo T. S. (2021). Translating scientific terms across European and African languages—Physics in Nguni II. WINHEC: International Journal of Indigenous Education Scholarship, 16(1), 91-112.

García, O. (2011). From language garden to sustainable languaging: Bilingual education in a global world. Perspectives, 34(1), 5–9.

García, O., & Wei, L. (2014). Translanguaging: Language, bilingualism and education. London, UK: Palgrave Pivot.

García, O., Johnson, S., & Setlzer, K. (2017). The Translanguaging classroom: Leveraging student bilingualism for learning. Philadelphia: Caslon.

García, O. (2019). Decolonizing foreign, second, heritage and first languages: Implications for education. In D. Macedo (ed.), Decolonizing foreign language education, pp. 152-168. New York: Routledge.

Government of Zimbabwe. (2013). Constitution of Zimbabwe, Amendment Act No.13. Harare, Zimbabwe: Government Printers.

Government of Zimbabwe. (1987). Zimbabwe Education Act. Harare, Zimbabwe: Government Printers.

Gutierrez, K. (2008). Developing a sociocritical literacy in the third space. Reading Research Quarterly, 43, 148–164.

Jørgensen, J. N. (2008). Poly-Lingual languaging around and among children and adolescents. International Journal of Multilingualism, 5(3), 161–176.

Lewis, G., Jones, B., & Baker, C. (2012). Translanguaging: Origins and development from school to street and beyond. Educational Research and Evaluation: An International Journal on Theory and Practice, 18, 641–654.

Makalela, L. (2016). Ubuntu translanguaging: An alternative framework for complex multilingual encounters. Southern African Linguistics and Applied Language Studies, 34, 187–196.

Makalela, L. (2015). Moving out of linguistic boxes: The effects of translanguaging strategies for multilingual classrooms. Language and Education, 29(3), 200–217.

Makalela, L. (2014). Teaching Indigenous African languages to speakers of other African languages: The effects of translanguaging for multilingual development. In C. Van der Walt & L. Hibbert (Eds.), Multilingual teaching and learning in higher education in South Africa (pp. 88–104). Clevedon, South Africa: Multilingual Matters.

Makoni, S. & Pennycook, A. (2007). Disinvesting and reconstituting languages. Clevedon, England: Multilingual Matters.

Maseko, K., & Mkhize, D.N. (2019). Translanguaging mediating reading in a multilingual South African township primary school. International Journal of Multilingualism, 18(3), 455-474.

Mbirimi-Hungwe, V. (2020). Translanguaging as an act of emancipation: Rethinking assessment tools in multilingual pedagogy in South Africa. Per Linguam, 37(1), 97-108.

Motlhaka, H., & Makalela, L. (2016). Translanguaging in an academic writing class: implications for dialogic pedagogy. Southern African Linguistics and Applied Language Studies, 34(3), 251–260.

Nhongo, R., & Tshotsho, B.P. (2020). Is terminology the real problem in failure to implement STEM Education in African languages? Translanguaging as an intervention strategy. Multicultural Education, 6 (4), 78-89.

Ngubane, N., Ntombela B.K., & Govender, S. (2020). Translanguaging pedagogy in selected English First Additional Language writing classrooms. Southern African Linguistics and Applied Language Studies, 38 (2), 141 – 152. DOI: 10.2989/16073614.2020.1771190.

Nomlomo, V., & Mbekwa, M. (2013). Teacher and learner perceptions on the use of the learners‟ home language in the teaching and learning of school mathematics and science. In D. B. Napier & S. Majhanovich (Eds.), Education, Dominance and Identity (pp. 133-149). Rotterdam, Netherlands: Sense Publishers. Pennycook, A. (2010). Language as a local practice. London: Routledge.

Sure, K., & Webb, V. (2000). Languages in competition. In V. Webb & K. Sure (Eds.), African voices (pp. 109-132). Oxford, UK: Oxford University Press.

Valesco, P., & García, O. (2014). Translanguaging and the writing of bilingual learners. Bilingual Research Journal, 37(1), 6–23.

Wei, L. (2011). Moment analysis and translanguaging space: Discursive construction of identities by multilingual Chinese youth in Britain. Journal of Pragmatics, 43(6), 1222–1235.

Wei, L. (2018). Translanguaging as a practical theory of language. Applied Linguistics, 39(1), 9–30.

Wei, L., & Lin, A. (2019). Translanguaging classroom discourse: pushing limits, breaking boundaries. Classroom Discourse 10(3-4): 209–215.