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Language-supportive pedagogy in biology learning: Exploring teachers' translanguaging practices and experiences in Tanzanian secondary schools

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Abstract. This study explored teachers' perspectives on language use in Tanzanian secondary school science classrooms, where English is used as the medium of instruction, even though the majority of students come from Kiswahili-speaking backgrounds. This study employed a qualitative approach with a multiple case study design, utilising sociocultural and immersion theories to gather data from sixteen (16) Biology teachers through interviews and classroom observations. Thematic analysis revealed the tension between "English-only policy" and linguistic realities of daily practice. Teachers reported that the exclusive use of English as the medium of instruction hinders comprehension for most students, especially those with limited English proficiency, hence the need for a translanguaging pedagogical strategy. Using both English and Kiswahili enhances understanding of scientific concepts, reduces cognitive load, and fosters meaningful learning. Additionally, students' linguistic trajectories in Kiswahili-dominant primary education pose significant barriers to their transition from Kiswahili-medium education to English-medium education, highlighting the need for multilingual scaffolding. Teachers advocate for a balanced multilingual approach that integrates Kiswahili to guarantee equal access to Biological content while maintaining English for academic purposes. Overall, the study underscores the risks of strict English-only instruction, including disengagement and lower academic performance, suggesting that flexible language practices are more appropriate in multilingual contexts. These findings contribute to discussions on language-of-instruction policies by illustrating how context-responsive multilingual practices can enhance inclusion and achievement in Biology education in Tanzania.

Keywords: translanguaging, language of instruction, multilingual education, science education, Kiswahili, English-only policy

1. Introduction

The transition from primary to secondary education in the Tanzanian context introduces a significant linguistic shift that directly affects the students' learning experiences. Kiswahili is the dominant medium of instruction at the primary level, offering learners a familiar linguistic environment that supports comprehension and interaction [72]. However, upon entering secondary school, students are expected to learn through English, the official language of instruction [72]. For the majority of learners, English functions as a foreign language, with limited exposure outside the classroom [19]. The abrupt shift from Kiswahili-medium education to English-medium education creates a notable discontinuity that hinders students' understanding of content, their ability to express ideas, and their engagement in classroom discourse.

Biology is particularly affected by this discontinuity due to its highly specialised vocabulary, much of which is derived from Greek and Latin roots [14]. Many discipline-specific terms are unfamiliar

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to students, making it difficult for them to fully grasp the concepts being taught [77]. Mastery of such terminologies demands both content knowledge and additional linguistic processing [4]. As a result, Biology demands a three-tier linguistic burden, which includes using English as the medium of instruction, Kiswahili as students' primary language of cognition and interaction, and a Biology-specific lexicon rooted in classical scientific nomenclature [16].

Teachers face similar challenges in mediating between these linguistic systems [16]. Their frequent shifts between English and Kiswahili are often unsystematic, driven by immediate classroom needs rather than structured pedagogical planning [38]. This situation is further compounded by the fact that the majority of teachers have not received adequate professional development programmes to unpack scientific etymology, a competency that would enable them to break down complex, Latin- and Greek-driven Biological terminology into meaningful components that would support learners' understanding [27]. As a result, linguistic barriers continue to exert a substantial negative influence on students' mastery of Biology, contributing to persistently low performance across Tanzanian secondary schools [49].

Performance data from the Form II and Form IV national examinations indicate the extent to which linguistic challenges undermine the learning outcomes in Biology. Biology performance from 2019 to 2023 shows inconsistent levels of mastery [65–68, 70]. While the Form IV pass rate rose dramatically from 1.3% in 2019 to above 60% in subsequent years, it declined from 66.22% in 2022 to 59.86% in 2023 [69]. The scholars consistently link such patterns to language-related barriers, noting that the students often struggle to interpret examination questions, follow the teachers' explanations, and communicate scientific ideas with precision due to limited proficiency in the language of instruction [19, 63]. This happens despite the government's efforts to harness students' multiple languages to promote thinking, access to various forms of knowledge, and learning of the language of instruction [40]. This challenge suggests that improvements in Biology performance are likely to remain inconsistent and difficult to sustain without deliberate, linguistically responsive pedagogical interventions.

Translanguaging has therefore become an important pedagogical approach in multilingual classrooms, as it offers learners the flexibility to draw meaningfully on both the language of instruction and their familiar language [21]. Translanguaging reduces cognitive load and enhances understanding of complex scientific concepts that might otherwise remain inaccessible when taught through a single language by allowing the learners to flexibly draw on both English and Kiswahili as complementary meaning-making resources [41]. International and regional evidence demonstrates that structured translanguaging enhances engagement, comprehension, and concept mastery [55, 63].

Despite this evidence, Tanzanian classrooms remain influenced by English-only ideologies, which are reinforced by school leaders and inconsistent interpretations of the policy [28]. Policy documents acknowledge Kiswahili's role as a supportive language [72], yet implementation is often restrictive [39]. Little is known about how Biology teachers specifically use translanguaging to meet disciplinary linguistic demands, especially when teaching the classification of living things. This topic requires interaction between indigenous knowledge and classical scientific nomenclature. These gaps highlight the need to examine teachers' language adaptation in order to explore their actual practices, motives, and linguistic strategies in this topic area.

This study aims to investigate how the teaching and learning of Biology in Tanzanian secondary schools are influenced by language practices, including the use of English as the official medium of instruction, Kiswahili as a familiar learning resource, and Biology-specific terminology largely derived from Greek and Latin. The study specifically investigated how the teachers navigate the tension between English-only policy expectations and real classroom linguistic needs. It also investigated how translanguaging practices support or hinder comprehension, how students' linguistic backgrounds influence their understanding of scientific concepts, and how teachers integrate multiple languages when teaching the classification of living things.

The study seeks to identify effective bilingual strategies to enhance content understanding, reduce linguistic barriers, and improve Biology learning outcomes by focusing on teachers' classroom practices and experiences. The study's ultimate goal is to inform pedagogical practice, classroom

language use, and language-in-education policy in Tanzania's multilingual educational context.

2. Literature review

The researchers reviewed the available literature under the following headings to situate the study in its proper context.

2.1. Conceptualisation of Translanguaging Term

Translanguaging refers to the fluid and strategic deployment of a speaker's full linguistic repertoire, including named languages, dialects, and multimodal resources, to make meaning, without artificial language separation [53]. Translanguaging, originally termed as *trawsieithu*, originated from Cen Williams' work in Welsh bilingual education. It was expanded by Ofelia García and others into a theory that considers bilingualism as a unitary, integrated system rather than parallel monolingual competencies [58]. In educational settings, translanguaging functions as both the natural practice (spontaneous use of repertoires) and deliberate pedagogy (structured scaffolding) that reduce cognitive load, activate prior knowledge, and promote deeper conceptual understanding [24]. Critically, while translanguaging challenges monolingual ideologies, its implementation is occasionally reactive and haphazard in policy-constrained environments, thereby restricting its potential for systematic language and content development. This tension is central to the present study's examination of how Tanzanian biology teachers navigate English-only instruction.

2.2. Studies on translanguaging in different parts of the world

The value of translanguaging in multilingual contexts has increasingly been highlighted by research on science education, particularly in the Global South, where linguistic diversity intersects with colonial language policies.

The learners struggle to access scientific knowledge when instruction is delivered exclusively in English in African countries such as South Africa, Zimbabwe, and Kenya [11, 35, 61]. For instance, a study of science and mathematics classrooms in Southern Africa found that students often face the dual burden of learning new scientific concepts through a language they have not fully mastered, which limits comprehension and engagement [47]. Similarly, research in South African classrooms shows that misalignment between learners' home languages and the language of instruction significantly contributes to low performance in science and mathematics [62]. Moreover, translanguaging has been shown to improve conceptual understanding and academic outcomes. These findings reinforce the argument that language plays a central role in shaping access to scientific knowledge rather than merely serving as the medium of instruction.

Similar patterns emerge in East and West African contexts. Studies in Kenya indicate that translanguaging enhances classroom interaction and supports epistemic meaning-making as the students use their full linguistic repertoire to develop knowledge of academic content. Translanguaging has been linked with improved participation, confidence, and deeper engagement with scientific concepts in Ghana and other multilingual settings, particularly when the learners struggle with English-only instruction. Since monolingual policies tend to marginalise the learners who are not proficient in the dominant language, translanguaging is also linked to broader issues of equity across these contexts. Most importantly, these studies challenge deficit views of African languages by demonstrating that they are valuable cognitive and pedagogical resources rather than obstacles to learning.

However, critical tensions persist across the literature despite the strong evidence in favour of translanguaging. The major problem is that translanguaging practices are often informal, spontaneous, and not systematically integrated into pedagogy. The teachers frequently use the learners' first languages without explicit planning or institutional support, often without even recognising translanguaging as a pedagogical strategy [11, 54]. Additionally, language-in-education policies across many African countries continue to promote monolingual English instruction, creating a

disconnection between policy and classroom practice [23]. This results in what scholars describe as "hidden" or "covert" translanguaging, in which teachers use local languages to support learning but avoid openly acknowledging these practices due to policy constraints [50].

These findings from other countries and Africa provide important insights while also revealing key gaps in relation to this study. There is limited work that specifically focuses on Biology as a discipline with unique linguistic demands, although the current research clearly demonstrates that translanguaging enhances comprehension, participation, and conceptual understanding in science education. Furthermore, a few studies go beyond descriptive accounts to examine how translanguaging can be systematically organised as a pedagogical approach in classroom practice. By focusing on Biology classrooms in Tanzania and examining how translanguaging is used and how it can be better understood as a deliberate and context-responsive instructional strategy, this study addresses this knowledge gap. In doing so, it contributes to ongoing debates over language, equity and science education in multilingual African contexts.

2.3. Translanguaging and language challenges in Tanzanian secondary education

The language of instruction in Tanzanian secondary education, particularly in science subjects such as Biology, remains a major challenge. Tanzania's education system requires students to transition from Kiswahili-medium education in primary school to English-medium education in secondary school, a shift widely associated with reduced comprehension and participation. The majority of students learn biology in a language they have not yet mastered, a practice that limits their ability to engage with abstract concepts and scientific terminology. For instance, the study by Juma [28] found that using English as the language of instruction hinders the development of biological literacy, with both teachers and students reporting difficulties in understanding and applying biological knowledge. The study concludes that the students' performance in Biology is occasionally constrained by language rather than cognitive ability.

However, classroom practices and official policy reveal a different reality. The teachers and students frequently employ Kiswahili to facilitate learning through translanguaging, despite the dominance of English-Medium Instruction (EMI). Studies on classroom interaction in Tanzania show that translanguaging through strategies such as translation, paraphrasing, and mixing languages enhances comprehension, participation, and motivation among learners [42]. However, these practices are rarely formalised; they occur spontaneously and are often influenced by the need to overcome immediate communication barriers. Research on science education, including work by Mkimbili [41], indicates that strict adherence to English limits meaningful engagement in science classrooms, forcing teachers to rely on informal bilingual strategies. These practices demonstrate the pedagogical value of translanguaging, but they also highlight a critical gap: the absence of structured, policy-supported approaches that effectively integrate multiple languages into the teaching of science and biology.

3. Theoretical framework

This study intends to examine how teachers mediate language during the teaching of Biology in multilingual Tanzanian classrooms using sociocultural theory and immersion education models. Sociocultural theory emphasises that learning is socially mediated, with language serving as the most important cultural tool for accessing new knowledge [74]. The students learn best when instruction builds on their familiar linguistic and cultural resources within the Zone of Proximal Development (ZPD) [56]. In Tanzanian classrooms, Kiswahili plays a central role as a mediation tool that helps learners make connections between real-world experiences and academic biology concepts delivered in English [19]. The teachers scaffold understanding, promote conceptual clarity, and encourage participation, resulting in outcomes consistent with Vygotskian principles when they integrate Kiswahili strategically.

Immersion theory distinguishes between total immersion (exclusive use of the target language) and partial immersion (the target language supplemented by the learners' first language) [12]. Total immersion functions effectively only when the learners have extensive exposure to the target language [57], a condition which does not reflect Tanzanian linguistic realities. The findings of this study show that strict English-only instruction often leads the students to become silent, confused, and disengaged. Partial immersion is evident when English is used for instruction, while Kiswahili provides clarification, an attempt to align more closely with students' linguistic repertoires and to support better understanding.

These theories explain how translanguaging helps learners to bridge familiar and scientific discourses in science education. Translanguaging acts as a mediational tool, supporting conceptual development, clarifying terminology, and reducing cognitive strain [54]. Through scaffolding, the teachers help students co-construct meaning, refine vocabulary, and navigate both everyday and academic scientific registers [30]. Taken as a whole, these theories provide a coherent framework for interpreting teachers' translanguaging practices in biology classrooms and support partial immersion as an effective pedagogical approach in Tanzanian multilingual settings.

4. Methodology

4.1. Location of the study

The study was conducted in two regions, namely Dodoma and Iringa, in Tanzania. In Dodoma Region, the study was carried out in secondary schools in Dodoma City Council, an urban setting where English is the medium of instruction along with Kiswahili, which dominates everyday communication. In Iringa Region, the study was conducted in Kilolo District Council, a predominantly rural area where students are taught Biology in English as the medium of instruction, along with Kiswahili, which is commonly used for communication. The students also use Ethnic Community Languages such as Kihehe in daily communication. Examining translanguaging practices in Biology classrooms was deemed necessary due to contrasting linguistic and socio-educational settings.

4.2. Research approach and design

A qualitative research approach was adopted to conduct an in-depth exploration of teachers' pedagogical practices, students' language use, and classroom interactions. This approach was appropriate because it allowed researchers to capture nuanced, context-specific insights into how translanguaging supports meaning-making during Biology instruction in multilingual classrooms, particularly when teaching the classification of living things. The study employed a multiple-case study design. This design facilitated the analysis of the differences and similarities in translanguaging practices across schools with varying linguistic environments while maintaining depth and contextual detail.

4.3. Target population and sampling procedures

The target population consisted of Biology teachers and students in public secondary schools within the Dodoma City Council and the Kilolo District Council. A total of sixteen (16) Biology teachers, eight from Dodoma City Council and eight from Kilolo District Council, were purposively selected based on their experience teaching in English-medium contexts and their participation in classroom observation lessons. Teachers were selected based on their willingness to participate, qualifications, and fit with the study focus. The inclusion of both urban and rural schools guaranteed linguistic and contextual diversity.

4.4. Data collection methods and instruments

The semi-structured interviews and non-participant classroom observations were the two main methods used for data collection. The triangulation and credibility of the findings were guaranteed

using multiple methods.

Semi-structured interviews were administered to sixteen (16) Biology teachers in order to explore their perceptions of the English-only policy, challenges that they face when teaching scientific concepts, and the role of translanguaging in supporting students' learning. The interviews lasted between 30 and 45 minutes and allowed the teachers to share their experiences while giving the researchers flexibility to probe more deeply. A semi-structured interview guide was developed to ensure consistency across interview sessions. It included questions on teachers' experiences with English-medium instruction, the perceived benefits and challenges of using Kiswahili or local languages, and students' linguistic readiness for Biology, as well as classroom strategies for supporting comprehension. Another interview explored the language-related challenges students face and their views on the application of translanguaging practices.

Non-participant classroom observations on the classification of living things were conducted during Biology lessons to capture authentic language-use practices. The observations focused on identifying the specific instances and functions of translanguaging. The focus was also on the teachers' strategies for scaffolding scientific terminology and students' reactions to English-only instruction, pronunciation challenges that emerge during instruction, and language-use patterns across English, Kiswahili, and local languages in actual classroom interactions. The researchers captured authentic linguistic interactions and meaning-making processes using this method. Furthermore, the key aspects of classroom interaction, including language-switching behaviours, communication patterns that emerged during teacher-student and student-student interactions, indicators of learner comprehension or confusion, and the use of translanguaging as scaffolding, were systematically recorded using the structured observation schedule.

4.5. Data analysis

The data were analysed using Thematic Analysis, which was guided by Braun and Clarke's (2006) six-stage framework. The analysis facilitated the systematic interpretation of the teachers' and students' interactions in multilingual science classrooms through an iterative process of reading, coding, and refining patterns across the dataset. This approach ensured that emerging meanings were grounded in the data and that theme development followed a clear, rigorous analytic path. After the data collection, the familiarisation and organisation of the data began immediately by listening and re-listening to participants' responses while transcribing the digitally recorded interviews. After transcribing and presenting the data in Word format, the transcription was read several times to familiarise with the data, thereby simplifying the data analysis and interpretation process. Having familiarised myself with the data, the coding and reduction process was followed, where the codes were assigned to the representative units of meaning for specific words, phrases, sentences, or paragraphs based on the research question. The themes were developed later. The data were presented in the final stage as themes developed during the coding and reduction stages and thereafter interpreted.

The analysis generated several overarching themes that appeared in both the urban (Dodoma City) and rural (Kilolo District) contexts. These themes included, "Translanguaging as a Meaning-Making Strategy", "English Language Production Challenges", "Pronunciation Difficulties", "Policy Practice Tension", and "Unsystematic Translanguaging Practices". These themes indicate how multilingual learners and teachers negotiate communication in the classroom, the linguistic barriers that they encounter, and the complex interplay between the language policy and actual teaching practices.

4.6. Ethical considerations

The Institutional Research Review Ethics Committee (IRREC) of the University of Dodoma granted ethical clearance for this study under reference number MA.84/261/86/135. In addition, the Vice Chancellor of the University of Dodoma issued the research clearance letters with reference numbers MA.84/261/86/133 and MA.84/261/86/134, which were submitted to the Regional Administrative

Secretaries (RAS) of Dodoma and Iringa Regions in an attempt to obtain official permission to conduct the study in the respective regions.

The permit letters, issued by the RAS offices, were submitted to the City Director of Dodoma City Council and the District Executive Director of Kilolo District Council after receiving regional approval. These permits authorised access to secondary schools in two districts. Upon arrival at the schools, the researchers presented the permission letters to the heads of school, who introduced them to Biology teachers who would facilitate data collection.

Before collecting any data, informed consent was obtained from all participating teachers. Therefore, the participants' names and the names of their respective institutions were anonymised with pseudonyms (e.g., Teacher 1, Teacher 8) to ensure their confidentiality. All data gathered through interviews and classroom observations were handled with strict confidentiality and used solely for academic purposes.

5. Findings

The data, which were collected through interviews and classroom observations, were analysed thematically, enabling the clarification of emergent themes, the expansion of descriptive insights, and the systematic integration of quotations, each supported by consistent source identifiers (table 1).

Table 1
Teachers' perspectives from interviews (field data, March, 2025).

Theme	Description	Illustrative quote
Tension between policy requirements and classroom reality	Teachers reported a mismatch between English-only instruction and learners' abilities, creating instructional challenges.	"Teachers should use English only . . . , If you allow students to speak Kiswahili, they end up writing those words even in exams." (Teacher 1, Bachelor's degree)
Practical barriers to exclusive use of English	Teachers acknowledged their own limitations in English fluency, which hindered lesson delivery.	"Even teachers are not always fluent. . . , I might enter a lesson and speak English, and that is a challenge." (Teacher 13, Master's degree)
Translanguaging as a pedagogical necessity	Teachers used Kiswahili intentionally to clarify complex terminology and improve comprehension.	"Mixing languages aids students' memory. . . , 'Rana temporaria' becomes easier when you say 'chura'." (Teacher 3, Bachelor's degree)
Ensuring understanding over memorisation	Teachers used translanguaging to shift learners from rote memorisation to meaningful learning.	"If you avoid code-switching, students memorise without understanding." (Teacher 9, Bachelor's degree)
Students' linguistic backgrounds influence learning needs	Students' reliance on Kiswahili or Ethnic Community Languages (ECLs) influences how they process Biology content.	"Most students come from a background with Kiswahili as their mother tongue." (Teacher 3, Bachelor's degree)
Influence of Ethnic Community Language (ECL)	Native languages create an additional barrier to English comprehension in science lessons.	"They speak Kihehe at home. The gap in English is very big." (Teacher 7, Bachelor's degree)
Balanced and flexible bilingual approach	Teachers valued a bilingual approach that uses Kiswahili for clarity and English for academic goals.	"Be flexible and use Kiswahili alongside English to ensure understanding." (Teacher 8, Bachelor's degree)
English for global mobility	Teachers recommended English as an important aspect for global and academic advancement.	"English prepares students to work internationally. It is used worldwide." (Teacher 14, Master's degree)

The study findings revealed a clear tension between policy requirements and classroom realities, as teachers described how the English-only curriculum policy conflicts with learners' linguistic needs. They explained that although the policy demands exclusive use of English, students' limited proficiency makes this expectation unrealistic. They further noted that even teachers face challenges with fluent English, as reflected when the teachers are mandated to use English only throughout the lesson. Allowing the students to speak Kiswahili may cause them to write those words in examinations.

These experiences show how strict language policy requirements do not align with the daily realities of science classrooms. Despite these challenges, the teachers positioned translanguaging as a pedagogical requirement, emphasising that the strategic use of Kiswahili helps students grasp complex scientific terminology and develop a meaningful understanding rather than relying on memorisation. They used the example "Rana temporaria", thus making it easier to understand, when accompanied by the Kiswahili word "chura" to indicate that mixing languages supports students' memory. They also cautioned that avoiding code-switching can occasionally lead to students' memorisation rather than comprehension. These instructional decisions are closely linked to students' linguistic backgrounds. The study findings reveal that the majority of students come from Kiswahili-medium primary schools or use ELSs such as Kihehe at home; this practice creates a substantial linguistic gap as the students transition from Kiswahili-medium education to English-medium education. The study found that most students speak Kiswahili as their first language and Kihehe as their mother tongue. Thus, an observed shift from Kihehe to Kiswahili and then to English was observed, thereby introducing a multilingual context during the learning process.

In response to these realities, the teachers advocated for a balanced and flexible multilingual approach in which English remains a central language while Kiswahili or Kihehe is intentionally used to enhance comprehension. They also argued that such flexibility allows the students to succeed academically while still gaining the English proficiency needed for future opportunities.

The findings of the study indicate that translanguaging plays a central role in mediating Biology learning by bridging the gap between students' linguistic resources and the demands of English-medium instruction (table 2). Evidence from cases 1-5, 8, and 9-16 shows that translanguaging serves as a meaning-making strategy, with students relying on Kiswahili to define and internalise biological concepts. The strong connection between cognition and familiar linguistic resources is further demonstrated by cases 2, 5, 10, and 13. The learners were only able to retrieve prior knowledge when prompted in Kiswahili. In addition, cases 3, 6, 9, and 11 demonstrate how the teachers actively scaffolded students' understanding by switching between English and Kiswahili, ensuring that complex concepts were accessible to all students.

The findings also reveal significant language-related barriers. In cases 5, 8, 12, and 14, the students remained silent when required to respond in English, despite understanding the content, indicating that language production challenges hindered their classroom participation. Similarly, cases 7, 11, and 15 show that students struggled with the pronunciation of scientific terms such as "triploblastic," reflecting difficulties in mastering the linguistic demands of Biology. The gap between conceptual understanding and language proficiency is particularly evident in cases 6, 8, 11, and 16, where the students were able to explain the concepts accurately in Kiswahili but were unable to explain them in English.

The use of Kiswahili also had notable affective and cognitive benefits. Allowing students to respond in Kiswahili improved their participation and confidence, as evidenced in cases 4, 8, 12, and 15, suggesting that translanguaging fosters a more inclusive learning environment. Furthermore, cases 2, 7, 10, and 14 indicate that allowing students to think and respond in Kiswahili reduced cognitive load, thereby enabling them to interact effectively with complex scientific ideas.

Despite these benefits, translanguaging practices were not systematic. The observations from cases 1-5, 8, and 9-16 reveal that teachers switched between languages spontaneously without structured pedagogical planning. This aligns with the evidence from cases 1, 5, 9, and 13, which highlight the clear tension between classroom practices and policy expectations. Although English is the sole language of instruction, the teachers frequently resorted to Kiswahili to maintain the flow of lessons and ensure comprehension. Overall, the evidence across all 16 cases suggests that translanguaging

Table 2
Teachers' perspectives developed from classroom observations (field data, March, 2025).

Theme	Description	Illustrative quote
Translanguaging as a meaning-making strategy	Teachers and students alternated between languages to clarify concepts and enhance comprehension.	"Students relied on Kiswahili when defining Biology terms, showing that their cognitive processing occurs in Kiswahili". (Refer case 1–5, 8, 9–16)
English language production challenges	Students understood the content but struggled to express their ideas in English, which led to silence.	"Students remained silent when addressed in English but responded when the question was rephrased in Kiswahili". (Refer to cases 5, 8, 12, & 14)
Pronunciation and scientific language difficulties	Students had difficulty in pronouncing complex scientific terminology, thus requiring teacher scaffolding.	"Pronouncing 'triploblastic' showed partial familiarity but limited mastery". (Refer to cases 7, 11, & 15)
Reliance on Kiswahili for prior knowledge	Students could retrieve concepts when the teachers provided Kiswahili cues.	"Students could not recall the concept until reminded using Kiswahili cues". (Refer to cases 2, 5, 10, & 13)
Haphazard translanguaging practices	Teachers switched to languages spontaneously without structured bilingual planning.	"Teachers switched to languages without structured guidance but responded only to immediate needs". (Refer case 1–5, 8, 9–16)
Teacher-led scaffolding through translanguaging	Teachers intentionally used Kiswahili to scaffold difficult concepts and support comprehension.	"The teacher explained the concept in English and then simplified it in Kiswahili to ensure that all students understood it. (Refer to cases 3, 6, 9, & 11)
Learner participation and confidence	The use of Kiswahili improved students' participation, confidence, and willingness to engage in learning science concepts.	"More students raised their hands and contributed, having been allowed to respond in Kiswahili". (Refer to cases 4, 8, 12, & 15)
Cognitive load reduction	Translanguaging reduced the cognitive burden associated with learning complex scientific concepts.	"Students were more relaxed and responsive when allowed to think and respond in Kiswahili". (Refer to cases 2, 7, 10, & 14)
Policy-practice tension	There was a mismatch between English-only policy expectations and actual classroom practices.	"Although English is recommended, the teacher frequently shifted to Kiswahili to maintain lesson flow". (Refer to cases 1, 5, 9, & 13)
Conceptual understanding versus language proficiency gap	Students demonstrated understanding of Biology concepts, but their ability to communicate that knowledge in English was limited.	"Students could explain the idea correctly in Kiswahili but struggled to explain it in English". (Refer to cases 6, 8, 11, & 16)

significantly enhances conceptual understanding, participation, and confidence in Biology classrooms. However, its implementation remains informal and reactive rather than being systematic. This underscores the need for deliberate pedagogical frameworks and supportive language policies that acknowledge translanguaging as a legitimate and effective instructional strategy.

Based on students' views, translanguaging is an essential strategy for improving comprehension, participation, and confidence in Biology lessons (table 3). Their experiences are consistent with teachers' comments, reinforcing the view that the English-only policy is impractical in a multilingual

Table 3
Students' perspectives from interviews (field data, March, 2025).

Theme	Description	Illustrative quote
Translanguaging enhances understanding	Students acknowledged that using both English and Kiswahili helped them to understand Biology concepts and terminology better.	"When the teacher explains concepts in both English and Kiswahili, I understand the concept better because Kiswahili helps me to understand the meaning". (Interview with student 1 from school B, 9th April, 2025).
Difficulty in expressing ideas in English	Students affirmed that they struggle to express their ideas in English during class discussions, although they understand the content.	"I know the answer, but I fail to explain it in English. So, I keep quiet". (Interview with student 3 from school A, 4th April, 2025).
Scientific terminology as a barrier	Students identified complex scientific terms as a major challenge, especially when taught only in English.	"Some Biology terms are too difficult to understand in English. I only understand them after being explained in Kiswahili by the teacher". (Interview with student 3 from school C, 15th April, 2025).
Kiswahili as a support for participation	The use of Kiswahili increased students' confidence and willingness to participate in class activities.	"When the teacher allows me to express myself in Kiswahili, I feel free to answer the questions and participate in class". (Interview with student 4 from school F, 3rd April, 2025).
Language background influences learning	Students' native-language backgrounds influenced their comprehension and engagement in Biology lessons.	"Since I learnt in Kiswahili in primary school, it is difficult for me to follow lessons taught in English only". (Interview with student 1 from school A, 2nd April, 2025).
Preference for flexible language use	Students preferred a balanced approach in which both English and Kiswahili were used strategically, rather than English-only instruction.	"It is better when the teacher switches between languages depending on the topic in order to understand the concepts and still learn English". (Interview with student 2 from school F, 16th April, 2025).

classroom context.

The study findings revealed that the use of both English and Kiswahili helps the students to understand difficult Biology concepts. This bilingual approach bridges the gap between the students' unfamiliar scientific terminology and their prior linguistic knowledge. The students can internalise meaning and make connections between abstract English terms and a more concrete understanding using Kiswahili explanations. In this approach, translanguaging serves not merely as translation but also as a cognitive scaffold that facilitates conceptual development.

Despite being unfamiliar with scientific terminology, the study found that the majority of students had difficulty expressing their ideas in English. Although they can often understand content delivered in English, they have difficulty expressing their thoughts clearly in the same language. This difficulty hinders their participation, as some students remain quiet during interactions conducted solely in English. The students' responses indicate an imbalance between receptive and productive English skills, highlighting the need for instructional approaches that enhance both simultaneously.

Scientific terminology constituted another significant barrier to learning. When presented exclusively in English, the students identified complex Biology terms as difficult to understand. However, comprehension improves considerably when these terms are explained with their Kiswahili equivalents. This suggests that strict English-only instruction may unintentionally hinder understanding of the content, especially for students whose prior education was exclusively in Kiswahili.

The study findings revealed that the use of Kiswahili also plays an important role in boosting the students' confidence and participation. It was further noted that being allowed to use Kiswahili reduces anxiety and creates a supportive environment for participation. This affective dimension of translanguaging demonstrates how inclusive language practices can foster participation and more equity in the classroom.

Furthermore, the influence of the students' language backgrounds on learning is reflected in their experiences. The majority of students face challenges during the transition from Kiswahili-medium instruction at the primary school level to English-medium instruction at the secondary level. The language-in-education policy should take into account learners' language abilities rather than assuming a uniform level of English proficiency, since students with limited exposure to English face greater challenges.

Overall, the students revealed that they prefer the flexible and balanced use of languages in the classroom. They emphasised that effective learning occurs when Kiswahili is used strategically, depending on the complexity of the content and students' needs, while acknowledging the significance of English for examinations and future opportunities.

6. Discussion

This study examined the translanguaging practices used by Biology teachers in secondary schools in Tanzania, where English is the medium of instruction, even though students primarily speak Kiswahili. The study's introduction, theoretical lens, methodology, and empirical results are integrated into the study's major findings.

6.1. Alignment with sociocultural theory

The findings of the study significantly support Vygotsky's [74] sociocultural theory, which considers language as the principal psychological and cultural tool for mediating higher-order thinking. The teachers' strategic use of Kiswahili served as classic scaffolding within the students' Zone of Proximal Development in the eight classrooms observed. The scaffolding helped to translate the term *Rana temporaria* into *chura*, linking indigenous ethno-taxonomies with Linnaean classification, or to rephrase abstract processes such as homeostasis. This scaffolding transformed passive, often silent learners into active participants capable of co-constructing scientific meaning through dialogue [33]. Vygotsky's assertion that cognitive development is maximised when instruction builds on familiar semiotic resources rather than excluding them is highlighted by the dramatic increase in student responses following the provision of Kiswahili cues.

Furthermore, these practices illustrate how Kiswahili served not merely as a temporary crutch but as a powerful mediational means that enabled interpsychological (social) processes to become intrapsychological (individual) understanding [26, 44]. Similar patterns have been documented in multilingual science classrooms across South Africa [48, 54], Kenya [51], Ghana [13] and Tanzania [18, 41]. The sociocultural argument that excluding students' primary language effectively denies them access to the very tools required for advanced conceptual development in science is reinforced by the consistent emergence of meaningful participation only after language one (L1) mediation.

6.2. Interpretation through immersion education models

Tanzania's official policy of total English-medium immersion from Form I onward assumes a level of target-language exposure and proficiency that simply does not exist for the vast majority of students [5, 34]. The "silent classrooms", superficial rote memorisation and widespread disengagement observed whenever teachers attempted strict English-only delivery replicate the well-documented failures of submersion and early-exit models across sub-Saharan Africa [3, 7, 25]. These outcomes are in stark contrast to successful immersion programmes in Canada and Europe, where learners

typically enjoy thousands of hours of naturalistic exposure to the target language before academic instruction, a condition which is conspicuously absent in Tanzania.

In practice, Kiswahili functioned as a temporary bridge that dramatically reduced cognitive overload and sustained engagement in unplanned and unsupported forms of partial immersion, a result of the spontaneous yet pervasive translanguaging revealed in this study. This mirrors the findings from additive bilingual programmes in other low-exposure contexts, where planned L1 support accelerates both content mastery and eventual target-language proficiency [20]. Therefore, the evidence presented here adds substantial weight to the growing pan-African consensus that late-exit or additive bilingual models are far more appropriate for post-colonial multilingual societies than subtractive English-only approaches [2, 25].

6.3. Translanguaging as pedagogical necessity

Far from representing interference or deficit, translanguaging emerged as a sophisticated, creative pedagogical resource that leveraged students' unitary and integrated linguistic repertoires [23]. The teachers and students shuttled fluidly between Kiswahili and English and occasionally ECLs (e.g., Kihehe names for local plants and animals) in an attempt to bridge everyday experience with academic discourse, clarify opaque Greco-Latin terminology, and activate culturally relevant prior knowledge. Examples of how translanguaging changes abstract and decontextualised terms into meaningful conceptual tools that are accessible to Bantu-language speakers include students who successfully pronounced and explained the concept of triploblastic after hearing only the scaffold *tabaka tatu za seli*.

This dynamic bilingual practice also challenged the traditional monolingual bias in science education by affirming that scientific knowledge can be legitimately constructed through multiple named languages simultaneously [10]. By drawing on the indigenous taxonomic systems alongside Linnaean nomenclature during classification lessons, the teachers enacted a decolonising pedagogy that validated local funds of knowledge while meeting curriculum requirements [60]. Such findings extend the translanguaging framework beyond urban elite multilingualism to rural African contexts where three or more linguistic systems routinely intersect in everyday meaning-making [46].

6.4. Tension between policy and practice

A profound and enduring contradiction persists between Tanzania's official language-in-education policy and multilingual realities of classrooms [39, 59]. Although the Education and Training Policy of 2014 explicitly permits Kiswahili as a "facilitating" language [72], the school administrators, inspectors and high-stakes examination washback continue to enforce an English-only ideology that stigmatises L1 use in practice [31, 32]. In this study, the teachers frequently concealed their bilingual strategies from headteachers or switched abruptly to English when observers entered, behaviour that echoes clandestine translanguaging reported in South Africa [54], Malawi [59], Zambia [45] and Botswana [43].

This hidden bilingualism produces immediate comprehension gains but at considerable professional risk and pedagogical cost. The teachers are caught in a double bind as they recognise that exclusive use of English leads to confusion and failure, yet they fear sanctions for deviating from policy [3, 8]. The result is a pervasive culture of "policy evasion" that prevents the development of explicit, structured multilingual approaches capable of systematically building both conceptual understanding and academic English proficiency [37, 73].

6.5. Language-related barriers to learning biology

Biology imposes uniquely severe linguistic demands that amplify the challenges of English-medium instruction, as students must simultaneously master a foreign instructional medium, process new information through the Bantu home language, and decode the third layer of Greco-Latin-derived

terminology that is phonologically and morphologically alien to Bantu language structures [15, 47]. This complex linguistic load places Biology among the most language-dependent subjects in the secondary curriculum, heightening comprehension barriers for learners with limited exposure to English. The pronunciation struggles (e.g., triploblastic, homeostasis), retrieval failures under English-only prompts, and productive silence documented across urban and rural sites are not evidence of cognitive deficit but evidence of systemic linguistic exclusion [17, 29].

These barriers are compounded by the absence of bridging programmes between Kiswahili-medium primary and English-medium secondary education, creating an abrupt "sink-or-swim" transition that disproportionately disadvantages rural and low-income students [6, 27]. The sudden linguistic shift forces students to grapple with content and language simultaneously, overwhelming many at the very entry point of secondary science learning. Despite fluctuations, persistent low performance on national biology exams continues to be misattributed to the incompetence of the learner or teacher rather than to policy-induced linguistic obstacles [52, 69, 71]. This misdiagnosis obscures the structural nature of the problem and redirects accountability away from systemic policy failures. The triple burden identified here mirrors findings from Kenya [36], South Africa [54], and Ghana [1], confirming that language policy remains the single greatest impediment to scientific achievement across Anglophone Africa. Therefore, the comparable evidence at the regional level positions linguistic reform rather than intensified testing or discipline as the most urgent lever for improving science outcomes.

6.6. Unsystematic translanguaging practices

While translanguaging was ubiquitous and effective for immediate meaning-making, its predominantly reactive and unplanned character represents both the strength and critical limitation [11, 54, 75]. The teachers switched between languages spontaneously in response to obvious students' confusion rather than following the deliberate sequence that builds conceptual depth in Kiswahili before gradually raising English demands. As a result, rather than through the proactive structure that anticipates conceptual bottlenecks, the learners occasionally received linguistic support only when they faced difficulties. This improvisational approach, while pragmatic under current policy constraints, misses opportunities to develop cumulative bilingual proficiency and higher-order scientific discourse in English [22, 64].

Structured, intentional translanguaging frameworks such as "translanguaging rings" or planned "language allocation" strategies have repeatedly demonstrated superior outcomes for both content learning and target-language growth in multilingual settings worldwide [9, 76]. Such models explicitly map when and how each language should mediate learning, creating predictable linguistic routines that support deeper cognitive engagement. The current reliance on survival-driven code-switching, therefore, highlights an urgent need for pre-service and in-service teacher education programmes that equip Tanzanian Biology teachers with theoretically grounded multilingual pedagogical content knowledge [41]. Without such professional development, even the most creative classroom translanguaging will have limited transformative potential.

In summary, this study provides strong evidence at the classroom level that monolingual English-medium policies in multilingual African societies perpetuate epistemic injustice and systemic underachievement in science. Considering language as a resource for disciplinary reasoning and equitable participation, rather than as a barrier to be policed, is essential to addressing these entrenched inequities. In an attempt to transform Tanzanian Biology education from exclusionary rote learning into inclusive, conceptually rich and culturally sustaining practice, legitimising, structuring and resourcing translanguaging is not merely a technical adjustment but also an equity imperative.

6.7. Implications for pedagogy and policy

This study's findings compellingly demonstrated that translanguaging is an indispensable, theoretically grounded pedagogical imperative in Tanzania's multilingual secondary Biology classrooms.

The fluid and strategic integration of Kiswahili and, at times, ethnic languages serves as the vital scaffolding within the students' Zone of Proximal Development, dramatically alleviating the triple linguistic burden of English as a distant medium of instruction, Bantu-language cognition, and impenetrable Greco-Latin scientific terminology. While strict English-only attempts invariably resulted in disengagement and superficial outcomes, this practice consistently transformed silence, confusion, and rote memorisation into vibrant participation, conceptual depth, and culturally resonant learning, even in its largely unsystematic form. The entrenched policy-practice chasm, rooted in colonial monolingual ideologies that stigmatise L1 use despite nominal allowances, emerges as a profound epistemic injustice that perpetuates systemic linguistic exclusion, translating into individual failure, and sustains unequal science education across generations.

Ultimately, the only way to decolonise Tanzanian classrooms, fulfil the equity mandate of education, and unlock authentic scientific literacy for all students is a bold shift toward explicit, structured bilingual policies and pedagogies that legitimise Kiswahili to build robust conceptual foundations before systematically expanding academic English. This would render the ongoing defence of monolingual purism not only pedagogically bankrupt but also ethically indefensible.

7. Conclusion

Drawing on Vygotsky's sociocultural theory and immersion models, this study offers robust, classroom-grounded evidence that translanguaging is an indispensable, theoretically sound pedagogical practice for achieving genuine conceptual mastery and equity in Tanzania's multilingual secondary Biology classrooms, rather than a mere stopgap measure. The study findings also reveal how the strategic, fluid integration of Kiswahili and, occasionally, Ethnic Community languages serves as essential scaffolding within the students' Zone of Proximal Development. This dramatically reduces the triple linguistic burden which is imposed by English as a foreign medium of instruction, Bantu-language cognition, and opaque Greco-Latin scientific terminology, thus transforming pervasive silence, rote memorisation, and disengagement into active participation, meaningful sense-making, and culturally sustaining learning.

The persistent policy-practice chasm, in which an inherited colonial English-only ideology continues to stigmatise L1 use despite nominal policy allowances, emerges as a form of epistemic injustice that systematically disadvantages the majority of learners, perpetuates fluctuating national examination performance, and misattributes linguistic exclusion to individual deficiency rather than systemic failure. The transformative potential of planned, intentional bilingual strategies that deliberately build conceptual foundations in Kiswahili before systematically expanding academic English and scientific discourse rests on the fact that even largely unsystematic translanguaging consistently outperformed rigid monolingual instruction. Ultimately, legitimising and structuring translanguaging is more than a technical adjustment, as it is a decolonising imperative and equity mandate that can redefine Tanzanian science education from an exclusive gatekeeping mechanism into an inclusive, intellectually rich space where all students, irrespective of linguistic background, gain authentic access to scientific knowledge, critical thinking, and future opportunity, making the ongoing defence of monolingual policy not only pedagogically untenable but also ethically indefensible.

8. Recommendations

To enhance conceptual understanding and strengthen students' academic English, pedagogical practices should focus on structured translanguaging approaches that go beyond spontaneous code-switching and instead employ planned bilingual strategies. The structured use of both languages enables the teachers to build clearer conceptual bridges for learners, especially when dealing with abstract biological processes. The teachers should deliberately use Kiswahili to clarify complex ideas and activate learners' prior knowledge before switching to English explanations. This scaffold reduces cognitive load and enhances comprehension. In addition, explicit support for vocabulary

development and pronunciation, including etymological explanations and phonological guidance, should be embedded in biology instruction to help learners understand difficult scientific terms. To further reinforce students' understanding of biological concepts, multimodal strategies such as diagrams, models, and culturally relevant illustrations should be used together with these bilingual practices.

At the policy level, there is a need to reconsider the current English-only instruction and move toward a flexible bilingual policy that reflects the realities of Tanzanian classrooms. Ensuring that bilingual practices are systematically implemented rather than improvised requires the inclusion of explicit translanguaging guidelines in curriculum documents, teacher manuals, and official circulars.

Embedding such clarity in policy documents would legitimise bilingual teaching and eliminate the ambiguity that teachers currently face. Most importantly, monitoring and evaluation processes should shift from punitive approaches to supportive ones, recognising translanguaging as a legitimate and effective pedagogical tool rather than as a deviation from policy.

Curriculum and teaching resources should also be aligned with multilingual learning needs. The learners are better supported in understanding complex scientific content when curriculum materials explicitly consider linguistic diversity. It is essential to develop Biology textbooks with language-supportive qualities, including bilingual glossaries, simplified explanations, pronunciation guides, and Kiswahili-based scaffolds. To improve comprehension and participation, the supplementary instructional materials, both print and digital, should be available in both English and Kiswahili. Furthermore, to mitigate the abrupt shift that currently hinders learning, there should be structured bridging programmes to support learners' linguistic transition from Kiswahili-medium education to English-medium education.

Teacher professional development must prioritise training in structured translanguaging, bilingual lesson planning, and assessment strategies that are appropriate for multilingual contexts. For teachers to teach Biology content confidently in both languages, the programmes should also focus on improving their academic English proficiency and mastery of scientific vocabulary. The establishment of Professional Learning Communities (PLCs) would provide the teachers with a platform to discuss teaching strategies, collaboratively develop bilingual materials, and address common language-related challenges. This kind of teacher investment guarantees the sustainable implementation of bilingual pedagogies across schools.

Future research should explore the impact of structured translanguaging across a wider range of Biology topics, beyond the classification of living things, to determine its broader relevance. Additionally, incorporating students' perspectives would provide valuable insights into how learners perceive bilingual instruction and the scaffolds they find most effective, resulting in more responsive and contextually grounded pedagogical practices. Such evidence will enhance understanding of how bilingual strategies influence long-term scientific literacy.

References

[1] Ayimbila, E.A. and Pappoe, A.N.M., 2022. Evaluating the Effect of Multimodal Instructional Approach on Students' Academic Achievement in Classification of Living Organisms. *American Journal of Educational Research*, 10(3), pp.141–148. Available from: http://pubs.sciepub.com/education/10/3/5.

[2] Barrett, A.M., Milligan, L.O., Sane, E. and Bowden, R., 2025. Multilingual education for sustainable development in sub-Saharan Africa: Towards epistemic inclusion. *PROSPECTS*, Jul. Available from: https://doi.org/10.1007/s11125-025-09731-1.

[3] Barrett, A.M., Sane, E., Atnafu, B.A., Ndabakurane, J.J., Bowden, R., Bainton, D.R.N., Baraki, A., Biseko, J.M., Clegg, J., Giampapa, F., Grieve, T., Jonas, E.B., Kinyaga, A., Magashi, S., Mbwafu, F.A., Mosha, G., Mulugeta, T., Nkaizirwa, J.P., Sitotaw, R., Wayimba, S.J. and Yu, G., 2024. *Evaluating language supportive approaches to transition at scale*. (Working paper 05/2024). London, UK: British Council. Available from: https://doi.org/10.57884/S9PQ-GW02.

[4] Bieri, A.S., 2018. Translanguaging practices in CLIL and non-CLIL biology lessons in Switzerland. *EuroAmerican Journal of Applied Linguistics and Languages*, 5(2), pp.91–109. Available from: https://doi.org/10.21283/2376905x.9.142.

[5] Bikongoro, P.F., 2015. The relevance of the language policy for instruction and assessment of secondary education in Tanzania: A comparative analysis between the former Swahili and English medium students. *African Educational Research Journal*, 3(1), pp.1–8. Available from: https://files.eric.ed.gov/fulltext/EJ1216288.pdf.

[6] Biswalo, U.P., 2022. The interplay between students' first/home languages and school culture on students' learning of English in Tanzania. *Journal of Research Innovation and Implications in Education*, 6, pp.119–125. Available from: https://www.jriiejournal.com/wp-content/uploads/2022/02/JRIIE-6-1-012.pdf.

[7] Brock-Utne, B., 2007. Learning through a familiar language versus learning through a foreign language–a look into some secondary school classrooms in Tanzania. *International Journal of Educational Development*, 27(5), pp.487–498. Available from: https://doi.org/10.1016/j.ijedudev.2006.10.004.

[8] Brock-Utne, B., 2012. Language and inequality: Global challenges to education. *Compare: A Journal of Comparative and International Education*, 42(5), pp.773–793. Available from: https://doi.org/10.1080/03057925.2012.706453.

[9] Cenoz, J. and Gorter, D., 2022. *Pedagogical Translanguaging*, Elements in Language Teaching. Cambridge: Cambridge University Press. Available from: https://doi.org/10.1017/9781009029384.

[10] Charamba, E., 2020. Pushing linguistic boundaries: translanguaging in a bilingual science and technology classroom. *Journal of Multilingual and Multicultural Development*, 43(10), pp.951–965. Available from: https://doi.org/10.1080/01434632.2020.1783544.

[11] Charamba, E., 2020. Translanguaging: Developing scientific scholarship in a multilingual classroom. *Journal of multilingual and multicultural development*, 41, pp.655–672. Available from: https://doi.org/10.1080/01434632.2019.1625907.

[12] Christoffersen, K.O.D., 2019. What students do with words: Language use and communicative function in full and partial immersion classrooms. *NABE Journal of Research and Practice*, 8, pp.92–110. Available from: https://doi.org/10.1080/26390043.2017.12067798.

[13] Dankwa-Apawu, D., Agbetsoamedo, Y. and Rescue, E., 2025. Enacting translanguaging in a Ghanaian multilingual classroom: Code choices in minority language classrooms. *Language Policy in Africa*, 1(1), pp.92–116. Available from: https://doi.org/10.36950/lpia-01-01-2025-7.

[14] David, O. and Nsengimana, V., 2022. The effect of the use of English as language of instruction and inquiry-based learning on biology learning in Sub-Saharan Africa secondary schools: A systematic review of the literature. *African Journal of Research in Mathematics, Science and Technology Education*, 26(3), pp.275–285. Available from: https://doi.org/10.1080/18117295.2022.2141961.

[15] David, O., Uworwabayeho, A., Nsengimana, T., Minani, E. and Venuste, N., 2021. Practices in STEM Teaching and the Effectiveness of the Language of Instruction: Exploring Policy Implications on Pedagogical Strategies in Tanzania Secondary Schools. *Multilingual Education Yearbook 2021*, Multilingual Education Yearbook. Cham: Springer, pp.95–115. Available from: https://doi.org/10.1007/978-3-030-72009-4_6.

[16] David, O. and Venuste, N., 2021. Practice in teaching and learning of invertebrates: Evaluating the effectiveness of pedagogical language strategies in Tanzania secondary schools. *Eurasia Journal of Mathematics, Science and Technology Education*, 17(2), em1940. Available from: https://doi.org/10.29333/ejmste/9697.

[17] Erling, E.J., Adinolfi, L. and Hultgren, A.K., 2017. *Multilingual classrooms: Opportunities and challenges for English medium instruction in low and middle income contexts*. British Council, The Open University, and Education Development Trust. Available from: https://www.teachingenglish.org.uk/sites/teacheng/files/PUB_EMI_web_version.pdf.

[18] Fussy, D.S. and Iddy, H., 2024. Harnessing the potential of translanguaging in Tanzanian

secondary education. *Qualitative Research Journal*, 25, pp.481–495. Available from: https://doi.org/10.1108/QRJ-02-2024-0020.

[19] Gabrieli, P., Sane, E. and Alphonce, R., 2018. From access to quality secondary education: Developing language supportive textbooks to enhance teaching and learning of biology subject in Tanzania. *Journal of Education, Society and Behavioural Science*, 25(1), pp.1–15. Available from: https://doi.org/10.9734/jesbs/2018/40999.

[20] Ganuza, N. and Hedman, C., 2019. The impact of mother tongue instruction on the development of biliteracy: Evidence from Somali–Swedish bilinguals. *Applied Linguistics*, 40(1), pp.108–131. Available from: https://doi.org/10.1093/applin/amx010.

[21] García, O., 2017. Translanguaging in schools: Subiendo y bajando, bajando y subiendo as afterword. *Journal of Language, Identity and Education*, 16, pp.256–263. Available from: https://doi.org/10.1080/15348458.2017.1329657.

[22] García, O. and Kleifgen, J.A., 2019. Translanguaging and literacies. *Reading Research Quarterly*, 55, pp.553–571. Available from: https://doi.org/10.1002/rrq.286.

[23] García, O. and Wei, L., 2014. *Translanguaging: Language, Bilingualism and Education*. London: Palgrave Pivot. Available from: https://doi.org/10.1057/9781137385765.

[24] Guo, Z. and Feng, Q., 2025. Exploring Scaffolding Strategies within Pedagogical Translanguaging in EFL Classrooms. *The Electronic Journal for English as a Second Language*, 29(3). Available from: https://doi.org/10.55593/ej.29115a3.

[25] Heugh, K., 2021. Multilingual pedagogies, action research and decolonial policy intervention in Higher Education. Conference presentation at the ECSPM Symposium. Available from: https://ecspm.org/wp-content/uploads/2021/07/Heugh_ECSPM-2021_Multilingual-Pedagogies-in-HE_Action-Research_280621.pdf.

[26] Hiza, C.D. and Paschal, M.J., 2023. Emphasizing Kiswahili as a medium of instruction for effective education output in Tanzania. *Education, Language and Sociology Research*, 4(1), pp.31–38. Available from: https://doi.org/10.22158/elsr.v4n1p31.

[27] Iddi, S. and Mtana, N., 2022. The contribution of language supportive teaching in facilitating the transition from Kiswahili to English medium of instruction in form one: The case of Morogoro Teachers' College, Tanzania. *East African Journal of Education Studies*, 5(3), pp.216–228. Available from: https://doi.org/10.37284/eajes.5.3.922.

[28] Juma, Z.R., 2022. The Role of Language of Instruction and Development of Biological Literacy among Tanzanian Secondary School Students. *Journal of Research Innovation and Implications in Education*, 6(1), pp.56–62. Available from: https://www.jriiejournal.com/wp-content/uploads/2022/01/JRIIE-6-1-006.pdf/.

[29] Karlsson, A., Nygård Larsson, P. and Jakobsson, A., 2019. Multilingual students' use of translanguaging in science classrooms. *International Journal of Science Education*, 41(15), pp.2049–2069. Available from: https://doi.org/10.1080/09500693.2018.1477261.

[30] Karlsson, A., Nygård Larsson, P. and Jakobsson, A., 2020. The continuity of learning in a translanguaging science classroom. *Cultural Studies of Science Education*, 15(1), pp.1–25. Available from: https://doi.org/10.1007/s11422-019-09933-y.

[31] Kinyaduka, B.D. and Kiwara, J.F., 2013. Language of instruction and its impact on quality of education in secondary schools: Experiences from Morogoro Region, Tanzania. *Journal of Education and Practice*, 4(9), pp.90–95. Available from: https://www.iiste.org/Journals/index.php/JEP/article/view/5752/0.

[32] Kirui, K.E.E.J., Osman, A. and Naisujaki, L., 2017. Attitude of teachers towards use of English Language as a medium of instruction in secondary schools in Republic of Tanzania: A pragmatic perspective of community secondary schools in Arusha District. *Advances in Social Sciences Research Journal*, 4(9), pp.105–117. Available from: https://doi.org/10.14738/assrj.49.2991.

[33] Kraatz, E., Nagpal, M., Lin, T., Hsieh, M., Ha, S.Y., Kim, S. and Shin, S., 2020. Teacher scaffolding of social and intellectual collaboration in small groups: A comparative case study. *Frontiers in Psychology*, 11, 587058. Available from: https://doi.org/10.3389/fpsyg.2020.587058.

[34] Lyimo, N.S. and Laiser, S.J., 2018. Perception of teachers on challenges facing the use of English

as medium of instruction of Tanzanian secondary schools: A case of Karatu District, Tanzania. *Journal of Research Innovation and Implications in Education*, 2, pp.43–49. Available from: https://jriiejournal.com/wp-content/uploads/2019/02/JRIIE-2-4-007.pdf.

[35] Makupe, M.A. and Machaba, M.F., 2024. English as a language of preference in Mathematics learning: Perspectives from high school learners in township contexts. *Interdisciplinary Journal of Education Research*, 6, pp.1–15. Available from: https://doi.org/10.38140/ijer-2024.vol6.24.

[36] Mandillah, L., 2019. Kenyan Curriculum Reforms and Mother Tongue Education: Issues, Challenges and Implementation Strategie. *Education as Change*, 23, 3379. Available from: https://doi.org/10.25159/1947-9417/3379.

[37] Marwa, N.W., 2014. Tanzania's Language of Instruction Policy Dilemma: Is there a Solution? *Mediterranean Journal of Social Sciences*, 5(23), pp.1262–1268. Available from: https://doi.org/10.5901/mjss.2014.v5n23p1262.

[38] Mbwile, T., 2023. Exploring Teachers' Views in Using Code-switching for Classroom Interaction in Secondary Schools in Temeke District, Tanzania. *African Journal of Empirical Research*, 4(2), pp.710–718. Available from: https://doi.org/10.51867/ajernet.4.2.71.

[39] Milligan, L.O., Clegg, J. and Tikly, L., 2016. Exploring the potential for language supportive learning in English medium instruction: A Rwandan case study. *Comparative Education*, 52, pp.328–342. Available from: https://doi.org/10.1080/03050068.2016.1185258.

[40] Ministry of Education, Science and Technology, 2019. *National Curriculum Framework for Basic Education and Teacher Education*. Dar es Salaam: Tanzania Institute of Education. Available from: https://www.tie.go.tz/uploads/documents/sw/1568799160-National%20Curriculum%20Framework%20for%20Basic%20and%20Teacher%20Education.pdf.

[41] 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, pp.265–275. Available from: https://doi.org/10.1080/18117295.2019.1654212.

[42] Mkimbili, S.T. and Fredlund, T., 2025. Exploring science teachers' approaches to facilitating student classroom talk when using a foreign language: A case of four secondary schools in Tanzania. *African Journal of Research in Mathematics, Science and Technology Education*, 29, pp.191–203. Available from: https://doi.org/10.1080/18117295.2025.2483129.

[43] Mokibelo, E., 2016. Code-switching: A strategy for teaching and learning or a problem in Botswana. *Research & Reviews: Journal of Educational Studies*, 2, pp.30–38. Available from: https://www.rroij.com/open-access/codeswitching-a-strategy-for-teaching-and-learning-or-a-problem-inbotswana-.php?aid=80160.

[44] Mugaya, T.S., 2019. The use of Kiswahili Language and Learning Approaches in Classroom Interaction: A case study of secondary schools in Dodoma, Tanzania. *Journal of Research Innovation and Implications in Education*, 2(4), pp.37–42. Available from: https://tinyurl.com/2btm72m3.

[45] Muzeya, N., 2023. Teachers and learners language practices in selected multilingual primary schools of Choma District of Zambia. *Journal of Lexicography and Terminology*, 7(2), pp.40–62. Available from: https://journals.unza.zm/index.php/jlt/article/view/1138/849.

[46] Mwambula, H., 2021. Teachers' perception on translanguaging in mother tongue based languages as a tool for teaching and learning in lower rural primary education in Tanzania: A case study of Rungwe District. *International Journal of English Language & Translation Studies*, 9, pp.41–45. Available from: https://www.eltsjournal.org/archive/value9%20issue3/5-9-3-21.pdf.

[47] Nhongo, R. and Tshotsho, B.P., 2019. Translanguaging as an instructional method in science and mathematics education in English second language. *The Independent Journal of Teaching and Learning*, 14(2), pp.57–71. Available from: https://www.researchgate.net/publication/378695310.

[48] Ntuli, T.G. and Mudau, A.V., 2025. Development of an indigenous African language scientific register for natural sciences: Focusing on challenges, opportunities, and perceptions. *Perspectives*

in Education, 43(3), pp.37–47. Available from: https://doi.org/10.38140/pie.v43i3.6581.

[49] Otieno, K.O. and Saiteu, L.L., 2023. Influence of Language of Instruction in Enhancing Students' Acquisition of Knowledge in Secondary Schools in Arusha City Council, Tanzania. *Journal of Research Innovation and Implication in Education*, 7, pp.11–21. Available from: https://jriiejournal.com/wp-content/uploads/2023/01/JRIIE-7-1-002.pdf.

[50] Otieno, R.L.O., 2025. Translanguaging Pedagogies And The Making Of Literate Multilinguals: A Cognitive And Sociocultural Inquiry. *IOSR Journal of Humanities and Social Science*, 30(12), pp.13–21. Available from: https://doi.org/10.9790/0837-3012091321.

[51] Otundo, B.K., 2023. Communicating in multilingual learning ecologies: Teacher trainees' perceptions of translanguaging in lecture rooms in Kenya. *Journal of Linguistics, Literary and Communication Studies*, 2(2), pp.24–34. Available from: https://doi.org/10.58721/jllcs.v2i2.378.

[52] Patrick, M.S., 2020. *Effects of Language of Instruction on Students' Academic Performance in Community Secondary Schools in Bunda District*. Master's thesis. Open University of Tanzania. Available from: https://web.archive.org/web/20221203025922/http://repository.out.ac.tz/2778/.

[53] Poza, L.E., 2018. The language of ciencia: Translanguaging and learning in a bilingual science classroom. *International Journal of Bilingual Education and Bilingualism*, 21(1), pp.1–19. Available from: https://doi.org/10.1080/13670050.2015.1125849.

[54] Probyn, M., 2019. Pedagogical translanguaging and the construction of science knowledge in a multilingual South African classroom: Challenging monoglossic/post-colonial orthodoxies. *Classroom Discourse*, 10(3–4), pp.216–236. Available from: https://doi.org/10.1080/19463014.2019.1628792.

[55] Pun, J.K.H. and Tai, K.W.H., 2021. Doing science through translanguaging: A study of translanguaging practices in secondary English as a medium of instruction science laboratory sessions. *International Journal of Science Education*, 43(7), pp.1112–1139. Available from: https://doi.org/10.1080/09500693.2021.1902015.

[56] Puntambekar, S., 2021. Distributed scaffolding: Scaffolding students in classroom environments. *Educational Psychology Review*, 34, pp.451–472. Available from: https://doi.org/10.1007/s10648-021-09636-3.

[57] Quay, S. and Kano, M., 2025. Implicit Foreign Language Learning: How Early Exposure and Immersion Affect Narrative Competence. *Education Sciences*, 15(10), 1382. Available from: https://doi.org/10.3390/educsci15101382.

[58] Ralushai, M.M., Ntombela, B.X. and Rammala, J., 2024. English first additional language teachers' perceptions of translanguaging pedagogy: A case of Vhembe District, Limpopo province. *African Perspectives of Research in Teaching and Learning*, 8, pp.57–72. Special Issue. Available from: https://doi.org/10.70875/v8i3article5.

[59] Reilly, C., Costley, T., Gibson, H. and Kula, N.C., 2024. The multilingual university: Language ideology, hidden policies and language practices in Malawian universities. *Language, Culture and Curriculum*, 37, pp.213–229. Available from: https://doi.org/10.1080/07908318.2024.2303686.

[60] Rioux, J. and Ewing, B., 2022. Contextualising aboriginal faunal stories with the Linnaean taxonomy: Culturally responsive pedagogy in zoology. *The Australian Journal of Indigenous Education*, 51(1), pp.1–16. Available from: https://doi.org/10.55146/ajie.2022.7.

[61] Spernes, K.I. and Ruto-Korir, R., 2018. Medium of instruction in school: The indigenous language, the national language or the official language? A case study from multilingual deep rural Kenya. *Journal of African Languages and Linguistics*, 39(1), pp.41–64. Available from: https://doi.org/10.1515/jall-2018-0002.

[62] Staden, S. van, Bosker, R. and Bergbauer, A., 2016. Differences in achievement between home language and language of learning in South Africa: Evidence from prePIRLS 2011. *South African Journal of Childhood Education*, 6(1), pp.1–10. Available from: https://doi.org/10.4102/sajce.v6i1.441.

[63] Svongoro, P. and Kondowe, W., 2024. Forms of translanguaging in Zimbabwe's classrooms: Are the practices useful or useless in the teaching and learning of STEM subjects? *African Perspectives of Research in Teaching and Learning Journal*, 8(1), pp.10–22. Available from: https://conf.ul.ac.za/aportal/application/downloads/Article_2_8_2024.pdf.

[64] Tai, K.W.H. and Wong, C.Y., 2023. Empowering Students Through the Construction of a Translanguaging Space in an English as a First Language Classroom. *Applied Linguistics*, 44(6), 12, pp.1100–1151. Available from: https://doi.org/10.1093/applin/amac069.

[65] The National Examination Council of Tanzania, 2020. *Students' Item Response Analysis Report for the Form Two National Assessment (FTNA) 2019: 033 Biology*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Students'%20Item%20Response%20Analysis%20(SIRA)%20Reports%20/FTNA/2019/033_BIOLOGY.pdf.

[66] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2021. *Students' Item Response Analysis Report for the Form Two National Assessment (FTNA) 2020: 033 Biology*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Students'%20Item%20Response%20Analysis%20(SIRA)%20Reports%20/FTNA/2020/033_BIOLOGY.pdf.

[67] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2022. *Students' Item Response Analysis Report on the Form Two National Assessment (FTNA) 2021: 033 Biology*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Students'%20Item%20Response%20Analysis%20(SIRA)%20Reports%20/FTNA/2021/033_BIOLOGY.pdf.

[68] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2023. *Students' Item Response Analysis Report for the Form Two National Assessment (FTNA) 2022: 033 Biology*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Students'%20Item%20Response%20Analysis%20(SIRA)%20Reports%20/FTNA/2022/033_BIOLOGY.pdf.

[69] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2024. *Candidates' Item Response Analysis Report on the Certificate of Secondary Education Examination (CSEE) 2023: 033 Biology*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Candidates'%20Item%20Response%20Analysis%20(CIRA)%20Reports%20/CSEE/2023/033%20BIOLOGY.pdf.

[70] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2024. Students' Item Response Analysis Report on the Form Two National Assessment. Available from: https://darasahuru.ac.tz/sira-form-two-report-books-ftna-2023/.

[71] The United Republic of Tanzania, Ministry of Education, Science and Technology and National Examination Council of Tanzania, 2026. *Form Two Learning Evaluation (FTLE) report (FTLE)*. Dar es Salaam, Tanzania: The National Examinations Council of Tanzania. Available from: https://www.necta.go.tz/publications/Performance%20Analysis%20Books/Students'%20Item%20Response%20Analysis%20(SIRA)%20Reports%20/FTLE/FTLE_2025.pdf.

[72] United Republic of Tanzania and Ministry of Education, Science and Technology, 2023. *Education and Training Policy 2014*. 2023rd ed. Dodoma: Ministry of Education, Science and Technology. Available from: https://web.archive.org/web/20250109073614/https://www.moe.go.tz/sites/default/files/EDUCATION%20AND%20TRAINING%20POLICY%202014,%202023%20EDITION.pdf.

[73] Vuzo, M., 2020. Exclusion through Language: A Reflection on Classroom Discourse in Tanzanian Secondary Schools. *Papers in Education and Development*, (29). Available from: https://journals.

udsm.ac.tz/index.php/ped/article/view/1450.
[74] Vygotsky, L.S., 1978. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, Massachusetts and London, England: Harvard University Press. Available from: https://w.pauldowling.me/rtf/2021.1/readings/LSVygotsky_1978_MindinSocietyDevelopmentofHigherPsycholo.pdf.
[75] Wei, L., 2022. Translanguaging as method. *Research Methods in Applied Linguistics*, 1(3), p.100026. Available from: https://doi.org/10.1016/j.rmal.2022.100026.
[76] Yumei, Z. and Jocuns, A., 2022. From Natural Translanguaging to Planned Translanguaging: Developing Classroom Translanguaging as Pedagogy in a Private University in China. *Arab World English Journal*, 13(1), pp.313–329.
[77] Zukswert, J.M., Barker, M.K. and Mcdonnell, L., 2019. Identifying Troublesome Jargon in Biology: Discrepancies between Student Performance and Perceived Understanding. *CBE—Life Sciences Education*, 18(1), ar6. Available from: https://doi.org/10.1187/cbe.17-07-0118.

A. Interview guide questions for biology teachers

1. How does the English-only policy influence the way you teach Biology, and which challenges do you face in implementing it?
2. How comfortable do you feel teaching Biology in English, and when do you find it difficult to maintain English-only instruction?
3. Which strategies do you use when explaining scientific terminology that students find difficult to comprehend in English?
4. In which situations do you use Kiswahili or Ethnic Community Language (ECL) during teaching, and why do you consider it necessary in the teaching process?
5. When do you notice that students are able to grasp the Biology concept more clearly using both English and Kiswahili?
6. When do you decide to switch between English and Kiswahili during teaching?
7. How does the use of Kiswahili affect the students' understanding of scientific terms and concepts?
8. How does the students' mother tongue or primary school background influence their comprehension abilities and participation in Biology lessons?
9. Which benefits or limitations do you experience when teaching Biology using the flexible bilingual approach?
10. How do you support your students to develop both Biology content mastery and English proficiency needed for future academic or career opportunities?

B. Students' post-observation interview guide

1. Which challenges did you face in understanding Biology concepts during today's lesson?
2. Why was the use of translanguaging important in today's Biology lesson?

C. Observation guide

Theme	Indicators	Observation noted
Language use during instruction	- Teacher uses English consistently for explanations. - Teacher uses Kiswahili to clarify or reinforce key concepts. - Teacher mixes English and Kiswahili strategically (planned translanguaging). - Teacher switches languages spontaneously and reactively (unsystematic switching).	
Students' responses and participation	- Students respond when asked in English. - Students remain silent or hesitant when addressed in English. - Students respond more actively when addressed in Kiswahili. - Students rely on Kiswahili prompts to recall prior knowledge.	
Comprehension and meaning-making	- Students demonstrate better understanding when the teacher uses Kiswahili to explain concepts. - Students demonstrate conceptual confusion when only English is used. - Students use Kiswahili to explain scientific terms during group or individual work.	
Handling scientific Terminology	- Students struggle with the pronunciation of complex terms. - Teacher provides scaffolding for pronunciation. - Students demonstrate partial familiarity with terminology but with limited mastery.	
Instructional strategies	- Teacher checks for understanding using both languages. - Teacher encourages English use for academic vocabulary. - Teacher explains scientific terms using real-life analogies in Kiswahili. - Teacher explicitly connects English scientific terms with Kiswahili equivalents.	
Classroom interaction patterns	- Students discuss concepts among themselves in Kiswahili. - Students attempt to answer questions in English, but they switch to Kiswahili. - Teacher accepts responses in Kiswahili and translates them to English. - Teacher insists on English-only responses.	
Teaching–learning environment	- Evidence of the English-only policy is posted in the classroom. - Teacher refers to policy expectations during the lesson. - There is visible tension between policy expectations and classroom practice.	