Inclusion of Sinhala Scientific Terminology in Grade 10 and 11 English Medium Science Textbooks: A Qualitative Study of Tamil First Language Teachers' Perceptions

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Abstract

This study examines the challenges associated with the use of Sinhala terminology in English-medium science textbooks within a multilingual context in Sri Lanka. This study adopts a qualitative approach to explore teachers' perceptions in depth. Data were collected through semi-structured interviews with four English-medium Tamil first-language science teachers who taught Grades 10 and 11 students and were analyzed using thematic analysis. The findings reveal an uneven, localized distribution of Sinhala terminology in science textbooks, with an inconsistent, multilingual presentation. Such inconsistencies confuse students, especially when the same concept is presented in both Sinhala and English. As a result, students often rely on surface learning rather than developing conceptual understanding. The study also identifies terminology-related challenges in examinations and assessments, where the presence of Sinhala-only terms can disadvantage learners, especially those Tamil-speaking learners. In response to these challenges, teachers implement strategies, including code-switching, referring to Tamil-medium textbooks, and providing additional verbal and visual explanations, which increase their instructional burden. These practices, however, are largely formed by the absence of clear policy guidelines and limited instructional support for multilingual science teaching, especially for Tamil Teachers. The study highlights the need for better, more organized use of multilingual terms in science education. Strengthening policy frameworks and providing targeted pedagogical support are essential for enhancing conceptual understanding and promoting equitable learning opportunities in multilingual classrooms.

Keywords: Multilingualism, Science education, conceptual understanding, Textbooks, Teacher perceptions

Introduction

In an ideal education system, textbooks serve as one of the main resources for curriculum implementation. Textbooks guide teachers in selecting teaching methods and support them in achieving course objectives. They also play an important role instudents' learning by enabling independent study, revision, self-assessment, and preparation for examinations. For many learners, especially in developing countries, textbooks remain the most accessible and affordable educational resource.

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Textbooks are a significant feature of students' school experience and significantly influence their understanding of subjects. In science education, textbooks play a particularly important role, as they often shape students' ideas about the nature of science (Ninnes, 2000). Science textbooks act as authoritative representations of scientific knowledge and strongly influence students' conceptual understanding. They also determine what science content is taught and how it is presented. Across many countries, science textbooks are one of the most frequently used teaching resources in classrooms.

In the setting of English-medium education, science textbooks also function as language-learning tools. Students are required to understand complex scientific concepts through English, which is often their second language. In Sri Lanka, many students learn science in their mother tongue at the primary level and shift to English at the secondary level. This transition presents important language and cognitive challenges. Students need to learn new scientific concepts while also using a language they are less familiar with.

Sri Lanka is a multilingual country where Sinhala and Tamil are the official languages, and English functions as a link language, particularly in education, administration, and technology. Bilingual education in Sri Lanka did not begin suddenly; it developed to meet long-standing educational and social needs. The Kannangara reforms in 1943 made English a compulsory second language, but the Sinhala Only Act of 1956 reduced its importance. By 1960, "*Swabhasha*" had become the medium of instruction at all levels, creating the background for later bilingual education reforms. In recent years, since 2003, English has been reintroduced as a medium of instruction in Sri Lankan secondary schools from Grade Six to the G.C.E Advanced Level. The Government of Sri Lanka has gradually promoted English as a Medium of Instruction (EMI) in schools. This policy shift aims to improve students' English proficiency, enhance access to global knowledge, and prepare learners for higher education and employment in a globalized world. As a result, English-medium science textbooks have become central instructional tools at the secondary school level.

Given this context, textbook analysis is essential to understanding how scientific knowledge is presented to learners. In Sri Lanka, textbooks are often the only readily available curriculum resource for both teachers and students. Therefore, the quality of textbook content, including language use, has a direct impact on teaching and learning outcomes.

Scientific terminology is a key component of scientific language. Many scientific terms used in English originate from other languages such as Latin, Greek, and French. These terms support making scientific communication clear and universal. Consequently, English-medium science textbooks frequently include terminology derived from these languages. However, secondary-level students often have little or no exposure to these source languages. As a result, unfamiliar word structures, abstract vocabulary, and dense technical terms can make scientific concepts difficult to understand and may prevent meaningful learning.

The shift toward English-medium science education has also introduced additional linguistic challenges. In some textbooks, scientific terms borrowed from other languages are presented without clear definitions, explanations, or linguistic support. Such practices raise concerns about the accessibility of textbook content and its suitability for learners with varying levels of English proficiency.

These challenges are particularly significant for students who learn English as a Second Language. In the Sri Lankan context, an additional concern is the inclusion of Sinhala terminology within English-medium science textbooks. This practice may disadvantage Tamil-speaking bilingual students, who may struggle to understand Sinhala-based terms and feel linguistically marginalized in the classroom. Language plays an important role not only in academic achievement but also in learners' sense of inclusion, identity, and access to education. Therefore, it is important to critically examine how the use of Sinhala-dominant terminology in English-medium textbooks affects Tamil-speaking students.

Most existing studies focus on curriculum alignment or student learning outcomes, while the linguistic characteristics of textbooks themselves receive less attention. In particular, although many analyses of science textbooks have been conducted internationally, very few studies have explored the presence and impact of non-English terminology, especially Sinhala terms, in English-medium textbooks in Sri Lanka, and their effects on Tamil-speaking learners.

Therefore, this study aims to examine teachers' perceptions of the inclusion of Sinhala terminology in English-medium science textbooks and to contribute to the development of linguistically inclusive materials, improved teaching practices, and informed policy decisions in English-medium education.

Objectives

1. To explore teachers' perceptions of how the use of Sinhala terminology in English-medium science textbooks influences students' learning and Teaching practises.
2. To investigate the strategies teachers use to explain Sinhala terminology and support students' understanding in the classroom.

Literature Review

English as a Medium of Instruction in Multilingual Sri Lankan Contexts

Sri Lanka introduced English-medium instruction (EMI) in 2001 to help students meet global demands. However, its implementation remains limited, with only a few schools offering EMI, and many students still preferring their mother tongue due to language and resource challenges (Wijayatunga, 2018). The language of instruction has strongly influenced access to science education in Sri Lanka. Studies in Sri Lanka show that teachers often use code-switching between English and Sinhala to explain difficult science concepts, which students find helpful for understanding (Abeywickrama, 2023). This shows that linguistic support improves understanding, and including Sinhala or Tamil terms in English-medium textbooks can further aid comprehension.

Sri Lanka is linguistically diverse, with Sinhala and Tamil as national languages and English as a link language. Although bilingual education is promoted, the implementation of EMI varies across regions and schools (Wedikarage, 2018). Student diversity makes EMI implementation more challenging in Sri Lanka. This diversity makes it difficult for teachers to rely on uniform teaching methods or materials (Perera, 2002).

The influence of textbooks extends to broader educational perceptions. Ravitch (2003) and Valverde et al. (2002) emphasize that textbooks help shape the understanding of subject content not only for students but also for teachers and families. The importance of investigating whether textbooks designed for EMI environments are linguistically and pedagogically appropriate for supporting students' academic success (Hu, 2021).

Language Influence in English-Medium Science Education

Language plays an important role in helping students understand scientific concepts, especially in English-medium classrooms in multilingual contexts like Sri Lanka. Devetak & Vogrinc (2013) scientific texts should employ clear explanations,

concise sentence structures, and minimal reliance on unfamiliar or foreign terminology to support learner comprehension. (Quality criteria for teaching materials, 2012) stress that textbook language must be carefully proofread and presented in a clear and coherent writing style.

Wiest (2003) explains that students understand texts better when they are interesting and engaging. When students come across unfamiliar words, they spend more time trying to understand them, which can slow down reading and affect comprehension (Mikk, 2000).

In the Sri Lankan context, studies by Wedikkarage (2018) indicate that teachers frequently rely on Sinhala or Tamil to clarify scientific concepts due to students' limited proficiency in English. Code-switching is widely used and helpful in English-medium classrooms in Sri Lanka, as both teachers and students see it as beneficial for understanding lessons, even though it is used naturally and students' preferences are not often formally considered (Abeywicrama, 2023). Cummins (2000) highlights that achievement in cognitively demanding subjects such as science depends not only on conceptual knowledge but also on learners' proficiency in the language of instruction.

Multilingual Terminology in Science Textbooks

Scientific terminology in English predominantly derives from Latin and Greek Terms such as *photosynthesis*, *mitosis*, and *evaporation* are linguistically distant from the everyday vocabulary of most learners. Fang (2006) emphasizes that although these terms are internationally standardized, they often lack transparency for students unfamiliar with classical languages. In multilingual societies, scientific terms are frequently borrowed, transcribed, or adapted into local languages. Linguistic borrowing can help understanding when terms are familiar, but inconsistent or unfamiliar borrowed words can confuse learners and slow their understanding (Nation, 2013). Scientific terms from languages other than English, such as Greek, Latin, Sinhala, and Tamil, can strongly influence how learners understand and process concepts. Boroditsky (2011) argues that Scientific terms from unfamiliar languages can affect how students understand concepts; without proper explanation, learners may rely on memorization, but clear support in textbooks can improve real understanding.

Impact on Teaching, Learning

Science places additional language demands because its concepts are abstract and it uses specialized terms that differ from everyday language. Wellington and

Osborne (2001) describe this as a "double challenge" for learners: students must simultaneously grasp new scientific concepts while decoding unfamiliar linguistic forms. When science is taught through a second or foreign language, as in bilingual or EMI contexts, this challenge becomes even more pronounced, increasing the risk of superficial understanding and cognitive overload. Bandara (2008) points out that inadequacies in learning materials complicate students' learning experiences in English-medium education. Moreover, while code-switching supports immediate comprehension, its unstructured use may result in fragmented knowledge and misconceptions, as students encounter multiple terms for the same concept without clear conceptual alignment.

In the Sri Lankan context, the presence of Sinhala terms in English-medium textbooks and the use of less relevant, culturally mismatched examples can negatively affect Tamil-speaking learners' understanding. (Ma, 2023) in a study on bilingual education, identifies multiple barriers affecting both teachers and learners, including cultural insensitivity in instructional materials, lack of authenticity, outdated content, limited exposure to diverse language varieties, and insufficient opportunities for meaningful language use.

Role of Textbook in Science Education

In science education, textbooks often function as authoritative sources of content, scientific terminology, and conceptual explanations, thereby utilising a significant influence on students' understanding of scientific knowledge (Harwood, 2005; Wellington & Osborne, 2001). Consequently, the manner in which scientific terminology is introduced, contextualized, and reinforced in science textbooks is critical, as it directly affects students' conceptual clarity, language development, and overall learning outcomes (Irez, 2009). Within the Sri Lankan education system, the role of textbooks becomes even more significant in the context of bilingual and EMI (Kularathne & Karunakaran, 2023). The content and process standards of the English as a Second Language curriculum have been criticized for their limited capacity to effectively support second-language development among both monolingual and bilingual learners (Kularathne & Karunakaran, 2023). In such a context, science textbooks used in EMI settings assume a key role in mediating both scientific understanding and language acquisition.

Beyond language policy considerations, concerns have also been raised regarding the quality and coherence of scientific knowledge presented in textbooks. Harwood (2005) notes that textbooks not only convey subject matter but also structure how knowledge is organized and interpreted in classroom contexts. Inaccurate,

fragmented, or poorly sequenced scientific content can lead to the formation of misconceptions among learners, thereby restricting meaningful conceptual understanding (Irez, 2009). Given these limitations, teachers play a critical mediating role. Teachers' awareness of textbook shortcomings enables them to supplement instruction, scaffold learning, and mitigate potential negative effects on students' academic development (Haggarty & Pepin 2002). Modern views suggest that textbooks should go beyond memorization by helping students understand concepts, make connections, and develop skills, while balancing content with learner comprehension and engagement (Nazarova & Gospodarik, 2006). Textbook language and design strongly affect learning. Unclear or untranslated terms can limit understanding, while well-designed materials can support diverse learners. However, research on this in Sri Lanka is limited, highlighting the need for further study.

Methodology

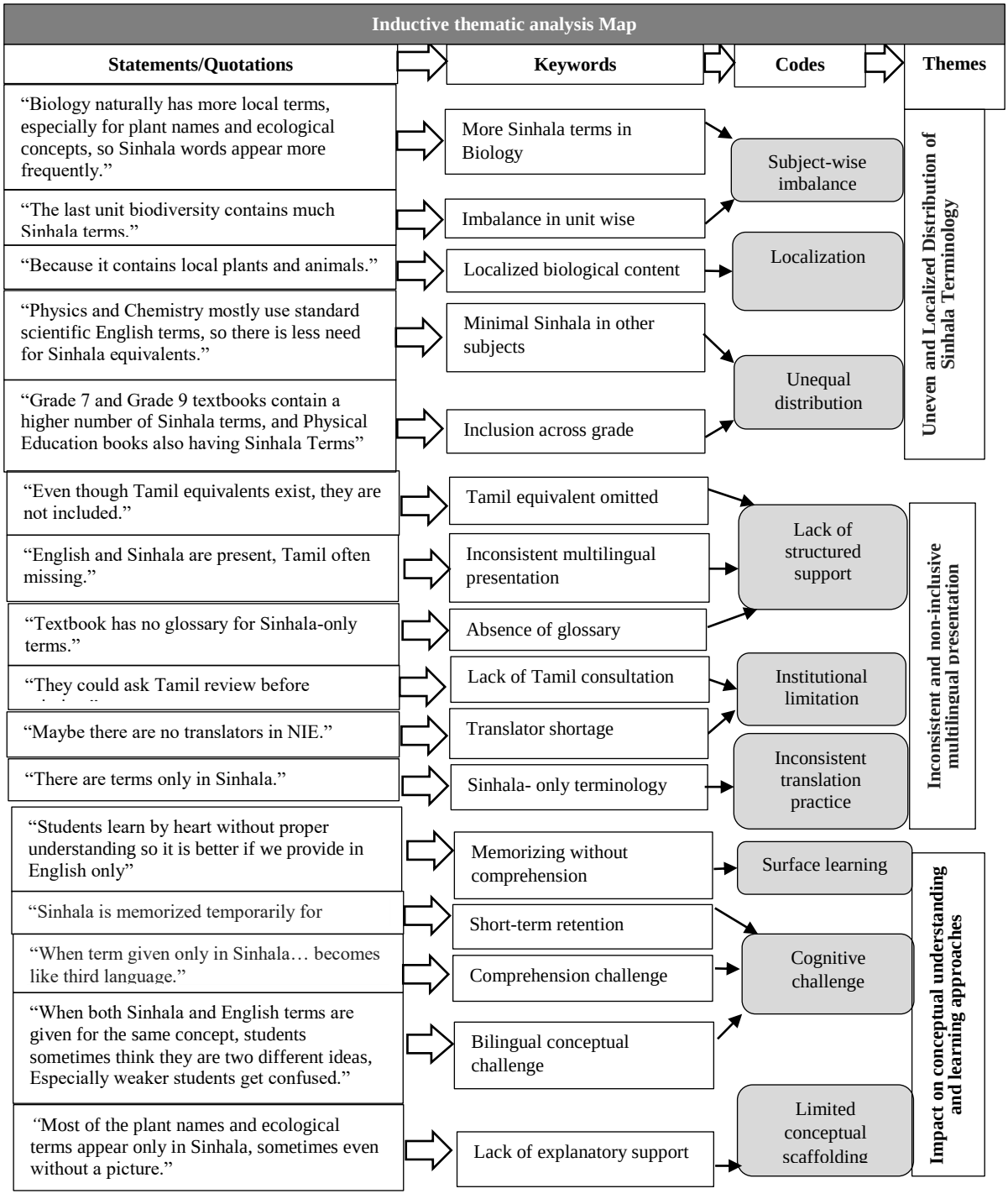
This study is part of a broader mixed-methods research study. However, the present paper reports only the qualitative findings derived from semi-structured interviews. This study adopted a qualitative research design to explore teachers' perceptions and experiences regarding the use of Sinhala terminology in English-medium science textbooks. Data were collected through semi-structured interviews. Data were analysed using an inductive thematic analysis approach, where themes were generated from the data (Braun & Clarke, 2006). The sample consists of four English-medium science teachers selected purposively from four leading schools in the Jaffna District, Sri Lanka. Each interview was conducted and lasted approximately 30-35 minutes, which aligns with recommended durations for in-depth qualitative interviews (Kvale & Brinkmann, 2009). The interviews were recorded with participants' permission and later transcribed for analysis.

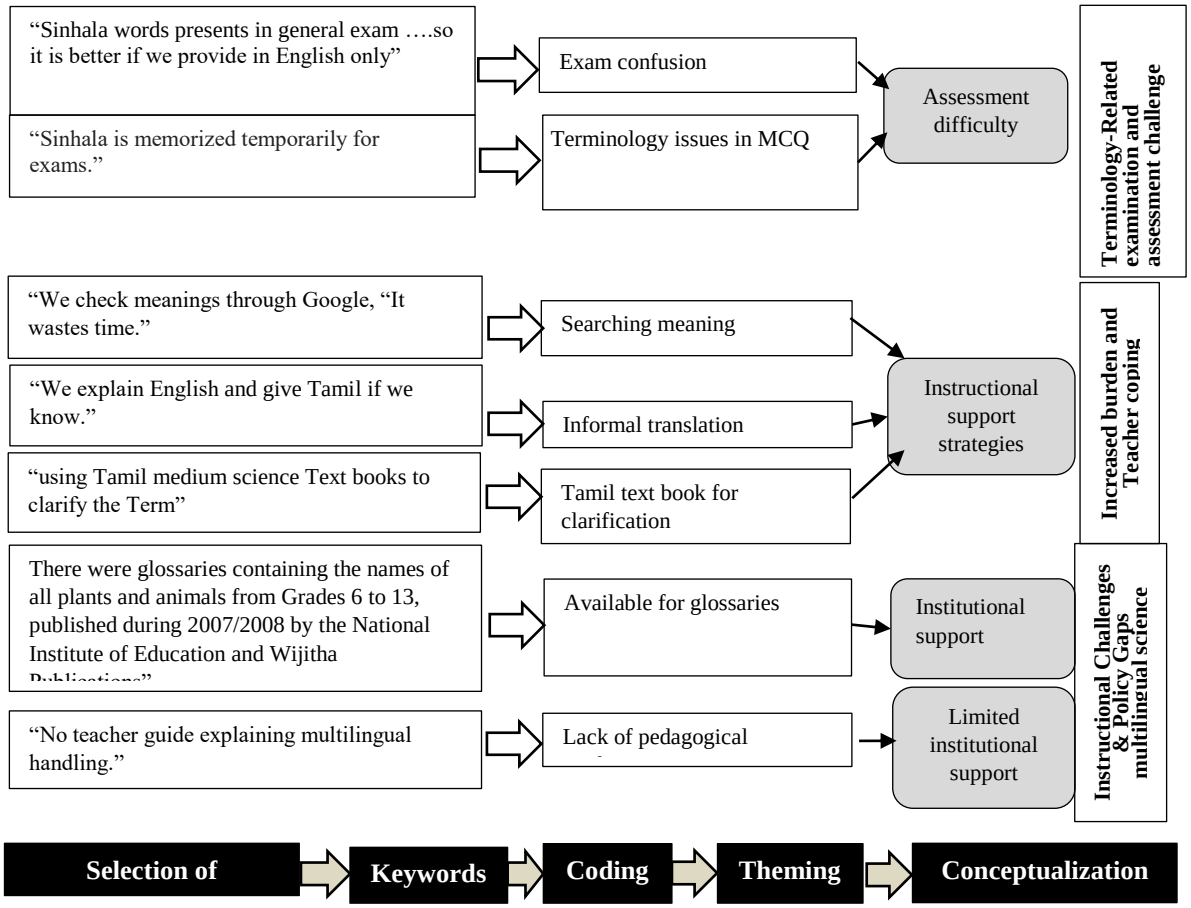
Results and Discussions

The Results and discussion section presents the main themes derived from the semi–structured interviews with four English-medium science teachers. The data were analyzed using thematic analysis, and key themes were identified from the main Interview script. Themes mainly highlight the issues related to the use of Sinhala terminology in science Textbooks and its implications for teaching, learning, and educational equity in multilingual contexts. A thematic map, Figure 1, is shown below to visually represent the identified themes.

Figure 1

Thematic Map





Uneven and Localized Distribution of Sinhala Terminology

Teachers noted that the use of Sinhala terminology varies across subject areas, with a stronger presence in Biology compared to Chemistry and Physics. This variation appeared to be connected to the nature of the subject content. One Teacher explained, "Some Biology terms are unfamiliar to everyone and require more explanation, so Sinhala terms are frequently used to clarify them. The plants are native to specific areas, and we had never heard of them before" (T1).

This demonstrates that language use is not uniformly arranged but is influenced by situational and disciplinary factors. While such localized use may support direct understanding, the lack of standardization can create inconsistencies in students' exposure to scientific terminology. This uneven distribution raises concerns about the consistency of language support across the science curriculum. This indicates that unfamiliar or locally specific Biology concepts require additional explanation, leading teachers to rely more on Sinhala terms to support student understanding. This may place Tamil-medium students at a learning disadvantage.

Another Teacher stated:

> The biology section naturally has more local terms, especially for plant names and ecological concepts, so Sinhala words appear more frequently. The biodiversity unit contains many Sinhala terms. In my view, Grade 7 and Grade 9 textbooks have a higher number of Sinhala terms, and Physical Education textbooks also include Sinhala terms. (T2)

This suggests that subject-specific content influences the frequency of Sinhala terminology, particularly in areas such as biodiversity and ecological concepts. The findings further indicate that this pattern is not limited to upper secondary grades (Grades 10 and 11), but is also evident in lower grades, such as Grades 7 and 9, and extends to other subjects like Health and Physical Education, suggesting that this issue is seen in various subject areas. Similarly, another Teacher stated, "Physics and Chemistry mostly use standard scientific English terms, so there is less need for Sinhala equivalents. Biology part contains more Sinhala terminology because it contains local plants and animals" (T4).

This statement also indicates that the frequency of Sinhala terminology in science textbooks depends on the subject area. Physics and Chemistry depend on universal standardized scientific English terms**,** which reduces the need for local-language equivalents. In contrast, Biology includes content related to local plants and animals**,** leading to a higher occurrence of Sinhala terminology. This indicates the use of local language in textbooks is influenced by the contextual and cultural relevance of the subject matter, rather than a uniform policy across all science subjects. These findings align with the Multiliteracies Pedagogy (MLP) framework (Mills, 2006), which emphasizes connecting classroom teaching to students' languages, cultures, and authentic experiences to enhance engagement and learning.

Inconsistent and Non-inclusive Multilingual Presentation

One Teacher stated:

> Even though Tamil equivalents exist, they are often not included in the textbooks. English and Sinhala are included, but Tamil is often missing… Some terms appear only in Sinhala. Usually, each unit has a glossary…but... this textbook does not provide one for the Sinhala-only terms. (T2)

This indicates that Tamil terms are rarely included in textbooks, and Tamil students may lack access to equivalent terminology. The absence of glossaries for Sinhala-only terms further limits the comprehensibility of the scientific terminology, highlighting gaps in multilingual support in science education. This was further

supported by another teacher, "Maybe…there is a lack of translators in the National Institute of Education, and the textbooks are not reviewed for Tamil inclusion before printing. Tamil review…could be conducted prior to publication…to ensure multilingual support for all students" (T3).

This suggests that system level factors, such as a shortage of translators and the absence of Tamil review during textbook preparation, contribute to the uneven inclusion of Tamil terminology. Implementing a review process prior to publication could improve multilingual support for all students. This aligns with Mikk (2000), who states that textbook development should involve different experts, such as subject specialists, teachers, educational psychologists, illustrators, and Text specialists, to ensure that educational and linguistic aspects are properly addressed. This highlights the importance of designing multilingual content in a clear, consistent, and inclusive manner.

Impact on Conceptual Understanding and Learning Approaches

One participant explained:

> Sometimes students get confused when Sinhala terms are used without a clear explanation... But our students are talented; they are able to memorize them very fast, whether they understand the concept or not... They translate on their own or ask friends when the textbook terminology is not clear. (T3)

This highlights that higher-performing students are able to cope with these inclusions through memorization rather than deep understanding, whereas lower-achieving students face greater difficulties. It also suggests that students rely heavily on self-study, with limited teacher support. Similarly, another Teacher stated:

> Sinhala is taught to students from Grade 6, so the language is not new to them. They are even better than us in some cases. But some biology-related specific terms are not familiar to them. They use the internet to search for meanings… they prefer to use English terms when answering. Learning English can benefit their higher studies, especially if they continue their education at foreign universities. We also encourage this. (T2)

It indicates that Tamil-speaking students are generally familiar with Sinhala due to formal instruction from grade 6, but local biology-specific terms remain challenging. They often rely on the internet to clarify meanings and prefer using English terms in their answers, which also supports their future higher education. Teachers encourage this approach as it enhances English proficiency. It also suggests that students rely on self-study, with limited teacher support.

> Most of the plant names and ecological terms appear only in Sinhala, sometimes even without a picture, which makes it harder for students to understand. So…they try to memorize the terms instead of really learning them. In many cases, students prefer to use English terms when answering… and it may be better to provide terms clearly in English to support their understanding. (T3)

This suggests that Sinhala-only terminology is present. Especially without visual support, it limits Tamil-speaking students' understanding and encourages only memorization. It also indicates a preference among students for English terms, highlighting the need for clearer and more consistent use of English in supporting learning. Brock-Utne (2007) argues that learning complex subject matter through a non-native language often leads to surface-level understanding rather than deep conceptual comprehension.

Terminology-Related Examination and Assessment Challenge

> When a term is given only in Sinhala, it is obviously becoming a challenge for students. When both Sinhala and English terms are given for the same concept, some students think they are two different ideas... Because of this, many students learn by heart without proper understanding, and Sinhala terms are often memorized only temporarily for exams. (T1)

The findings reveal that terminology-related conflicts pose significant challenges for students in examinations and assessments. When Sinhala terms are introduced without sufficient explanation, Tamil students recognize them as an additional or "third language," increasing cognitive load and limiting comprehension. Consequently, Tamil students rely on surface learning strategies, with Sinhala terminology often retained only for examinations and quickly forgotten. Such patterns indicate that learning becomes predominantly exam-oriented, limiting deep understanding and long-term knowledge retention. Overall, these findings suggest that inconsistent multilingual terminology not only affects conceptual clarity but also negatively influences students' assessment performance, thereby reducing the effectiveness of multilingual science education. One teacher stated, "In the last English medium science exam, a Sinhala word "Okra" appeared in a question. Although it did not affect marks, it confused students at the time…. This kind of usage should be avoided, especially in common exams" (T2).

This highlighting that introducing pure Sinhala terms in General English medium examinations can create confusion among students, even though it does not directly affect their marks. It suggests that such language use disturbs Tamil speaking

students' understanding during exams, particularly when they are unfamiliar with the terms. Therefore, the inclusion of Sinhala terminology in common examinations may not be appropriate, as it can negatively impact students' clarity and confidence.

Increased Burden and Teacher Coping Strategies

" We check meanings through tools like Google, which interrupts the flow of the lesson and wastes classroom time. Instead of focusing on teaching the concept, time is spent searching for appropriate explanations or translations" (T3).

This shows that teachers experience an extra burden due to unclear or limited terminology support in textbooks. As a result, they rely on external resources and make quick adjustments, which can disrupt the classroom lesson flow. Another Teacher stated, "We mostly teach in English, but we use Tamil when we can to help students. This depends on the teacher's sinhala knowledge; actually, we are poor in Sinhala, so the support is not always the same" (T4).

This indicates responsive yet variable teaching approaches, in which multilingual explanation depends on individual teachers' competence rather than on systematic guidance. Such variability can contribute to unequal learning experiences among students.

Under the theme Increased Burden and Teacher Coping Strategies, teachers reported difficulties in managing multilingual scientific terminology during instruction. Frequent use of external sources such as Google to clarify meanings disrupts lesson flow and reduces teaching efficiency, indicating limited linguistic support in textbooks and increased workload for teachers. This reflects the absence of structured guidance for multilingual science teaching. Supporting this, Vithanapathirana & Nettikumara (2020) note that Sri Lankan science curriculum materials are not designed for Content and language integrated learning (CLIL), and teachers require strong support to integrate content and language effectively in secondary education.

Instructional Challenges and Policy Gaps

"We use Tamil medium science textbooks to clarify the terms when students do not understand the English or Sinhala terminology...but, this requires extra effort and time to cross-check the particular content across different sources" (T4).

This reflects Tamil first-language teachers' dependence on alternative textbooks as a compensatory approach**,** indicating gaps in the prescribed English-medium materials. While this strategy supports comprehension, it also increases

workload and may interrupt the continuity of classroom instruction. “There is no teacher guide explaining how to handle multilingual terminology in the classroom...” (T2).

This highlights a critical lack of institutional and pedagogical support, leaving teachers without clear strategies for managing multilingual instruction. Without formal proper guidance, it will contribute to irregular teaching practices and place responsibility on individual teachers to manage language challenges.

> There were glossaries with the names of all plants and animals from Grades 6 to 13, in all three languages, published in 2007/2008 by the National Institute of Education and Wijitha Publications... But I am still looking for a copy now,…and no one seems to know where it is. I am also using the Internet to find the Sinhala meanings or using Tamil medium science textbook. (T4)

This indicates that some institutional efforts have been made to support terminology standardization through glossaries. However, the limited scope, which focused mainly on biological terms, and the dated nature of these resources suggest that such initiatives are not systematically updated or integrated into current classroom practice, reducing their practical impact on multilingual science education.

Conclusion and Implications

Based on the analysis of interviews with Tamil first-language teachers and their perceptions, the following conclusions can be drawn. Sinhala terms are distributed unevenly across subjects, appearing more frequently in Biology due to local content, whereas Physics and Chemistry rely mainly on standardized English terms. There are rare Tamil equivalents, which create unequal access to scientific terminology, particularly for Tamil-medium students. Tamil first-language Students’ understanding is affected as many rely on rote memorization of Sinhala terms rather than conceptual learning. High-performing students can adapt using self-study and online resources, but lower-achieving students are struggling. This indicates that comprehension depends heavily on an effective teacher's explanation. The presence of pure Sinhala terms in exams, even without affecting marks, further disrupts understanding and can cause confusion.

Teachers attempt to address these challenges through strategies such as code-switching, using Tamil or Sinhala explanations, verbal clarification, visual support, referring to external resources like Google and Tamil-medium textbooks, and encouraging the use of English terminology. However, these practices depend heavily on individual teacher competence and are not supported by systematic institutional

guidance. As a result, multilingual science teaching places additional instructional burdens on teachers and creates inconsistent learning experiences for students. The study highlights the need for linguistically accessible textbooks, updated multilingual glossaries, teacher guidance materials, the absence of formal Tamil review, and stronger policy support to improve equitable science education in multilingual contexts.

Overall, the study highlights the need for consistent, well-structured multilingual terminology support in science textbooks, along with teacher guidance and institutional policies, to enhance comprehension, reduce inequities, and improve the effectiveness of multilingual science education.

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