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Evaluating Language Supportive Approaches to Transition at Scale

ELSATS project team

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Evaluating Language Supportive Approaches to Transition at Scale

By ELSATS project team

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Abstract

Across many countries in the Global South, secondary education uses a language for learning and teaching (LoLT) that is not the main language learners use outside of school. In Tanzania and Ethiopia, transition to English occurs relatively late, at the beginning of lower secondary education. Late language transition coincides with the curriculum splitting into different subjects, with their own set of academic language practices and taught by subject specialist teachers. Language supportive approaches are multilingual pedagogies that integrate instruction on academic language practices into subject teaching. The *Evaluating Language Supportive Approaches to Transition at Scale* (ELSATS) project aimed to explore how language supportive promote epistemic inclusion across education systems with a late transition. Inclusion was analysed with respect to opportunities for all children to access the specified curriculum, and recognition of students as knowledge-holders. Four studies were conducted: (1) international literature review on late language transition; (2) action research that introduced language supportive pedagogy into a teacher education programme at a university in Addis Ababa; (3) an analysis of how language skills in the Tanzanian curriculum; and (4) teaching and learning of science in the first year of English Medium Instruction in 16 Tanzanian schools. Study (4) included lesson observations, interviews with English and Biology teachers, groups interviews with students and an assessment of students' knowledge of scientific vocabulary. Findings point to five areas of opportunity and challenge for transformation towards inclusive language transition. First, policies that insist on monolingual practices in schools impede subject learning and are harmful to learners' wellbeing and so should be removed. Second, the specific curriculum should set out a coherent, continuous and gradual learning journey across educational phases, Grades and subjects. Third, learning materials should be designed for multilingual learners. Fourth, inclusive multilingual policies should be integrated into every component of teacher education programmes. Finally, education institutions should nurture collaborative pedagogic innovation.

Contents

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Abbreviations

ELSATS	Evaluating Language Supportive Approaches to Transition at Scale
EM	English Medium
EMI	English Medium Instruction
Form I	1st year of secondary education, 8th year of basic education
GPI	Gender Parity Index
KM	Kiswahili Medium
L1	Learners' main language or language of learning and teaching for an earlier educational phase
L2	New language of learning and teaching that is not familiar to the majority of learners
LSP	Language Supportive Pedagogy
LoLT	Language of Learning and Teaching
MLE	Multilingual education
SDG4	Sustainable Development Goal 4
SDG4.1	First target of SDG4
Std 7	Last year of primary education, 7th year of basic education

1. Introduction

Many education systems in the Global South expect children to use a language for learning in school that they rarely use outside of school. Often, this is an international language, which is the language of a former colonising power. Using an unfamiliar language for learning impacts negatively on learning (World Bank Group, 2021) and excludes vulnerable learners (Milligan et al., 2020). Recognising this, many national governments and development programmes do support the use of local community languages in early years education. However, across Africa[1], lower secondary school is only available in English, French, Portuguese or Standardised Arabic. This means that millions of children experience a transition in the language of learning and teaching (LoLT) sometime between lower primary and lower secondary school.

In a small number of countries, this transition occurs relatively late, at the beginning of lower secondary education. However, there is an emerging consensus, at least amongst international agencies (Simpson, 2019; Trudell, 2023), that teaching and learning should continue to use a learners' familiar language throughout primary education. As we write, this model is being rolled out in Nigeria and The Gambia. It is instructive therefore to study late language transition in countries where this is a longstanding policy. In Tanzania and Ethiopia, the **transition** from using an African language as the LoLT to using English coincides with the transition from upper primary to lower secondary, although each country has at least one devolved education system where language transition occurs earlier. The *Evaluating Language Supportive Approaches to Transition at Scale* (ELSATS) project explores the potential of multilingual education (MLE) to strengthen science education with education systems with a policy of late language transition. It does this through research in lower secondary education in Tanzania and a MLE intervention with student teachers in Addis Ababa, Ethiopia.

1.1 Rationale for ELSATS

Why study late language transition?

Language transition can be **subtractive**, meaning that the new LoLT displaces the previous LoLT, which we will refer to as the familiar language. Or, it can be **additive**, meaning that the familiar language continues to be used and developed for academic purposes alongside the new LoLT. Language transition can be abrupt, with little preparation for the change in LoLT, or it can occur gradual and phased way, as explained by (Simpson, 2019). In both Tanzania and Ethiopia, the language transition is subtractive and abrupt, although Tanzania has recently introduced a short language-focused programme to help students make the transition. How language transition is described in policy can be different from how it is implemented in classrooms. Across Africa, teachers have been observed to respond to the challenges of

[1] The exception is South Africa, where policy allows for 11 languages, including 9 African languages, to be used in basic education, including secondary education. Kretzer, M. M., & Kaschula, R. H. (2021). Language policy and linguistic landscapes at schools in South Africa. *International Journal of Multilingualism*, *18*(1), 105-127. https://doi.org/10.1080/14790718.2019.1666849

language transition creatively, improvising multilingual strategies to support their learners (Benson, 2010). Tanzania and Ethiopia are no exceptions (Brock-Utne & Holmarsdottir; Heugh, 2010). To understand language transition, it is important therefore to study both how the curriculum is specified in documents and how it is enacted in classrooms.

ELSATS uses the phrase '**language transition at scale**' to indicate that research is concerned with state-funded public education systems. Like many, although not all, of the systems where language transition occurs at scale, both Ethiopia and Tanzania, seek to implement language transition at scale with constrained financial resource whilst still also working to make secondary education universal. The gross enrolment ratio for secondary education was below 50% in both countries in 2021 (World Bank, 2024).

What do we mean by Language Supportive Approaches to Transition?

The Language Supportive approach to transition was developed in East Africa for the first year of English medium education within a system of subtractive language transition (Barrett, Mtana, et al., 2014; Milligan et al., 2016; William & Ndabakurane, 2017). In Tanzania, members of the ELSATS research team were involved in developing a language supportive pedagogy (LSP) for the first year of secondary education, known as Form I (Gabrieli et al., 2018; Casmir M. Rubagumya et al., 2021; William & Ndabakurane, 2017). This approach involves two strategies. First, the use of familiar languages for classroom talk is extended beyond the official point of language transition. *Familiar languages* refers to languages learners have used for an earlier educational phase or outside of school. Second, explicit scaffolding or support for reading, writing, and speaking the new LoLT is integrated into the teaching of non-language subjects. There are substantial overlaps between language supportive pedagogies and other multilingual pedagogies, such as genre-based approaches and pedagogical translanguaging, which we have elaborated elsewhere (Bowden & Barrett, 2022).

The ELSATS research evaluates the language supportive approach from two angles. First, teacher educators explored its relevance and potential in the Ethiopian context through action research within a science course that was part of a teacher education programme. Second, in Tanzania, the project evaluated how LSP is being adopted by science teachers and how they are experienced by students.

1.3 Aim and research questions

Aim

The aim of the ELSATS project was to evaluate the potential of language supportive pedagogy (LSP) to improve science learning at scale in lower secondary school for diverse learners transitioning from an African language of learning and teaching (LOLT) to English Medium Instruction.

Research questions

The research was guided by three overarching research questions, each with a set of sub-questions.

1. What is the existing evidence that language supportive pedagogies and other bi/multilingual approaches can strengthen subject learning across transitions in language of instruction in sub-Saharan Africa?
   a. What challenges and opportunities does international literature suggest for implementing language supportive or bi/multilingual education at upper primary or lower secondary level at scale?
   b. What insights do theory and international research give into how transitions in LOLT influence subject learning for girls and boys in various sociolinguistic contexts?
   c. What is the potential of LSP to strengthen science learning in another African country, where EMI starts in lower secondary education?

2. What system level changes are needed to implement LSP at scale in Tanzania?
   a. What curriculum changes are needed to align language competencies targeted in English and language demands of lower secondary science?
   b. What are the challenges and opportunities for developing language supportive teaching and learning materials in Tanzania?
   c. What knowledge needs and research priorities do policy makers, curriculum designers and materials developers identify regarding language, subject learning and transition?
3. Are Form 1 science teachers' LSP practices improving science learning for girls and boys across diverse sociolinguistic settings within Tanzania?
   a. What language supportive practices are teachers implementing in lower secondary science classrooms in diverse sociolinguistic contexts?
   b. What knowledge, professional support and teaching and learning resources enable teachers working with diverse learners to implement LSP?
   c. Is LSP measurably improving English-language scientific vocabulary of girls and boys across diverse sociolinguistic contexts?
   d. To what extent do upper primary education and Form 1 language orientation programmes prepare students for EMI secondary education using LSP?
   e. What gendered differences are observable in results of vocabulary assessments and student views on teaching and learning across contexts that differ with respect to gender parity in enrolment, socioeconomic characteristics, languages spoken in the community and availability of printed literature?

The research questions were addressed through four discrete research studies, as follows:

Study 1: RQ 1.a. & b.	A configurative international literature review
Study 2 RQ 1.c.	A teacher education action research project at Kotebe University of Education, Addis Ababa
Study 3 RQ 2.	An analysis of language skills in the national curriculum of Mainland Tanzania
Study 4 RQ 3.	School-based research of teaching and learning in Form I (Grade 8, first year of secondary education) in 16 schools in Tanzania, including Zanzibar

1.4 Overview of theoretical framing

The research is framed by the concepts of epistemic inclusion and academic language practices (Kerfoot & Bello-Nonjengele, 2023; Kuchah et al., 2022). An epistemically inclusive education enables learners to actively engage in classroom meaning-making activities, connecting curriculum content to their prior knowledge and environment. Language is central to epistemic inclusion in two ways. First, learners use language to articulate ideas and so, participate in meaning-making. Second, learning a subject involves mastering the language and literacy practices unique to that subject. These academic language practices differ from everyday language and must be learned, even by native speakers of the language of instruction. Hence, students must learn to talk and write science by using technical vocabulary and specific genres, which often include multimodal elements like diagrams, charts, and formulas (Halliday & Martin, 1993).

In the upper primary or lower secondary phase of education, the curriculum begins to fragment into discrete subjects, and learners are introduced to specialized academic language practices associated with these subjects. Christie (2012) identifies this as a pressure point where many learners struggle with complex language practices. In low and lower-middle-income countries, the transition from primary to secondary education is also a point when disadvantaged learners are particularly vulnerable to drop out (Edwards et al., 2014). The ELSATS research generates insights on how to design a coherent learning journey for learning making the transition from primary to secondary education within a multilingual education system.

Developing academic language skills is a social justice issue because proficiency in standardized written and spoken language opens doors to higher education and high-level employment opportunities (Heugh & Stroud, 2019). Additionally, access to disciplinary

knowledge allows learners to engage in democratic debate, contributing to "society's conversation about itself" (Wheelahan, 2012).

1.5 Organisation of this report

The four studies that made up the research report are presented in Sections 2, 3, 4 and 5 of this report. Each section has a brief introduction followed by an overview of the methodology, presentation of findings and conclusions. Except for Section 3 (Study 2), the findings are organised by the research questions presented above. The answer to the single research question for Study 2 is presented in the conclusion to Section 3. An overarching discussion in Section 6 draws out insights regarding the implications of language transition for epistemic inclusion, how epistemic inclusion interacts with other forms of social justice in education and ways forward for transforming language transition systems to be inclusive. Section 7 concludes with recommendations for policy, practice and further research.

2. Study 1: Literature review

This section of the report draws on a configurative literature review that has been published separately (Bowden & Barrett, 2022). It provided the basis for the theoretical framing of the research, presented in sub-sections 2.2. We also draw on the literature review to address research questions 1(a) and 1(b). We start by briefly outlining the review methodology.

2.1 Methodology for the literature review

The configurative literature view process was iterative, with re-definition of focus areas, themes and concepts on the basis of emergent understanding. We identified publications through keyword searches online and in electronic databases of academic journals, using the reference lists from selected publications and in consultation with project team members. In total, over 160 documents were included in the review, comprising peer-reviewed papers, book chapters and grey literature. We sought out literature from sub-Saharan Africa (SSA), particularly East and Southern Africa, including the Horn of Africa but did not exclude relevant literature from elsewhere. There are limitations to this review. We only consulted English language publications. The review publications were diverse with respect to methodology and context, which makes comparison challenging.

2.2 Theoretical framing

Language as social practice

We view language as situated social practice (Blommaert, 2010). As social institutions, schools have their own set of distinctive language practices, which differ from those used in other contexts, such as at home or in the playground, and therefore must be learned. Each educational phase is associated with a distinct set of language practices (Halliday, 1993). When children start primary school, they begin learning to read and write, as well as the associated discourses. They also learn the spoken language practices of school (Christie, 2012). Later, learners are introduced to different subjects, and each subject discipline has its own set of language practices that support its distinctive methods of inquiry. These language practices become progressively more complex as students advance from lower secondary to higher education. Some theorists extend the idea of language to include non-verbal communication, such as gestures, images, and symbols. Scientific texts are frequently multimodal, using a combination of words, scientific symbols (e.g., chemical formulae), graphs, diagrams, photographs, and other images, charts, and tables to produce meaning. We use the term **multimodal literacies** to refer to academic language practices that combine text together with other forms of representation (Kress, 2010).

In multilingual settings, language practices often span named ‘languages’. People, who are multilingual, draw fluidly and flexibly from across their linguistic repertoire as they navigate different social situations and relations. Such practices are known as ‘translanguaging’. García

(2009) uses the analogy of an off-road vehicle, to describe a single system of verbal and non-verbal linguistic resources which multilinguals draw on as they negotiate social interactions. This transglossic view of language contrasts with the monoglossic view of language, often found in education policy, which treats languages as discrete, standardised systems of communication and therefore assumes that it is only possible to use one language at a time for teaching and learning (Tollefson & Tsui, 2018). Ndhlovu and Makalela (2021) observe that multilingualism has long been a feature of African societies with people moving easily between languages, which colonisers regarded as discrete and separate.

Academic language practices in lower secondary education

The ELSATS research is framed by the concepts of epistemic inclusion and academic language practices. An epistemically inclusive education recognises that learners already hold knowledge gleaned from outside of school and earlier educational phases. Learning is treated as a process of meaning-making through which learners process and digest new concepts. As they do so, they make sense of new concepts by relating them to their prior knowledge in a process of meaning-making (Kerfoot & Bello-Nonjengele, 2023; Kuchah et al., 2022).

Language is the main tool of learning and is central to epistemic inclusion in two ways. First, learners articulate their ideas and participate in meaning-making using language. Second, learning a subject involves learning the language and literacy practices associated with that subject. These academic language practices differ from those used in other contexts, such as at home or in the playground, and therefore must be learned, even by students whose main language is the LoLT. As Daniels (, 2016:72) summarised, students do not learn a subject from talk but rather learn to talk the subject. Within lower secondary school science, this involves learning how to use technical vocabulary with precision and distinctive styles of writing, known as genres (Christie, 2012; Halliday & Martin, 1993; Polias, 2016). Scientific genres tend to be multimodal, involving scientific diagrams, charts, graphs, and formulae (He & Forey, 2018).

Sociolinguists use the concept of register to distinguish between language practices associated with different contexts. Language as it is written in textbooks is more formal than spoken language, and this is one aspect of an academic register. Classroom talk in lower secondary education typically switches between formal and informal registers (Halliday, 1993). These pedagogic language practices allow learners to take knowledge acquired in the context of formal education and apply it in contexts where talk is informal, for example, in their homes or communities. Conversely, it allows them to draw on their knowledge from outside of school to make sense of new formal concepts introduced in the classroom. When the LoLT is unfamiliar to learners, the back-and-forth movement between registers becomes a back-and-forth movement between learners' familiar languages and the LoLT (Setati et al., 2002). This is a form of translanguaging known as pedagogic translanguaging (Lewis et al., 2012). Hence, translanguaging is necessary for epistemic inclusion for multilingual learners (Probyn, 2015). It is, therefore, not surprising that numerous empirical studies of classrooms across a wide range of contexts have observed that where learners share a familiar language, classroom talk is multilingual (Charamba, 2022; Clegg & Afitska, 2011; García & Wei, 2015; Lewis et al., 2012; Msimanga & Lelliott, 2014).

Somewhere between the upper primary or lower secondary phases of education, the curriculum begins to fragment into discrete subjects. Christie (2012) has identified this as a pressure point, when many learners struggle to master the more formal registers of different disciplines. Christie (2012) describes three main characteristics of the formal registers of lower secondary school science:

i. the use of technical vocabulary;
ii. grammatical patterns that remove agency through heavy use of nouns and the passive tense;
iii. reading and writing longer pieces of text that follow certain conventions of presentation and style, known as genres; and
iv. interpreting and creating multimodal texts that include scientific diagrams, graphs, tables and equations.

As well as being central to epistemic inclusion within education, mastering academic registers has implications for opportunities to participate across other social institutions. This is because "access to the standardised variety of written and spoken languages [opens] doors to higher education and high-level employment opportunities" (Heugh & Stroud, 2019: 219). It has also been argued that access to disciplinary knowledge allows learners to participate in democratic debate or, as Wheelahan (2012:2) puts it, "society's conversation about itself", as students learn "how knowledge is used and the broad criteria that need to be applied in evaluating the validity of arguments". This latter argument suggests that developing academic registers of community languages and widely spoken African languages can benefit participative democracy (Prah, 2009).

In Section 1.1, we described an additive language transition as one that develops both the new LoLT and one or more familiar languages for academic learning. We have now clarified that developing language skills for learning involves apprenticing students into the academic practices of the different subjects that make up the curriculum. We have also established that inclusive MLE is one in which learners use their familiar languages to actively engage in meaning making processes in the classroom. Having established a theoretical framing for the project, we now turn to the two research questions that guided the literature review.

2.3 Implementing MLE at scale

Implementing MLE at scale requires orienting every aspect of the education system to multilingualism (Schroeder et al., 2021). Challenges and opportunities arise across the areas set out below.

Knowledgebase for additive multilingual pedagogy

There is an extensive literature on multilingual pedagogies. MLE may target academic language skills only in the new LoLT or across a familiar language plus the new LoLT. Targeting both has been argued to promote cross-linguistic transfer, that ultimately accelerates their development in the new LoLT and contributes to learner resilience (Kerfoot & Bello-Nonjengele, 2023). Three

distinct multilingual pedagogies are implemented in lower secondary school classrooms on the African continent: genre-based pedagogies, language supportive pedagogies and pedagogical translanguaging. Although there are differences in emphasis, they are each underpinned by three key principles, set out in Box 2.1.

BOX 2.1: KEY PRINCIPLES FOR ADDITIVE MULTILINGUAL PEDAGOGIES IN LOWER SECONDARY EDUCATION

1. Continue the use of L1 to support subject learning across the curriculum, including through exploratory talk.
2. Explicitly teach academic language skills within curriculum subjects.
3. Provide the three forms of scaffolding for academic language learning through:
    i. curriculum design and organisation (macro-scaffolding);
    ii. structured activities that move from exploratory talk to formalised statements in the target language (meso-scaffolding); and
    iii. use of classroom dialogue to move students from informal

Teachers and teacher educators as pedagogic innovators

The knowledge base on MLE pedagogies derives from researchers' observations of teachers' practices (e.g. Benson & Kosonen, 2013; García & Wei, 2015; Lo & Lin, 2021) and research-led collaborations with teachers (e.g. Forey, 2020). Teachers routinely engage multilingual classroom practices with little or no explicit training or multilingual resources (Benson, 2010). University-based teacher educators are researchers, who deliver teacher education and professional development programmes. They also have links to partner schools and may be consulted by policy makers. Hence, they can play a pivotal key role in developing and disseminating multilingual pedagogic innovations (Barrett et al., 2021; Casmir.M. Rubagumya et al., 2021).

System and school level leadership

Education ministries and local education leaders also have a role to play in fostering teacher innovation and teacher collaboration for the inclusion of multilingual learners. State governments have historically favoured monolingual education policies and subtractive language transitions (Shoba & Chimbutane, 2013). In Africa, this often means that an African LoLT is abruptly displaced by a European LoLT. When education leaders interpret policies literally, teachers are inhibited from innovating and sharing multilingual pedagogies.

Transforming education systems from subtractive to additive MLE requires a coherent joined up approach to all elements of the education system, including teaching and learning materials, national assessments, quality assurance or inspection regimes and teacher education. School language policies should recognise and celebrate students' linguistic heritage, including by engaging with parents and other local stakeholders through languages that are familiar to them

(Trudell, 2016). With respect to teaching and learning, MLE requires coordination between subject and language teachers to develop and implement a coherent whole school approach (DBE, 2011; Forey, 2020) that meet the needs of multilingual learners (Meskill & Oliveira, 2019).

Creating a multilingual curriculum framework and materials

At the system level, a curriculum framework needs to be put in place for "continuous and expanding" curriculum (Lin, 2019) backed by language policies that affirm and encourage multilingual classroom practices. Few national curriculum frameworks embrace MLE beyond the primary phase. Notable examples are the WIDA English Language Development Standards in the USA and South Africa's national curriculum, both of which are designed with multilingual learners in mind.

Teaching and learning materials such as textbooks elaborate the curriculum and guide teaching while serving as a learning resource. In an additive MLE system, learning materials should be adapted to students' language ability; have bilingual features, such as glossaries, and visuals, such as pictures and charts, that help learners interpret the text as well exercises that build academic language skills (Barrett, Kajoro, et al., 2014; Clegg, 2021). In Tanzania, the British Council's Baseline program and the Language Supportive Teaching and Textbooks project both integrate language and subject learning (Gabrieli et al., 2018; Mtana & O-saki, 2017). Expanding access to multilingual resources online and open access is also suggested (Pitchford et al., 2021; World Bank Group, 2021).

Designing multilingual assessment from a very limited knowledge base

Teaching and learning are heavily influenced by national examinations, especially in selective, competitive education systems. Yet, knowledge on multilingual assessment is limited. National examinations should align with the curriculum by assessing competence in familiar and national languages and providing scaffolding for academic writing (Benson, 2021; Bunyi & Schroeder, 2017). Research in Zanzibar (Rea-Dickins & Yu, 2013) and South Africa (Heugh et al., 2017) allowing learners to choose their response language for bilingual examinations.

Teacher education for MLE

Student teachers, who have graduated from subtractive MLE systems, often had limited opportunity to develop academic language practices when they were at school. Hence, teacher education and professional development for MLE need to target teachers' own academic language skills as well as the theory and practices of additive MLE (Department of Basic Education, 2012; J.-C. Beacco et al., 2016; Le Pichon-Vorstman et al., 2017; Probyn, 2021).

2.4 The influence of language transitions on subject learning

The second research question for the literature review focused on how language transition influenced subject learning for boys and girls in different contexts.

Subtractive MLE is associated with lower learning outcomes and exacerbates inequalities

Large-scale studies have linked subtractive MLE to poor learning outcomes and reduced schooling years (Heugh et al., 2017)((Schroeder et al., 2021). Subtractive MLE exacerbates educational inequalities, especially affecting students marginalised by poverty, gender, ethnicity, and disability (Benson & Wong, 2019; Manocha & Panda, 2015; Sah & Li, 2022). Studies indicate EMI negatively impacts children from lower socioeconomic groups, poor urban and rural areas, nondominant language groups, and conflict-affected areas, with girls being particularly disadvantaged (Milligan & Adamson, 2022; Milligan et al., 2020).

Evidence from large scale 'natural experiments', which measure the effects of policy differences or changes, suggests that delaying the introduction of a new LoLT benefits language and subject learning (Genesee, 2013; Heugh et al., 2017). This includes evidence from Ethiopia, showing that students who had 8 years education in a familiar language and are assessed in this language, outperform students who switched to English medium earlier (Opare-Kumi, 2024; Ramachandran, 2012; Seid, 2019).

Subtractive language transition contributes to dropout before or during secondary education

Transition from primary to secondary school is a point of heightened vulnerability to drop-out for disadvantaged learners due to factors such as increased expense, longer journey from home to school and weaker relationships with teachers (Edwards et al., 2014). Empirical studies conducted in Tanzania have found that the linguistic challenge of using English as LoLT in secondary education compounds these challenges (Joyce-Gibbons et al., 2018). Even in Rwanda, where English is introduced as the LoLT from lower primary onwards, it still contributes to disadvantaged girls' vulnerability to drop out in secondary school (Milligan et al., 2023).

Language transition inhibits classroom participation and learning outcomes in non-language subjects

In a systematic review of research on the effect of EMI in secondary school biology classrooms in sub-Saharan Africa, David and Nsengimana (2022) found that it was linked to low academic achievement and poor conceptual understanding. They also found that the linguistic demands of using English as LoLT inhibit participation and learning. A meta-analysis of research in Hong Kong (Lo & Lo, 2014), found a consistent pattern of relative underachievement amongst learners, who transition from Chinese Medium primary education to EMI secondary education, compared to those who continued with Chinese medium secondary education.

Additive multilingual pedagogies strengthen subject learning

Most research on subject learning in multilingual contexts has focused on science and mathematics classrooms. In Tanzania, David et al. (2021) and Juma and David (2021) both found that language-supportive lessons improved student engagement and student learning outcomes in studies involving 36 and 26 lower secondary school science teachers respectively. Charamba (Charamba & Zano) reported similar improvements from pedagogical translanguaging interventions in a Grade 10 Chemistry class in South Africa and a Grade 8

general science class in Zimbabwe (Charamba, 2020). Qualitative studies in South Africa show that pedagogical translanguaging that targeted academic language skills in both students' home language and English, successfully engaged students in making sense of scientific phenomena (Kerfoot & Bello-Nonjengele, 2023; Msimanga & Lelliott, 2014; Probyn, 2019). Similar findings have been reported in primary school science classrooms from Grade 3 upwards (Charamba, 2022; Guzula et al., 2016; Probyn, 2019).

In all these studies, teachers were using deliberate multilingual pedagogies. David and Nsengimana (2022) differentiate these from common practices of ad hoc code-switching. In a study of 130 teachers in Botswana, Mokgwathi and Webb (2013) observed that code switching helped students understand concepts but did not develop language skills in the LoLT.

2.5 Conclusion

The empirical studies on additive multilingual pedagogies for subject learning cited above, confirm the link between epistemic inclusion and additive multilingual education that frames the ELSATS research. Studies 2 and 3 focus on two different areas that are identified as being both a challenge and an opportunity for transforming systems towards additive MLE. Study 2 is small scale research on teacher education in Ethiopia intended to explore the potential for teacher educators to innovate multilingual pedagogies. Study 3 focuses on curriculum design in Tanzania around the point at which English is introduced as the main LoLT. How teachers implement the curriculum and how it is experienced by students is the main focus of Study 4.

3. Study 2: Action research in teacher education in Ethiopia

3.1 Introduction

Study 2 was an action research intervention, designed and conducted collaboratively by a science educator and a language educator. It was addressed to research question 1(c), which concerns the international relevance of LSP for science education beyond Tanzania. Additive multilingual pedagogies are situated. They are the practices and theories innovated by reflexive educators that are responsive to the linguistic capabilities of their students. In Tanzania, LSP was developed through collaborations between science and language specialists working with trainee teachers (Barrett et al., 2021). The design of Study 3 was influenced by this process of innovation more than the pedagogy it produced. A full account of the research has been published separately (Atnafu et al., 2023). The section starts by setting out the research design followed by findings and reflections on the research. Research question 1(c) is answered in the conclusion to the section.

3.2 Research design

Participants

The research was conducted with third year students on a Bachelor of Education programme, which is a qualification for teaching in secondary schools, at Kotebe University of Education (KUE). A biology topic course, Entomology (study of insects), was selected for the study, for which the class was made up of four females and 12 males. The course would normally be delivered by a science educator. However, for the action research the science educator (Tewodros) teamed up with an English language educator (Bekalu). The students had completed four years of EMI secondary education and were now in their third year of EMI higher education. Teachers and students all had Amharic as L1.

The intervention

The intervention focused on developing two academic language skills: learning subject specialist vocabulary and writing texts that describe and organise scientific information. Bilingual strategies were used to support learning of scientific vocabulary and build conceptual understanding. This involved Tewodros offering translations of key terms and engaging the class in exploratory bilingual discussion. Bekalu provided explicit instruction on four ways to organise a paragraph of academic writing that describes and organises scientific information: description, comparison, component and classification (Polias, 2016). He also gave formative constructive feedback on students' draft writing.

Data collection

Three types of data were collected to evaluate student learning. First, an assessment was administered before and after the intervention, consisting of four questions on the anatomy of insects, one for each subgenre of writing. Second, a focus group discussion was conducted with six students, to elicit their views on the bilingual learning environment, the writing intervention and their learning. The focus group comprised three male and three female students and was heterogeneous with respect to age. Finally, Bekalu interviewed two biology educators at KUE, who had not been involved in the research, to elicit their views on multilingual education.

Limitations

Action research should involve more than one cycle of review-plan-practice-evaluate and review-redesign plan. The team only had time and resources to complete one cycle. One reason for this was that the impetus for the inquiry arose from engagement with previous research, principally Polias' (2016) text on scientific genres and Tanzanian team's account of their previous research (Casmir M. Rubagumya et al., 2021), rather than a dissatisfaction with their practice.

3.3 Findings

Writing scientific genres

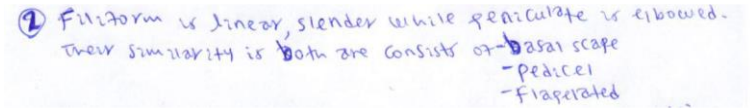
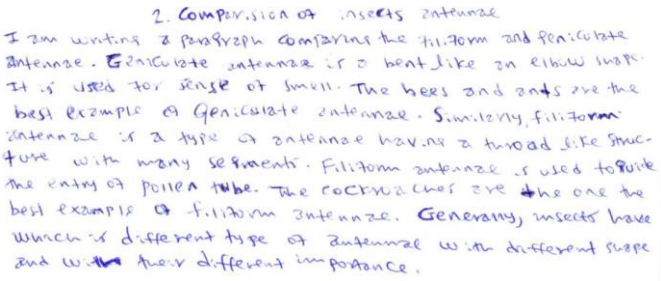
Prior to the intervention, the biology tutors had accepted student responses in assessments that were presented as bulleted lists (see table 3.1). Following the intervention, all students presented their responses as a paragraph that opened with a topic sentence and closed with a summary sentence. All used technical vocabulary precisely and accurately although with variations in the amount of detail provided. The degree of grammatical complexity that students could handle did vary. The lowest performing students used simple present tense, whereas middle to high performing students demonstrated mastery of generalisable present tense. They were also able to use linking and contrast words. High performing students were also able to construct sentences with one or more subclauses.

Student perspectives

In the focus group discussion, students expressed appreciation for the explicit instruction on academic writing. As one student commented, 'Within a short period of time, we developed a solid understanding of how a paragraph is being organized and written.' The formative feedback provided by Bekalu was viewed as a key enabler for writing. Participants also commented on the benefits of flexible bilingual classroom dialogue:

> We do not participate and listen attentively when the lesson is delivered totally in English because there are a lot of new vocabularies. Thus, I believe it is a good approach to translate those words to local language because this approach helps us to understand the contents of the lesson without difficulty and develops our listening skill. (Hanna, focus group participant)

TABLE 3.1: PRE-INTERVENTION POST-INTERVENTIONS RESPONSES TO A COMPARISON QUESTION FROM AN AVERAGE-PERFORMING STUDENT

Question	Insect species may have varying antennae. Compare and contrast the filiform and geniculate types of antennae.
Response before the intervention	 1. Filiform is linear, slender while geniculate is elbowed. Their similarity is both are consists of – basal scape – pedicel – flagerated
Response after the intervention	 2. Comparison of insects antennae I am writing a paragraph comparing the filiform and geniculate antennae. Geniculate antennae is a bent like an elbow shape. It is used for sense of smell. The bees and ants are the best example of Geniculate antennae. Similarly, filiform antennae is a type of antennae having a thread like structure with many segments. Filiform antennae is used to guide the entry of pollen tube. The cockroaches are the one the best example of filiform antennae. Generally, insectus have which is different type of antennae with different shape and with different importance.

Teacher educator perspectives

The two biology teachers interviewed commented on the use of two languages in the classroom. They regarded it as an effective strategy that strengthens conceptual understanding and allows students to make connections to their prior knowledge.

> In most of my classes I have observed that most students hold back from engaging in classroom discussions if they are not able to transfer such knowledge into the language of instruction. (Sara, biology teacher interviewee)

3.4 Reflections on the intervention

Evaluation and reflection are a key part of action research. All four members of the research team were involved in this, leading to the following insights:

1. **Multilingual practices in classrooms where most of the students L1 is different from the teacher.** Many KUE students completed their schooling outside Addis Ababa and their L1 is not Amharic. Team members shared the strategies they had improvised for teaching students with whom they did not share a familiar language, such as eliciting translations of key words from the class.
2. **Multilingual learning and explicit support for learning academic language remains important many years after English is introduced as a LoLT:** The students in this study were in their seventh year of learning science using English as the LoLT and only months away from qualifying to teach in secondary schools. Yet, they still benefited from a multilingual pedagogy. Exploratory talk that moved fluidly between English and Amharic engaged their attention, so that they developed a full understanding key concepts and learned how to scientific vocabulary with precision.
3. **Value of collaboration between science and language educators:** The six-week action research intervention was the first time that the students had received explicit instruction in scientific genres of writing. KUE, in common with many EMI universities around the world, including within UK, delivers training in academic writing through dedicated academic language courses, delivered by language specialists. Bekalu's active coaching within the science lesson facilitated the transfer of writing skills from these classes into the context of a biology class.
4. **Scientific understanding demonstrated through writing:** writing discursively in paragraphs involved hierarchical organisation of information, through use of connecting words and subclauses. Hence the paragraphs students wrote after the intervention demonstrated a fuller understanding of insect anatomy than the bulleted lists they had produced before the intervention.
5. **Feasibility of integrating multilingual genre-based approaches into science education at KUE:** Following the intervention, the two science educators on the team continue to require students to compose written paragraphs in response to open questions in assessments. They also continue to use and develop multilingual teaching and learning strategies, despite no longer team teaching with a language specialist. They are demonstrating that it is feasible to implement LSP within existing structures without changes to the organisation of the Bachelor programme, although an initial period of interdisciplinary collaboration is important. Next steps for scaling up to an institutional

level would include incorporating attention to language development into KUE's quality assessment framework and creating a toolkit for university-based teacher educators.

6. **Recommendations for further research:** The research was small scale. Accumulating similar interventions across other class groups would strengthen the evidence basis for persuading other teaching staff to use multilingual strategies and integrate explicit instruction on writing into their teaching. Such research would also further develop and adapt language supportive and genre-based approaches within the Ethiopian higher education context. We recommend that a toolkit for teachers should be an output of further research.

3.5 Conclusion: the potential of LSP to strengthen science learning in Ethiopia

The study demonstrated that LSP does have the potential to strengthen science learning in Ethiopia. More specifically, it showed that that integrating explicit instruction on writing into a science course has benefits for scientific learning. Furthermore, developing LSP within a new context expanded the knowledge base on MLE. Previous action research within teacher education in Tanzania had focused on pedagogy courses and student placements (Barrett et al., 2021; Gomezulu, 2021). The KUE research found that introducing LSP into a subject content course can be a simpler first step that develops students' academic writing skills, whilst modelling a multilingual pedagogy for them.

Reflection on the research process of the study highlights key elements of endogenous pedagogic innovation. First, the innovation was led and designed by researcher-practitioners. Second, the research built on conversations between team members that brought together and re-interpreted the pedagogic knowledge of language and science educators. Third, the team drew inspiration from literature on MLE, principally Polias' (2016) book on scientific genres. Finally, the significance of findings was elucidated through collegial conversations, including with the ELSATS team in Tanzania. Hence, the endogenous innovation is shown to be a process of situated experimentation that builds on *in situ* expertise whilst also engaging with knowledge and knowledge-holders elsewhere.

4. Study 3: Analysis of language skills in the Tanzanian curriculum

Introduction

The literature review highlighted the system level changes that are necessary for MLE at scale (see section 2.3). One of these was the creation of a multilingual curriculum framework and materials. Study 3 focused on curriculum materials in Mainland Tanzania. It was addressed to research question 2, which is concerned with aligning language learning across English language and science subjects. The study is reported in full in a separate working paper (Barrett et al., 2024). In this section, we provide an overview of the research design and the findings. Findings are organised by the sub-questions for research question 2, as set out in section 1.3.

4.2 Research design

Sampling strategy

TABLE 4.1: DOCUMENT SAMPLE

Curriculum subject:	Biology	English Language
Main documents:	• Biology Form I student's book • Biology Form I Syllabus	• English Language Standard 7 pupil's book • English Language Standard 7 Syllabus for Kiswahili Medium Schools
Other documents:		• English Language Form I student book • Baseline pupil's book (language orientation course for Form I)

The specific documents analysed were the syllabus and textbook for subject biology in Form I (Grade 8), the first year of secondary education and the syllabus and textbook for English Language in Kiswahili medium schools for Standard 7 (Grade 7), which is the final year of primary education[2]. For one part of the analysis, we also looked at the textbook for Form I

[2] Mainland Tanzania plans to move to a new system in 2024 with a six-year rather than seven-year primary education system, so English will start to be used as LoLT from the seventh year of fulltime basic education.

English and the textbook for the Baseline orientation course. All documents are published by the Tanzania Institute of Education (TIE), which acts as the national curriculum authority.

For detailed analysis it was necessary to sample within documents. When comparing between the English and biology curricula, we selected chapters from the end of the Standard 7 English textbook and from the start of the Form I biology textbook. When analysing language support in the biology textbook, we selected chapters that addressed more tangible topics e.g. waste disposable, and more conceptual topics e.g. classification of living things. When analysing tasks, the sample was expanded to cover the full range of activities, for example, by including a chapter with laboratory experiments.

Methods

Five different methods were used to measure and compare the linguistic demand of the curriculum. These were:

1. Inductive comparison of the language expectations in biology Form I and skills targeted in English Language Standard 7 for Kiswahili medium schools.
2. Measuring the linguistic demand of biology Form I and English Language Standard 7 against an external scale. We used the Global Scale of English (GSE), which provides descriptors matched to the Common European Framework of Reference for languages (CEFR) (Pearson, 2022a, 2022b).
3. Comparison of quantitative indicators of readability generated by computational lexical analysis using the online tool Lextutor. Quantitative indicators used were the Flesch-Kincaid Grade Level (FKGL), the vocabulary range and CEFR levels.
4. A descriptive analysis of the non-lexical features that support interpretation of the text by conveying meaning (e.g. illustrations, glossary) or organising information (e.g. length of paragraphs, bulleted lists).
5. A descriptive analysis of tasks and activities that support talking (e.g. word list, sentence starters), reading (e.g. multiple-choice questions, label a diagram, fill gaps) and writing (e.g. activities and questions requiring short or long answers written in different genres).

A more detailed description of the research methods and indicators is provided in Barrett et al. (2024).

Limitations of the research

Texts are produced and consumed for specific purposes within specific sociocultural contexts and hence it is not possible to devise a culturally neutral measure of language difficulty. Readability measures were mainly designed for adults in Western contexts (the USA and UK). The GSE qualitative scale was designed for international use with second language English learners within formal educational settings and has a version for young learners. We compensated for cultural bias by triangulating across different scales and measures.

Qualitative comparisons necessarily depended on the researchers' judgements. The Tanzanian English language syllabus described fewer competencies and gave less detail than the GSE

descriptors. The biology curriculum did not explicitly specify language skills, which is normal for science curriculum documents. Hence, in making judgements we had to draw on the experience of team members, all of whom had worked as teachers and teacher educators in Tanzania or in international programmes.

4.3 Findings

RQ 2(a): What curriculum changes are needed to align language competencies targeted in English and language demands of lower secondary science?

Table 4.2 summarises the skills that targeted by subject English Language at Standard 7 in Kiswahili medium primary schools alongside a summary of the language skills that required for the subject biology in Form I of secondary school. Skills targeted in the last year of primary education cluster around the A2 level, whilst the skills required for biology at the beginning of secondary education were concentrated around B2. A smooth language transition would aim for students to demonstrate language skills consistent with the CEFR A2+ level by the end of primary education and then encounter a curriculum in the first year of secondary that integrates support for progress towards the B1 level.

Findings show that the Tanzanian curriculum, as specified in syllabi and textbooks, is disjointed with respect to language learning. A substantial gap exists between the English language skills targeted in primary education and those assumed by the secondary school science curriculum. Turning it into a coherent plan for language learning depends both on strengthening the English language curriculum for primary education and also reducing the language demand of Form I science education. In particular, two areas of improvement are recommended:

1. A reduction in descriptive content of the biology curriculum, reducing the number of specific examples of different phenomena, to allow learners more time to explore key concepts and develop a secure understanding of these.
2. Integrate macro-scaffolding for writing into the curriculum through specifying learning objectives for different genres of writing that learners are expected to interpret and produce, with a gradual progression in grammatical and multimodal complexity and joined up planning across subject disciplines, including English language, and across the four years of lower secondary education.

TABLE 4.2: SUMMARY COMPARISON OF LANGUAGE SKILLS IN ENGLISH AND BIOLOGY CURRICULUM DOCUMENTS

	Targeted in Std 7 English	**FI Biology explicit**	**F1 Biology assumed**
CEFR level	A2: Basic users, still need simplified language input and structured support ... (Pearson, 2022b:10)	B2: Can understand the main ideas of complex text on both concrete and abstract topics, … . Can produce clear, detailed text on a wide range of subjects … (Council of Europe, 2024)	
Reading The learner can…	Read general-purpose text, simple stories and simple dialogues related to everyday situations.	• Read text, including on abstract and microscopic topics, with a high density of scientific and general academic vocabulary. • Interpret multimodal texts that include graphical information.	• Grasp of complex grammar, including passive tense, sub-clauses and noun groups. • Follow signals of textual organisation.
Writing The learner can…	• Write short texts focused on language items or general purpose topic. • Write a simple story and texts of more than one paragraph if given prompts and a model.	• Write simple academic text that compares, describes and explains biological processes and structures, using scientific vocabulary with precision.	• Can use grammar accurately when writing about subject topic; can use simple signals of textual organisation; use diagrams within written texts.
Listening The learner can…	• Understand a single simple sentence, a simple story or simple informal social dialogue about every day concrete matters.		• Understand teacher talking about scientific concepts, processes and biological structures using technical vocabulary.
Speaking The learner can…	• Produce simple sentence with support from prompts, models etc. • speak unsupported in pairs and groups about subjects in short (around 5 words) simple sentences using general-purpose vocabulary.	• participate in teacher-led classroom discussion and unsupported discussion in pairs and groups on both relatable, concrete and abstract concepts, using technical vocabulary.	

RQ 2(b): What are the challenges and opportunities for developing language supportive teaching and learning materials in Tanzania?

We addressed this research question through a close analysis of the TIE biology Form I textbook.

Reading difficulty of Form I textbooks

Quantitative indicators for the readability of textbooks suggest an even wider gulf between Standard 7 and Form I than the qualitative analysis. The results for the biology textbook appear to be skewed by the wide range of vocabulary appearing in book. Secondary school science texts are expected to have a high density of technical vocabulary (see section 2.2 of literature review). Nonetheless, the range for the TIE textbook is exceptionally high. Other Form I textbooks were also found to be hard to read, even for subjects such as History, which have less technical vocabulary (see table 4.6). So, the biology textbook is not an outlier. It is possible to design a textbook to be compatible with the Tanzanian syllabus and easier to read. This is indicated by the findings for a prototype language supportive Form I biology textbook, which was also analysed using the same software (see last column in table 4.6).

TABLE 4.3: SUMMARY OF FINDINGS FOR READABILITY

Indicator	Std 7 English	Form I Biology
Flesch-Kincaid Grade level of textbook*	5-6	9-10
Vocabulary range required to read textbook with support	3000 words	7000 words
Vocabulary range require to read textbook fluently	5000 words	13000 words
Readability CEFR level†	A2 – B1	C1-C2

*****Range of findings across sampled textbook chapters and examination papers.*

†*Range indicates range of descriptors to which specific learning objectives and benchmarks were matched.*

TABLE 4.6: COMPARISON OF READABILITY OF FORM I TEXTBOOKS.

Publisher	TIE					Language Supportive
Indicator	Biology	History	Geography	English	Baseline	Biology
Fleisch-Kincaid Reading Grade Level	9	9.7	12	10.5	9.7	5
% subject specific words	11	7	16	6.4	10.6	2.1

Grammatical patterns

Grammatical features of the TIE Form I biology textbook were consistent with those that previous research (Christie, 2012) has associated with secondary school science (see section 2.2), namely heavy use of the passive voice, nominalization and long noun phrases.

Features that support interpretation of the text

The biology textbook had several features that support readers to interpret the text. These included:

- One-paragraph chapter introductions help orient students to the chapter topic.
- Formatting that breaks up long pieces of text into smaller chunks
- Numbered lists that break down instructions for experiments into steps.
- Pictures and diagrams that convey meaning and support interpretation of the text.
- Tables and diagrams used to display information and support vocabulary learning.
- Exercises at the end of the chapter included a number of questions that reinforce learning of specialist vocabulary, often in the form of multiple-choice questions.
- Chapter summaries, a monolingual glossary and exercises support vocabulary learning

The book has no bilingual features that would help learners make connections to their previous learning in Kiswahili medium (KM) primary school or from outside of school and would make learning new vocabulary quicker and more convenient.

Writing and talking activities

Activities and exercises throughout the book provided opportunities to practice academic writing, discussion of scientific ideas and cooperative learning. Activities mostly targeted two foundational science process skills, namely observing (10 out of 16 activities) and classifying (nine out of 16). However, little scaffolding was provided to support learners to write or discuss in pairs. A very narrow range of sub-genres of writing were repeatedly required within exercises and there was no macro-scaffolding across the textbook through gradual introduction of progressively more complex genres and no meso-scaffolding to provide structured support with writing tasks (see section 2.2). Meso-scaffolding was however provided for recording and presenting findings from practical investigations using tables.

Opportunities for making Form I textbooks language supportive

The analysis above suggests three areas of improvement are possible for textbook design:

1. Adding Kiswahili translations to the glossary and providing a Kiswahili translation of chapter introductions to help learners make connections to prior learning from primary school.
2. Reducing vocabulary range through repeated use of a limited number of general academic words.
3. Redesigning writing and speaking activities to include scaffolding that provides guidance on simple scientific genres.

2(c) What knowledge needs and research priorities do policy makers, curriculum designers and materials developers identify regarding language, subject learning and transition?

We were not able to conduct interviews with curriculum designers and materials developers as we had planned. However, we note that extensive research (e.g. Brock-Utne et al., 2010; Mwinsheikhe, 2007) has shown that language transition is not working well in Tanzania. Language in education policy has also long been the subject of debate amongst researchers, educators and in the media (Brock-Utne & Vuzo, 2022; Mapunda, 2022; Qorro, 2004; Rubagumya et al., 2011). However, less research has focused on developing materials and curricula that provide learners with a coherent, progressive language learning journey. There has been some, as indicated in section 2.3 (e.g. Clegg, 2021), including the research that created the language supportive biology prototype textbook (Gabrieli et al., 2018; Mtana & O-saki, 2017). Re-designing the curriculum to meet the needs of multilingual leaners requires open knowledge exchange between researchers, practitioners and policy makers and curriculum designers as well as collaboration between language and subject educators. It also requires time. At the national level, curriculum design and textbook production are subject to political timetables that exclude possibilities for exploring, creating, trialling and evaluating new forms of curriculum or textbook design. Hence, abrupt subtractive language transition, that in Tanzania dates from a time when only a select minority could progress from primary to secondary education, has continued up to the present time, when lower secondary education is defined as part of the basic education cycle that should be free and compulsory for all.

4.4 Section conclusion

This section has reported the findings of Study 3, which analysed the specified curriculum in Tanzania around the point of language transition. Its main finding is that curriculum documents present learners within a disjointed language learning journey with a large gap between the language skills targeted in Kiswahili medium primary education and those assumed in the secondary school curriculum. Study 4, presented in the next section, was concerned with how the curriculum is interpreted and enacted by teachers and how it is experienced by learners in the first year of secondary education. Discussion of findings for both Studies 3 and 4 is presented in Section 6.

5. Study 4: Pedagogies of language transition in Tanzania

5.1 Section introduction

Study 4 focused on the science teaching and learning in the first year of secondary school in Tanzania and addressed research question 3, as set out in section 1.3. It investigated the extent to which science teachers implement multilingual strategies, influences on their teaching, how students experience transition and to measure improvement in students' knowledge of scientific English. Study 4 was the largest empirical component of the research and, like Study 3, it focused on subject Biology in the first year of secondary education. The research was conducted in Tanzania Mainland and Zanzibar. Zanzibar is a semi-autonomous island region of Tanzania, where English is introduced as LoLT for some subjects, including science and mathematics, in Standard 5 (Grade 5). We start by setting out the research design followed by findings, which are organised according to the five sub-questions for research question 3 (see section 1.3).

5.2 Research design

We conducted 16 Form I biology classroom case studies that look for a relationship between teachers' use of multilingual strategies in Form 1 and improvement in students' knowledge of scientific vocabulary. For each of the 16 classes, four different methods were used to collect data: lesson observation, one-to-one interviews with the biology and one English teacher, focus group interviews with students and an assessment of students' knowledge of scientific vocabulary.

Description of the sample

Schools and their environment

Each class was in a different school, with the sample comprising four schools in each of four regions: Arusha, Dodoma, Morogoro, and Unguja, Zanzibar (see figure 5.1). All schools were government-funded and locally managed. In Dodoma, Morogoro, and Zanzibar, urban, semi-urban, and rural schools were included, while all Arusha schools were rural (see table 5.1). Urban schools ranged from city centre schools, where parents were mainly professionals, to suburban schools serving diverse communities. Semi-urban schools were near cities or towns. Rural schools included day schools serving nearby villages and boarding schools with an intake from across dispersed remote dwellings. In Arusha, all schools were boarding, predominantly serving Maasai students whose main language, Maa, is not a Bantu language and hence differs from Kiswahili. In the other regions, students spoke Kiswahili or minoritised Bantu languages at home. Kiswahili is the primary language in Zanzibar, although some schools served communities using a non-standard dialect.

FIGURE 5.1: MAP OF TANZANIA, SHOWING REGIONS WHERE RESEARCH WAS CONDUCTED

Based on: NordNordWest, License: Creative Commons by-sa-3.0 de

TABLE 5.1: SCHOOL CHARACTERISTICS

Region	No. of schools	School location			Boarding	Single sex	
		Rural	Semiurban	Urban		Boys	Girls
Arusha	4	3	1		4	1	2
Dodoma	4		2	2	0	0	0
Morogoro	4		3	1	0	0	0
Zanzibar	4	2	2		1	0	0

TABLE 5.2: LANGUAGE TRANSITION POLICY AND LANGUAGE ENVIRONMENT BY REGION

	English LoLT starts …	Main languages spoken outside of school	
		Urban/semiurban schools	Rural Schools
Arusha	Form I	none	Maa
Dodoma		Kiswahili	Kiswahili & Kigogo
Morogoro		Kiswahili	Kiswahili & Kiluguru
Zanzibar	Standard 5	Kiswahili	Kiswahili & Kimakunduchi*

* Dialect of Kiswahili

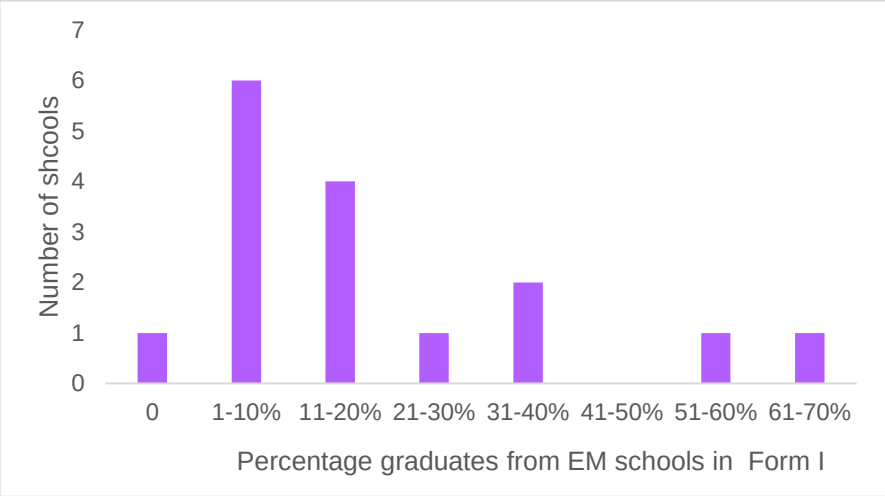
Student characteristics

In our sample, 53% of students, who sat the first assessment were girls. Across all four regions, girls are enrolled in Form I in greater numbers than boys with the gender parity index (GPI)

ranging from 1.07 in Arusha up to 1.44 in Zanzibar (Office of the Chief Government Statistician, 2023; PO-RALG, 2024). The GPI increases in higher grades, indicating that boys are more likely to drop out of formal education during both the primary and secondary phases.

Overall,20% of students in our sample had graduated from KM primary schools. All but one school had some graduates from English Medium (EM) primary schools in Form I. Urban schools had the highest proportion of EM graduates, reflecting the distribution of private provision.

FIGURE 5.2: PERCENTAGE OF GRADUATES FROM EM SCHOOLS IN FORM I



Teacher characteristics

Eight of the 16 participating biology teachers were female. Most of the biology teachers (12 out of 16) had participated in at least one LSP workshop. Two of these were graduates of the degree level science teacher education programme that included training in LSP. One teacher had participated in Baseline training, which also is concerned with integrating subject and language teaching.

Data collection methods

Lesson Observation and Student Interviews

Biology lessons were observed to note teacher-student interactions and language learning support. Immediately after, three students were interviewed about their perspectives and understanding of the lesson.

Biology Teacher Interviews

Biology teachers were interviewed individually about their awareness of language in science learning, resources used, support for Language for Specific Purposes (LSP), and related training.

English Teacher Interviews
In each school, one English teacher was interviewed to discuss Form I students' language learning needs, the teacher's views on supporting language learning across the curriculum, and school-wide support for language learning.

Student Focus Group Discussions
A group of six students from each class participated in discussions on their transition to secondary education, beliefs about language learning, language learning opportunities outside school, and available learning resources.

Biology vocabulary assessment in English
Vocabulary knowledge is an indicator of learners' overall language competencies (Elleman et al., 2009; Yu, 2010). Students' knowledge of scientific vocabulary was assessed using a multiple-choice instrument. The assessment tool consisted of 20 questions of the type illustrated in figure 5.2. The assessment was administered in the first four months of Form I (Round 1) and then the same assessment was administered a second time two to eight months later (Round 2). The assessment was administered to 790 students in Round 1 and overall 715 students participated in both Rounds.

FIGURE 5.2: EXAMPLE ITEMS FROM THE VOCABULARY ASSESSMENT

____	part of human body	1	model
		2	mature
		3	equipment
____	something used as example	4	muscles
		5	victim
____	apparatus	6	method
		1	advantage
____	features of something	2	observe
		3	produce
____	note something	4	suspect
		5	enable
____	favours something	6	characteristics

Limitations of the research

Limitations with respect to lesson observations and interview data arise from the size of the sample, which necessitated relatively short one-day visits to school and limited time to gain the trust of participants. Data collection followed shortly after teachers had received directives to only use English in the classroom. This meant teachers were reticent to perform multilingual practice in front of observers but did not prevent them talking about it. Limitations in the vocabulary assessment research arise from the logistical challenges of collecting data over a large geographic area. This meant that comparability of the vocabulary assessment scores between schools was compromised by the variation in time intervals between Round 1 and 2 of the vocabulary assessment.

5.3 Findings

3(a) What language supportive practices are teachers implementing in lower secondary science classrooms in diverse sociolinguistic contexts?

We observed a mix of practices amongst the biology teachers, ranging from short episodes of explicit language instruction through to total absence of any effort to engage students with language learning needs. We divide these into three types of practices: explicit support for language learning; reducing cognitive demand and unsupportive practices. A cross-cutting finding was that teachers dominated classroom talk and rarely elicited ideas from students. Neary all writing was copying from the board. This meant that students had few or no opportunities to engage in meaning making activities, which is a form of epistemic exclusion. We did not observe gender differences with respect student-teacher or student-student interactions.

Meaning making through exploratory talk

Several teachers allowed time for students to discuss ideas in small groups. Students were not explicitly instructed regarding the languages to use in discussion. No teacher talked about students' multilingualism as a resource for learning and none mentioned use of an African language other than Kiswahili in the classroom (although this was observed in one class, see Box 3.2).

BOX 3.1: LANGUAGE SUPPORTIVE TEACHING SEQUENCE

At one school in Zanzibar, the Biology teacher first introduced key concepts and vocabulary related to the topic laboratory apparatus. He gave instructions on how to take notes, before showing the class a 6-minute video showing pictures of apparatus with names. After watching the video, students were given time to process it through group discussion. The teacher then guided them verbally on how to form a sentence:

> Now we are going to discuss together in our groups what is Biology apparatus, according to those functions that we were doing before… One boy and one girl... *Nitakuuliza* [I will ask you], what is this… *na wewe utajibu* [and you will respond], this is..., it is used for… (Biology lesson, teacher instruction to class)

Episodes of explicit language instruction

Where teachers offered explicit language instruction, it was mainly directed at vocabulary learning, including meaning, pronunciation or spelling. Meaning might be explained through direct translation into Kiswahili or interpretation in simple English. Teachers typically modelled pronunciation and then led students in chorused rehearsal. One teacher allowed students to discuss the meaning of key words in groups before inviting individuals to write the words on the

board. Two teachers followed up exploratory talk with support for forming simple one-sentence scientific statements (see Box 3.1). Only in one lesson, did students initiate episodes of explicit language instruction.

Practices that reduce cognitive demand

Teachers reduced overall cognitive demand of the lesson either by reducing the linguistic demand or simplifying content. They reduced linguistic demand by translating explanations into Kiswahili and the use of visual aids. To reduce content demand, they either reduced content or related it to students' everyday experiences.

Using translation to reduce linguistic demand: Several teachers were observed to switch between English and Kiswahili, translating explanations of key points. In the interviews, most biology teachers admitted that they used translation, even if they regarded it as poor practice, because it was the only way that students would understand. Students viewed this practice as helpful and supportive.

Reducing linguistic demand through use of visual aids: Teachers used visual aids to reduce linguistic demand and support learning of scientific vocabulary. Alternatively, teachers directed students' attention to images in the TIE textbook. As one teacher explained:

> if you tell them this is a model and the actual thing, they understand very easily. If you talk about the heart, for example, that it has ventricles and auricles, also go with a model which shows them. (Biology teacher)

Students reported that visual aids helped with learning vocabulary, especially when several new scientific terms were introduced in one lesson.

Relating content to students' environment: Drawing connections to students' everyday experiences and local environment makes scientific concepts more relatable and less abstract for students. Five teachers explicitly contextualise subject content, but no one elicited examples from students. Neither were students invited to articulate their understanding, with the exception described in Box 3.2. However, every group of students interviewed after a lesson did, with prompting, explain the relevance of the lesson to their own lives.

Reducing content: In two lessons, teachers deviated from their lesson plan to focus on more fundamental content having discovered students did not understand foundational concepts.

Unsupportive practices

We also observed practices that excluded some or all students from developing language skills or accessing curriculum content. These included:

- **All student writing was copying from the board:** Students did not have opportunities to produce their own writing, even when activities such as labelling a diagram or completing a table, were provided in the TIE textbook.

- **Oversimplifying science content** to the point that the lesson was, in the words of one student, “simple because we had learned it primary school”.
- **Not engaging students:** Two teachers dominated classroom talk, only speaking in English and ignoring the majority of students, who never silent throughout the lesson.
- **Failing to model academic English**: A minority of teachers did not have sufficient mastery of English to model scientific language for their students. Their talk shifted back and forth between error-strewn English and Kiswahili.
- **Punishing mistakes with corporal punishment:** We did not observe corporal punishment but, in one school, students indicated it made them reticent to participate in class. Other groups talked indirectly about corporal punishment.

BOX 3.2: A LESSON THAT ENGAGED STUDENTS’ PRIOR KNOWLEDGE THROUGH USE OF THEIR ETHNIC LANGUAGE

In a boarding school in Arusha, where most of the students are Maa speakers from remote Maasai communities, the teacher, also a Maa speaker, brought some plants to class. Students named them in Maa as ‘Olemuran’ and explained, in Kiswahili, that they are used by the Maasai to ward off mosquitos and treat malaria. The teacher then introduced the botanical name, ‘Amaranthus’. They went on to name other plants in the Amaranthus family, together with their uses. The lesson was active and engaging. One point, students laughed as they move around the classroom waving the Amaranthus plants.

3(b) What knowledge, professional support and teaching and learning resources enable teachers working with diverse learners to implement LSP?

Overall, training in LSP and beliefs regarding language and learning were the most important enablers for biology teachers' use of LSP. Beliefs, however, were strongly influenced by school language policies. Pre-service teacher education with consistent focus on LSP was the most effective form of LSP training.

Teachers' pedagogical knowledge and training

Training in LSP did influence practice. Most of the teachers, who had participated in either LSP or Baseline workshops, were observed to implement language supportive practices. The two teachers, whose pre-service training at St. John's University of Tanzania (Gomezulu, 2021; Jonas, 2021) focused on LSP, were the most confident implementing and talking about LSP. Two other teachers, featured in Boxes 3.1 and Box 3.2, adapted language supportive strategies to available teaching and learning resources and students' linguistic resource.

School language policies and teachers' beliefs about language and science learning

School language policies influenced teachers' beliefs regarding language in science learning. The ten teachers in schools that tolerated multilingualism, asserted that students would not understand them if they only used English:

> The books we use are written in English; these diagrams are labelled in English. Outside of the classroom, children communicate in Kiswahili and at home also it is Kiswahili. The examinations are in English and we are exhorted to teach in English. Sometimes we determine things for ourselves because there is no way, if I stick to English, to teach someone who does not understand anything. (Biology teacher)

Few teachers talked about students' use of language. Those that did, advocated explicit language support:

> If they can digest and explain in another language, you accept it and then you help them to explain in the language of learning. (Biology teacher)

A belief in a monolingual school environment was linked to a view of language learning as "a struggle" that needed to be "forced". 13 out of 15 English teachers plus the seven biology teachers at schools with an 'English only' policy talked of "fear", including fear of "being laughed at", as an incentive to learning. This joyless discourse makes students responsible for their language proficiency, whilst absolving teachers from providing support. For example, one teacher commented that when a student looked up a word up in a dictionary, they were more likely to remember it but did not acknowledging that few students own a dictionary. No one suggested that 'English only' language policies promoted learning of non-language subjects.

Cooperation between language and science teachers

All English teachers and some biology teachers regarded language and subject learning as two separate domains of teaching and learning. Ony two teachers distinguished between academic and communicative English. Hence, English teachers did not recognize themselves as having a role in supporting learning across the curriculum except within the Baseline programme. Biology

teachers indicated that they consulted language teachers as language experts, asking them to proofread written outputs such as school examination papers or guidance on pronunciation, but did not consult with them on pedagogy. Some biology teachers asserted that language teaching was not their responsibility.

Teachers' use of learning and teaching resources

Teachers had reliable access to textbooks. The TIE student book and syllabus were the main resource that guided biology teaching. Teachers did however make use of other textbooks as reference books when preparing lessons and one teacher used the British Council Baseline student book. Three teachers used resources they had sourced from the internet. We observed different teachers, who were using the same textbooks, teach in language supportive and unsupportive ways.

Students' access to textbooks varied between schools. Biology teachers reported pupil to textbook ratios between 3:1 and 15:1 and attributed the amount of lesson time spent copying from the board to textbook supply:

> There are very many students and not enough book. We are writing those questions that are in book on the board because of the shortage of textbooks. (Biology teacher, Zanzibar)

In summary, teachers' access to teaching and learning resources did not seem on their own to be an enabler of LSP. However, student access to textbooks expands pedagogic possibilities.

3(c) Is LSP measurably improving English-language scientific vocabulary of girls and boys across diverse sociolinguistic contexts?

Across the whole sample, the mean difference in score between the first and second round vocabulary assessment was a highly significant improvement of 12.2 percentage points (table 5.3). There was no significant difference in the improvement for boys and girls. The time interval between Round 1 and 2 was greatest in Dodoma, followed by Arusha, with the schools in Zanzibar making the smallest improvements. Schools in Dodoma Region had three months more learning time between Round 1 and 2 than those in Morogoro Region, so it was surprising that Morogoro region had the greatest improvements in score. This may be due to the higher proportion of EM graduates in the Morogoro schools.

TABLE 5.3 OVERALL IMPROVEMENT IN VOCABULARY ASSESSMENT RESULTS

Variable	Mean	Mean difference	p-value
Round 1 scores	39.1		
Round 2 scores	51.3	12.2	<.0001

There was a small but significant difference of 3.74 percentage point between schools that were tolerant of multilingual teaching and learning practices and those that claimed to have a punitive English-only policy. This finding supports the view of the majority of biology teachers and students that a completely monolingual classroom is harmful to subject learning.

3(d) To what extent do upper primary education and Form 1 language orientation programmes prepare students for EMI secondary education?

Comparing graduates from EM and KM primary schools

In all observed lessons, we found that a minority of students contributed frequently to classroom discussion through prompt response to teacher questions. Teachers and students indicated that these were mainly students who had graduated from private EM primary schools. The first-round assessment, conducted shortly after students had started secondary school, indicated weak knowledge of scientific vocabulary needed in Form I across the sample group. However, graduates of EM primary schools had a substantial and significant advantage, performing on average 21.5 percentage points higher than those from KM schools (see table 5.4).

TABLE 5.4: COMPARING ROUND 1 VOCABULARY SCORES FOR GRADUATES FROM KM AND EM PRIMARY SCHOOLS

Primary school type	N	Score (%)	Std Deviation
KM	641	34.7	17.7
EM	149	56.2	24.5
Total	790	39.0	21.0

Evidence on the Baseline programme

Students described the Baseline programme as easy:

> When we were on the Orientation course, it was like returning to primary school except that we are using the English language. (Student Focus Group)

Biology teachers observed that the Baseline programme was improving language skills needed for learning biology and recommended that it be extended and syllabus content for Form I biology be reduced to create instructional time for Baseline.

Evidence on introducing English as LoLT in primary school

Zanzibar has a policy of introducing English as the LoLT for science teaching in the fifth year of primary school, three years earlier than Mainland. This did not deliver any advantage in knowledge of scientific vocabulary. Table 5.5 indicates that students in Zanzibar scored on average 17 percentage points lower than Mainland Tanzania. The highest scoring school in Zanzibar scored 7.7 percentage points below the average across the three Mainland regions.

This finding resonates with conclusions from larger scale studies conducted elsewhere (Genesee, 2013; Heugh et al., 2017; Opare-Kumi, 2024).

TABLE 5.5: MEAN SCORE AND STANDARD DEVIATION IN ROUND 1, BY REGION

	N	Mean % score	Std Deviation
Mainland			
Arusha	219	43.0	22.4
Dodoma	182	42.0	18.7
Morogoro	209	42.7	18.1
Zanzibar	180	25.6	8.7

3 (e) What gendered differences are observable in results of vocabulary assessments and student views on teaching and learning across contexts that differ with respect to gender parity in enrolment, socioeconomic characteristics, languages spoken in the community and availability of printed literature?

Teachers' perspectives on differences between girls and boys

The mean score for girls was slightly higher than for boys in both rounds of the vocabulary assessment, however the difference was not significant. All except two out of 31 teachers claimed girls outperformed boys in language skills and learning, which they attributed to their behaviour or attitude to learning.

Personal resources for language and subject learning

Teachers claimed that students' personal learning resources gave them a major advantage in language and subject learning. However, students indicated that they had access to very few learning resources outside of school. Only one student had more than five miscellaneous textbooks and revision guides at home, most only had one. Exercise books belonging to friends and siblings were the most widely available personal learning resources. Students' access to English language media outside of school was limited, as radios and television in the home were tuned to Kiswahili stations. A minority of students were able to access the internet by borrowing a parent's smartphone.

Student attitudes to language learning

Students expressed commitment to learning English and support for the use of English as the language of instruction, always for instrumental reasons:

> Because if I use English in my examinations, it will help me to do well.
>
> Because English is an international language, a person who had studied how to use English may be employed in foreign countries that use English for communication. (Student Focus Group)

Students had a strong sense of personal responsibility for language learning. They emphasised the importance of their own efforts “to practice talking the language and reading” (Student Focus Group). Several focus groups felt they had made progress with learning English since starting secondary school, through expanding their vocabulary and practicing communicative speech. Some students from EM primary schools, also expressed a sense of responsibility for supporting their peers with English language learning. In one school, peer learning had been contrived by teachers:

> The teacher has directed those of us, from English Medium schools, who know how to speak, read and write to help our peers. … For example, I have been given three people to teach and at last they were understanding... Because when the teacher gave them to me, I did not have the confidence to teach them to understand. (Student Focus Group)

Conversely, students from KM primary schools indicated appreciation for peer support:

> .. we request those who do know from the private school to help us to know the vocabulary, which we do not know… (Student Focus Group)

Peer learning thrived in an affirmative learning environment, where students could take risks with speaking English:

> Things which make me know English is that when I used to use broken English, different people corrected me, this is the main thing which has enabled me to speak good English. (Student Focus Group)

Girls described peer cooperative learning more often than boys. One all male focus group explained that social conversation in English was considered ridiculous and pretentious.

> S2: You may want to learn but your peers do not cooperate, they laugh at you.
> S1: They do not cooperate. They say that you are pretending that you know to speak English (Student Focus Group)

Students attitudes to learning English may be related to the high value placed on English proficiency. English was talked about in relation to aspirations for examination success, future employment and international travel. It was also described as difficult, a requirement, associated with ridicule (one focus group) and talking with friends (one focus group). Kiswahili by contrast was associated with social communication, home and easiness. Ethnic community languages were only mentioned as the language that other students used amongst themselves or at home.

5.4 Section conclusion

Study 3 showed that there is wide gap in the Tanzanian specified curriculum between the language skills developed in KM primary schools and those assumed by the Form I science curriculum. Study 4 findings have confirmed that graduates from EM primary schools do have a

vocabulary advantage at the start of primary school and are more likely to be included in classroom talk. However, comparison between Mainland Tanzania and Zanzibar suggests that introducing English as LoLT in earlier in the government primary education system does not deliver the English language of private EM primary schools. Some science teachers are successfully using language supportive strategies to integrate explicit language instruction into their teaching at the same time as developing students' conceptual understanding. However, most use a limited range of practices, which allow students little opportunity to explore ideas and practice articulating their understanding, in any language. Schools seek to compensate for the curriculum gap in language learning through punitive enforcement of 'English only' policies, despite no one believing that monolingual language practices promote subject learning.

6. Discussion

6.1 Section introduction

This section discusses the findings from all four studies. The research aimed to evaluate the potential of LSP to enhance science learning and inclusivity at scale within late transition MLE systems. 'At scale' refers to a focus on national education systems. Following the theoretical framework presented in Section 2.2, the discussion focuses on the epistemic dimension of inclusion and is oriented towards identifying ways forward for transforming late transition from a subtractive to an additive approach. An additive MLE includes all learners in classroom meaning-making processes by allowing them to articulate their understanding in both a familiar language and the new LoLT. Epistemic inclusion encompasses two main aspects: access to the curriculum and the recognition of students' knowledge. Section 6.2 discusses the first aspect, drawing mainly on findings from Study 2. Section 6.3 explores the second aspect by discussing the ways in which monolingual language practices deny students opportunities to engage in meaning making. Drawing on findings from Study 4, it highlights how subtractive MLE perpetuates wealth-related inequalities and violent school practices. Section 6.4 draws across Studies 2 and 4, to discuss the potential for teacher education to foster the innovation of additive multilingual pedagogies.

6.2 A coherent curriculum for language learning

Study 3 demonstrated the need for curriculum to set out a coherent language learning journey across language and non-language subjects and across educational phases (argued further in Barrett et al., 2024). Introducing a new LoLT should be a gradual process (Simpson, 2019). Learners benefit from gaining mastery of grammatical features used in academic writing first in a familiar language and then in the second language before they use them in subject learning (Cummins, 2017). Subject textbooks and other learning materials should avoid routine use of grammatical features before learners have practiced them to the point of mastery within language lessons. This may mean deferring to upper secondary or higher education the use of some language elements associated with scientific writing. For example, South Africa science textbooks are written in the active voice up to and including Grade 12 (Siyavula, n.d.). This contrasts with routine use of the passive voice in science textbooks that starts from Grade 8 (Form I).

A coherent language learning journey requires integration of explicit instruction on academic language within science subjects, including through the gradual introduction of scientific genres of writing. These need to be introduced gradually, with opportunities to practice the simpler genres before more complex ones are introduced (macro-scaffolding) (Polias, 2016) (see Section 2.3). Explicit instruction on language as part of non-language subject teaching has been shown to improve learners' writing skills in monolingual education systems (Christie, 2012; Forey, 2020) but becomes even more essential for multilingual learners (Schleppegrell et al.,

2002). Indeed, the action research at KUE (see Section 3) demonstrates that explicit language instruction, particularly of scientific genres, remains important even within higher education.

Language and subject learning cannot be disentangled. Coherence in the language learning journey depends on conceptual coherence of the curriculum, as demonstrated in our analysis of the biology Form I textbook (Section 4.3). Curriculum overload and conceptual incoherence multiplied the range of subject specific words and hence the linguistic demand of secondary school biology. International studies of curriculum overload (OECD, 2020; Pritchett & Beatty, 2012) have not previously given much attention to policies around LoLT. Conversely, debates on language policies rarely engage scholarship on curriculum coherence. Yet, the relationship between linguistic complexity and academic level of subject learning is well known. It has been extensively researched by sociolinguists such as Halliday, Martin and Christie (Christie, 2012; Halliday & Martin, 1993) and informs the CEFR descriptors, arguably the world's most high profile and widely used tool for assessing language proficiency. Principles of curriculum coherence and pacing matter in all education systems (OECD, 2020). However, their importance is magnified in multilingual education systems, where the conceptual demand of subject learning is compounded by the linguistic demand of language transition.

6.3 Monolingual practices that exclude

The second aspect of epistemic inclusion concerns recognitions of learners' knowledge practices. This requires engaging learners' full linguistic resource by allowing them to articulate ideas and negotiate learning in a familiar language. The two dimensions of epistemic inclusion may be regarded as two sides of a coin. Learners more readily acquire academic language skills in the new LoLT, if they also develop them in their main or familiar language (Cummins, 2017; Lo et al., 2023). This is supported by Study 4, which found that Zanzibar's policy of introducing English as LoLT in science in upper primary delivered no advantage with respect to their knowledge of scientific vocabulary in English. Indeed, learners in Mainland Tanzania, most of whom had only used English for learning science for a few weeks had a wider scientific vocabulary in English. Researchers (Christie, 2012; Schleppegrell et al., 2002) have argued that academic language needs to be explicitly taught as a part of subject learning. This makes sense if science education is viewed as a gradual induction into a community of practice (Packer & Goicoechea, 2000). In other words, learning science is a process of acquiring the epistemic practices, including language practices of science (Barrett & Bainton, 2016; Polias, 2016). Multilingual education allows learners to bring their own personal and cultural ways of knowing, including the community language practices, to the learning process (O'loughlin, 1992). In Study 2, we found that this principle extends to the science learning in higher education.

Study 4 found that the majority of biology lessons in Tanzania are not monolingual. Teachers used translation or code-switching in their own talk as a part of transmissive pedagogy. These teachers sought to make the curriculum accessible through their own bilingual talk and by providing examples that were familiar to students, but rarely elicited ideas or examples form students beyond basic one-word information (for example, names of plants or animals). They offered very limited opportunities for students to digest scientific concepts through explorative talk or to develop and practice scientific genres. In other words, they attempted to address the

first dimension of epistemic inclusion but appeared unaware that epistemic inclusion also required engaging learners as knowledge holders. At the same time, nearly all student writing in science lessons was copying from the board. So, most students had no opportunity to articulate their understanding verbally or in writing at any point within science lessons. They were completely excluded from meaning making processes or *practice* producing academic language in class.

Different students experienced the transition to secondary education differently, depending on whether their primary school had used Kiswahili or English as the LoLT. The aspirational discourse around English, as the language of future possibility contributed to a status hierarchy amongst teachers and learners based on perceptions of their proficiency in English. Hence, English teachers were positioned as experts to be consulted on matters of linguistic accuracy by their colleagues but did not reciprocate by appreciating the pedagogical expertise of subject teachers. Amongst themselves, students positioned EM graduates as experts, competent to advise and support their peers with language learning. This status difference was reinforced by those teachers, who only engaged with more confident learners. In schools that enforced an 'English only' policy, KM graduates were vulnerable to ridicule or punishment for making linguistic mistakes, which had a silencing affect, similar to observed by researchers in other East African countries (Kiramba, 2018; Kuchah et al., 2022). Because EM schools are always fee paying, hierarchies of status predicated on English proficiency reflected patterns of wealth advantage.

Policies that privilege English language learning at a cost to learning in other subjects and to student wellbeing arguably are an example of the long shadow that coloniality casts on education today (Rudolph et al., 2018). Like other forms of coloniality, many educators and students resisted them, if only covertly. Just over half of the schools did not impose a blanket 'English-only' policies despite political messaging around the time of the research. Biology teachers indicated that their classroom talk was bilingual, and students charged with reporting their peers for speaking languages other than English, routinely under-reported or abstained altogether.

6.4. Pedagogic innovation for additive MLE

The literature review identified a growing body of research on pedagogies for multilingual education (MLE), highlighting innovative multilingual practices of subject teachers (Lewis et al., 2012; Lo et al., 2023; Probyn, 2019) and research-led innovation (Charamba, 2022; Makalela, 2015; Casmir M. Rubagumya et al., 2021). In Study 4, ten out of 16 biology teachers demonstrated language supportive practices (LSP). Notably, an exceptional Maa-speaking biology teacher innovated trilingual practices in a remote school serving marginalised communities (see Box 5.2). The two teachers best able to articulate the theories behind their LSP practices, had both been trained at St. John's University of Tanzania. Teacher educators at St. John's have written about the research-driven process through which they integrated LSP into every aspect to their Science Education degree programme (Casmir.M. Rubagumya et al., 2021). This involved collaboration between language and science educators, tutors' re-evaluating their education values and theories, reorganisation of delivery to allow more time for

interactive seminars and revising assessment criteria for teaching practice. Partnership with neighbouring schools was another important component of the change process, as teacher educators engaged with in-service teachers to trial LSP in schools. Crucially, the university leadership was actively engaged with the research that drove change.

In Study 2, teacher educators at KUE similarly made their own classes the starting place for exploring the potential of LSP. While previous research in Tanzania focused on developing students' pedagogic skills for MLE, the KUE team focused on students' writing practices. The KUE curriculum, like many worldwide, separates language learning from subject learning. Within 'Communication Skills' courses, language educators focus on communicative skills and accurate use of grammar, while within science courses, science educators emphasize conceptual learning and technical vocabulary. The collaborative inquiry between language and science experts at KUE created scaffolding for students to use their English grammar knowledge in scientific writing. English and biology tutors together devised a method to integrate explicit language instruction into science subjects, in a way that enhanced and did not distracting from science learning. This demonstrates how situated research, even on a small scale, contributes to expanding the international knowledge base for MLE.

Pre-service teacher education has been described as a "fulcrum for change" (Stuart, 2002). Because it lays the foundations for teachers' developing practices, values, and professional identity careers (Dembélé & Miaro-II, 2012), a profound change to teacher education can influence teaching and learning in schools for a generation. However, the St. John's experience and that of members of the research team (Sane, 2024) demonstrates that university-based teacher education can also be fulcrum point for pedagogic innovation across the education system. This includes through research that documents and theorises the innovatory practices of school-based teachers (Bowden & Barrett, in press), partnership with schools and direct contributions to curriculum review. However, the capacity for innovation demonstrated by St. John's and the KUE team, can be nurtured within other types of education institutions (Samoff et al., 2013). International research and theoretical literature consistently points to the power of school-based collaborative communities of teachers to drive meaningful pedagogic change (Moon & Umar, 2012).

6.5 Section conclusion

The literature review identified areas of challenge and opportunity for system level transformation towards MLE. These included curriculum design, pedagogic innovation, teacher education and leadership at the school and system level (see Section 2.3). The discussion above has implications for all four areas and provides a basis for recommendations for policy, practice and research set out in the next Section.

7. Recommendations

7.1 Introduction

The discussion above has in shown that language policies and practices matter for inclusion and learning across the curriculum. System level transformation towards additive language transition is a feasible starting point for wider-ranging transformation towards engaged active learning facilitated by more confident reflexive teaching within more caring and inclusive school environments. The first target (target 4.1) of the United Nations Sustainable Development Goal for inclusive quality education (SDG4) is that all girls and boys complete free and equitable primary and secondary education leading to relevant and effective learning outcomes (United Nations, 2015). Universal secondary education is a formal policy ambition in both Tanzania and Ethiopia. The recommendations for policy and practice, in Section 7.2, and further research, in Section 7.3, are all based on findings and discussion of the ELSATS research. If followed, they will bring Ethiopia, Tanzania and other late transition education systems closer to achieving the dream of relevant, inclusive quality secondary education for all.

7.2 Recommendations for policy and practice

1. Leadership and policy should reject monolingualism and celebrate linguistic diversity

Language policies that restrict multilingual learners and teachers to monolingual language practices are incompatible with Target 4.1, harmful to learning and harmful to learners. Teachers' beliefs and values regarding language and learning are not fixed and immovable but are influenced by the institutional environments in which they work. Educational leaders, therefore, have considerable influence. They can exercise this influence by to change attitudes to multilingual education by removing monolingual policies, whether they are official or unofficial, and by recognising and celebrating the linguistic diversity of school communities.

2. National curriculum frameworks should set out a gradual continuous language learning journey for all boys and girls that is coherent across educational phases, grades and curriculum subjects

A national curriculum that is coherent with respect to language learning is necessary to inclusive education. A coherent curriculum balances the demands of language and subject learning and takes into account the extra cognitive demand of introducing a new LoLT. Box 7.1 lists key features of a coherent curriculum. Involving both language and other subject specialists in reviewing both language and other subject curricula is likely to help ensure that consistent language demand across the curriculum.

Box 7.1: Key features of a coherent curriculum

1. Curriculum load and pace is appropriate to age and grade.
2. Exploration and consolidation of foundational concepts is prioritised over memorising large numbers of examples and a wide scientific vocabulary.
3. General academic language skills, such as mastery of different tenses and writing complete paragraphs, should be introduced and practiced within language subjects before they are routinely used in other subjects.
4. Curricula for non-language subjects explicitly state subject-specific language learning outcomes such as writing short texts using specified scientific genres.
5. Guidance to textbook publishers and examination councils includes explicit guidelines on readability.

3. Develop curriculum materials for multilingual learners

Lower secondary textbooks and other resources should be designed for multilingual learners through attention to the features Box 7.1. Engaging language as well as subject educators in development of non-language subject textbooks will ensure that reading difficulty, tasks and are aligned with development of communicative and general academic language skills within the language curriculum.

Box 7.1: Features of language supportive lower secondary school textbooks

- Limited range of general and general academic vocabulary and the rate at which subject specific vocabulary is introduced.
- Text broken down into short chunks, accompanied by images and figures to support interpretation.
- Sentences are kept short with minimal use of subclauses. Use of active rather than passive voice.
- Provide bilingual or multilingual glossaries so that learners can make connections back to previous learning using a different LoLT or make connections to knowledge from outside schools.
- Tasks and exercises should provide scaffolding for reading, writing and talking.

4. Integrate additive multilingual practice into every aspect of pre-service teacher education

The theory and practice of additive multilingual education should be a consistent thread running through every component of the programme. This includes modelling additive multilingual

practices, such as LSP, through the pedagogy of subject courses; introducing students to the theory of additive MLE in general and subject pedagogy courses; giving students opportunities to practice multilingual pedagogies; and making inclusive language practices part of the assessment criteria for teaching practice. Teacher educators, who themselves implement additive MLE, are well-placed to facilitate teacher professional development in schools and to advise on the design of curriculum and assessment.

7.3 Recommendations for further research

Further research is needed that provides knowledge for implementing the above recommendations. Broadly this falls into two types of research: research that stimulates knowledge exchange and research that stimulates innovation.

1. Innovative research that expands pedagogical knowledge for multilingual education

Further research is needed that expands the knowledge base for implementing MLE by stimulating pedagogic innovation. This extends beyond classroom teaching to curricula, teaching and learning materials and assessment, which are all intrinsically pedagogic. The principles that guided KUE's action research and also previous LSP research in Tanzania (Barrett et al., 2021; Casmir.M. Rubagumya et al., 2021) are pertinent to further research. These are:

- All pedagogic practice is situated and so ML pedagogies can only be developed within the contexts of implementation.
- Innovative research is outward looking. It engages with and reinterprets pedagogic theory from elsewhere.
- Pedagogic innovation is a collaborative process. Collaborations between language and subject specialists are particularly powerful for developing multilingual pedagogies for lower secondary education.

University-based teacher educators are well placed to lead research on pedagogy, but research should also involve school-based teachers. However, all education institutions, including schools, curriculum authorities and examination councils, can nurture pedagogic innovation by creating time and space for communities of educators to collaboratively explore the potential of multilingual pedagogies.

2. Research that stimulates knowledge exchange

In Tanzania, as in many countries in the global South (Shoba & Chimbutane, 2013), there is a gulf between the monolingualism of the curriculum and the multilingualism of classrooms and school communities. A quarter of the biology teachers in Study 4 were able to innovate multilingual pedagogies adapted to the linguistic capabilities of their students. This suggests that Tanzania has thousands of secondary school teachers with knowledge and expertise to

contribute towards system level change. Further research should create communities of practice within and across schools through which pedagogical expertise and innovation is shared between researchers. It should also facilitate knowledge exchange between the different actors and institutions involved in educational transformation, including learners, teachers, teacher educators, local education officials, quality assurance officers or inspectors, curriculum designers, textbook authors, as well the communities that schools serve. For example, knowledge exchange research may engage learners, community members and teachers in making connections between indigenous knowledge and the specified curriculum so that learners are recognised as knowledge holders with ideas to contribute in class. Or knowledge exchange project may bring together publishers and textbook authors from different country contexts to share knowledge on how to design materials for multilingual learners. Further research should also facilitate knowledge exchange between actors working within different organisational levels of education systems, for example, teachers and curriculum authorities.

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Glossary

Applied linguistics, like any discipline, has developed a number of specialised terms. Unlike the natural sciences, where specialist vocabulary is very precisely defined, authors do not always use these terms in exactly the same way and with the exactly the same meaning. This glossary provides short explanations of how we have used key terms that appear in this report. It should not be treated as definitive or authoritative.

Academic language practices
The language and literacy practices that are associated with subject disciplines. They have evolved to support the logic and modes of inquiry of the discipline. As disciplines are continually evolving, so are their language practices (Colombi & Schleppegrell, 2002).

Additive multilingual education
Programmes which systematically provide for the progressive development of two or more languages and draw on these languages to deliver curricular content in non-language subjects.

Configurative literature review
A critical interpretivist approach to literature review that is iterative, involving re-definition of focus areas, themes and key words on the basis of emergent understanding.

English Medium or English Medium Instruction (EMI)
A term used to describe schools or education systems where English is officially the only language allowed to be used in all teaching and learning. All English medium primary schools in Tanzania, with a very small number of exceptions, are private fee-paying schools.

Epistemic exclusion
Epistemic exclusion in the context of basic education has two dimensions. The first is denying access to the specified curriculum by failing to engage learners in active meaning making processes in the classroom. The second is failing to recognise the knowledge of learners and their communities.

Epistemic inclusion
Epistemic inclusion has two dimensions. The first is engaging learners in meaning making so that they have opportunities to process and make sense of key concepts in the specified curriculum. The second is recognising the knowledge and knowledge practices of learners and their communities. As learners make sense of new concepts by relating them to existing knowledge, the two are interdependent. However, this report mainly focuses on the first dimension.

Familiar language
Language that is used in social interactions on a daily basis or has been developed to the point of fluency in an earlier phase of education. Usually the preferred language for social interactions between students.

Genre
Widely applicable, predictable and relatively stable forms of behaviour. For example, scientific genres include laboratory reports, classifications, theoretical explanations and arguments (Polias, 2016).

Kiswahili Medium (KM)
A term used to describe schools in Tanzania where Kiswahili is officially the only language allowed to be used for teaching and learning. All Kiswahili medium schools are government-funded primary schools.

Language of learning and teaching (LoLT)
Main language used for learning and teaching across curriculum subjects. It is the language in which curriculum documents are drawn up, including textbooks, and in which national assessment is conducted. It may or may not be officially mandated as the only language that teachers and learning can use in the classroom and even where it is mandated in policy, teachers and learners may in practice be using other languages.

Language supportive pedagogy (LSP)
A distinctive approach to supporting learners following a change in the LoLT that has been developed in East Africa. It has three main elements: (i) students are encouraged to use a familiar language for informal exploratory talk, i.e. informal discussion through which new concepts are explored and processed; (ii) explicit scaffolding for reading, writing, talking and listening in the new LoLT; and (iii) emphasis on and explicit support for learning subject specific vocabulary. Language supportive teaching and learning materials include bilingual features, such as glossaries that translate key words, to help learners connect to previous learning and their 'common sense'.

Macro-scaffolding
Gradual introduction of different genres of writing, starting with simple genres that use simple present tense and active voice and gradually introducing to more complex ones that engage multimodal literacies.

Meso-scaffolding
Support for development of academic language practices through activities that provide structured support for producing spoken and written text in a new LoLT. For example, an example might start with explorative informal talk in learners' familiar language and then provide sentence starters to help learners' make a formal statement of their conclusion in the new LoLT.

Micro-scaffolding
Generally unplanned ad hoc classroom dialogue which moves students from informal statements or descriptions in a familiar language to formalised statements in the new LoLT.

Multilingual education
Multilingual education (MLE) refers to education systems where a language which is not the main language of the majority of learners is used to teach non-language subjects. MLE includes situations where bi or multilingualism is an official educational goal and situations where multilingualism is 'de facto' and not officially sanctioned (Heugh et al., 2017).

Multimodal literacies
Language practice that combine interpretation and creation of more than one form of semiotics, for example, text, gesture, images, charts, equations, chemical or mathematical symbols.

Pedagogic translanguaging
A multilingual pedagogy that involves deliberate movement between a familiar language and the LoLT. Learners are encouraged to articulate their understanding in a familiar language and then translate statements into the LoLT. They may also be encouraged to translate statements in the LoLT into their familiar language or a second LoLT (Lewis et al., 2012).

Pedagogy
Pedagogy encompasses both the act of teaching and the theories and debates that inform the act of teaching and that are continuously reviewed and revised by teachers and others in the light of experience, observations and outcomes (Alexander, 2001).

Register
Language practices associated with a specific social context. Registers tend to vary along a continuum that involves field (concrete, every day and commonsense versus technical and abstract), tenor (informal and subjective versus formal and objective) and mode (communication mainly dependent on gesture or action versus written language).

Scaffolding
Structured support provided for a learner in order for them to complete a task or acquire a skills, which is then gradually reduced and removed.

SDG4
The fourth United Nations Sustainable Development Goal is to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030.

Target 4.1
The first target of SDG4 is to ensure that by 2030 all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.

Social justice
Social justice concerns parity of participation in social institutions (Fraser, 2008), including education institutions, as well as the opportunities and freedoms that members of a society have (Sen, 2009; Young, 1990).

Subtractive multilingual education (MLE)
Subtractive MLE reflects the assumption that the learners' main language and/or previous language of instruction (familiar language) should be removed and replaced by a new LoLT. It aims to maximise exposure to the new LoLT in order to develop the grammatical accuracy and lexical range of native speakers.

Target language
The language in which the academic language skills are developed. This is usually in the official LoLT.

Translanguaging
Translanguaging describes the flexible and fluid discourse practices that bilinguals use to communicate and make sense of their worlds, which may span standardised languages that have been described as discrete and separate.

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Executive summary

1. Introduction

Across many countries in the Global South, secondary education uses a language for learning and teaching (LoLT) that is not the main language learners use outside of school. The *Evaluating Language Supportive Approaches to Transition at Scale* (ELSATS) project aimed to explore how language supportive promote epistemic inclusion. Research was conducted in Tanzania and Ethiopia, where English becomes the LoLT at the beginning of secondary education. This is when the curriculum splitting into different subjects with different academic language practices. Language supportive approaches are multilingual pedagogies that integrate instruction on academic language practices into subject teaching. The ELSATS research evaluates the language supportive approach from two angles. First, teacher educators in Ethiopia explored its relevance to their context through action research. Second, in Tanzania, the project researched curriculum, pedagogy and student experience around the point of language transition. The research consisted of four Studies.

2. Study 1: International literature review

An epistemically inclusive education is one where all learners have opportunities to achieve learning objectives specified in the formal curriculum and where they are recognised as knowledge holders. Language contributes to both aspects. Access to the curriculum depends on opportunities to develop and practice academic language practices. Recognition of knowledge students bring depends on allowing them to articulate ideas using a familiar language, which was use the LoLT for earlier phases of education or is used socially outside of school. Additive multilingual education (MLE) is inclusive because it maintains the use of a familiar LoLT alongside the introduction of a new LoLT and integrates explicit language instruction into subject teaching.

3. Study 2: Action research in teacher education in Ethiopia

A team of language and science teacher educators at Kotebe University of Education developed an approach to language supportive pedagogy (LSP) into a biology course for student teachers. LSP, as developed through the action research, involved multilingual exploration of scientific concepts and explicit instruction on writing scientific genres that describe and organise information. The research also demonstrated introducing LSP into a subject content course develops students' academic writing skills, whilst modelling a multilingual pedagogy for them.

4. Study 3: Analysis of language skills in the Tanzanian curriculum

The national curriculum in Tanzania is specified through syllabi and textbooks that are published by the Tanzania Institute of Education, which acts a curriculum authority. The research compared the language skills targeted in the English language curriculum specified for Kiswahili medium (KM) primary schools with those the language skills that learners need to engage with the subject biology in the first year of secondary school (Form I). A considerable

gap was found between the two. In particularly, the biology textbook presented learners with an extraordinarily wide range of vocabulary.

5. Study 4: Pedagogies of language transition in Tanzania

Study 4 conducted research in 16 schools spread across four regions in Tanzania: Arusha, Dodoma, Morogoro and Zanzibar. English is introduced as the LoLT for science three years earlier in Zanzibar than the other three regions. Four types of data were collected in each school: observation of a Form I biology lesson; an interview with the biology teacher and an English teacher; group interviews with students about the lesson and their experience of transition to secondary school; and an assessment of students' knowledge of scientific vocabulary in English. Findings indicated that nearly all biology teachers provided support with learning scientific vocabulary but only a minority integrated explicit instruction on writing or talking about science in English. Students had few opportunities to practice articulating their own ideas either through talk or writing. Students from KM primary schools had a disadvantage with respect to their knowledge of scientific vocabulary and were less likely to be invited to talk in class. Students preferred teachers who translated key words and concepts into Kiswahili and used visual aids to illustrate concepts. Six out of the 16 schools implemented an English-only language policy, which was punitively enforced. Students, who had graduated from KM primary schools, were more vulnerable to corporal punishment and humiliation from teachers and bullying from students. Whilst all English teachers supported English-only policies, biology teachers believed it impeded subject learning. Teachers, who supported English-only policies, associated learning with struggle and described it as something that had to be forced. Despite the policy in Zanzibar of introducing English as a LoLT for science from Grade 5 of primary education, vocabulary assessment scores were much lower than for Tanzania Mainland.

6. Discussion

Together the four studies generate insights on the design of curricula, the relationship between epistemic inclusion and social inclusion and the importance of nurturing pedagogic innovation. Curricular frameworks that guide teaching, learning and assessment in MLE systems need to set out continuous and gradual language learning, that is coherent across educational phases, Grades and curriculum subjects. When a new LoLT is introduced, more time is needed to explore and consolidate foundational concepts using both the previous and new LoLT. This means that the number of specific illustrative examples had to be reduced, which also reduces vocabulary range required for subject learning. Monolingual policies and practices exclude students and exacerbate social inequalities, as access to EM primary education depends on parents' ability to pay private school fees and location. However, vocabulary results from Zanzibar suggest that introducing English as LoLT earlier in the public education system is likely to impact subject learning negatively. Although only a minority of teachers in Tanzania innovated language supportive pedagogies, across there are likely to be thousands of innovative teachers. Study 2 demonstrates the potential of university-based teacher educators to drive pedagogic innovation.

7. Recommendations

The following recommendations will bring late transition education systems closer to achieving quality inclusive secondary education for all:

1. Leaders at the system and school level should remove monolingual policies and instead celebrate the linguistic diversity of their countries and their school communities;
2. National curriculum frameworks should set out a gradual continuous language learning journey that is coherent across educational phases, grades and curriculum subjects; and
3. Learning materials, such as textbooks, should be designed for multilingual learners.
4. Multilingual pedagogies should be integrated into every aspect of pre-service teacher education.

Further research can contribute towards transforming MLE systems to be inclusive through collaborating with teachers to expand pedagogical knowledge MLE and stimulating knowledge exchange between different types of educational institutions, including schools, teacher education institutes, curriculum authorities and examination councils.