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Language Supportive Teaching and Textbooks in Tanzania

Glossary

cow - ng'ombe
 dog - mbwa
 cat - paka
 goat - mbuzi
 rabbit - sanguru
 sheep - kondoo

2. Write one sentence in English about each of these mammals, explaining how they are useful to people. Use the sentences below to help you.

dog	is useful	meat
cow	for	guarding
goat		homes
...		milk
...		...



Activity 5.1: Talking about two animals

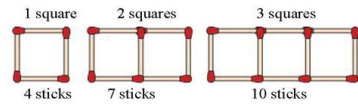


Figure 7.1: Matchstick squares

iv) Carry on adding sticks. Complete table 7.1

Strengthening secondary education in practice: Language Supportive Teaching and Textbooks in Tanzania

(LSTT)

Pilot Study Report

August 2014



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Report Authors

Angeline M. Barrett, University of Bristol, UK
Peter Kajoro, Aga Khan University
Michele Mills, University of Bristol, UK

Lead Researchers

Angeline M. Barrett, University of Bristol
Peter Kajoro, Aga Khan University
Noah Mtana, University of Dodoma
Kalafunja Osaka, University of Dodoma
Casmir Rubagumya, University of Dodoma

Field researchers

Prosper Gabriel, University of Dodoma
Malimi Joram, Aga Khan University
Flora Mbembe, University of Dodoma
Festo Nguru, University of Dodoma
Jesse Julius Ndibakurane, University of Dodoma
Mwema Pambila, University of Dodoma
Rajab Kheir Rajab, Aga Khan University
Eliakimu Sane, University of Dodoma
Francis William, University of Dodoma

Data Analysis

Angeline M. Barrett, University of Bristol
Michele Mills, University of Bristol
Faustina Msigwa, University of Bristol
Rittah Njeru, University of Bristol
Adella Raymond, University of Bristol

Authors of pilot chapters

John Clegg, Independent Consultant
Neil Ingram, University of Bristol
Peter Kajoro, Institute for Educational Development, East Africa Campus, Aga Khan University
Aisha I. Ghuhiya, Tanzania Institute of Education
Ratera S. Mayar, Tanzania Institute of Education
Juliana B. Mosi, Tanzania Institute of Education
Stomin H. Msaka, Tanzania Institute of Education
Makoye J.N. Wangeleja, Tanzania Institute of Education

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Strengthening secondary education in practice: Language Supportive Teaching and Textbooks in Tanzania

(LSTT)

Pilot Study Report

Chapter 1 - Introduction

1.1 Introducing the LSTT project

The Language Supportive Teaching and Textbooks in Tanzania project (LSTT) is directed at supporting students making the transitioning from standard seven of primary school to Form 1 of secondary school in Tanzania. For a large majority of students this involves a transition in the language of instruction from Kiswahili to English. Low levels of language proficiency in English is known to be a major barrier to learning in secondary schools Tanzania (Arthur, 2001; Oyoo, 2004; Rea-Dickins et al. 2009; Brock-Utne et al., 2010; Rubagumya et al., 2011) . Although private primary schools generally offer English-medium education, these are an option only for a minority of students living in urban areas with parents able to pay the fees. LSTT is a collaboration between three universities and the Tanzania Institute of Education (TIE). The university departments are the Graduate School of Education, University of Bristol; the College of Humanities and Social Sciences and the Faculty of Education, University of Dodoma; and the Institute for Educational Development, Aga Khan University East Africa Campus.

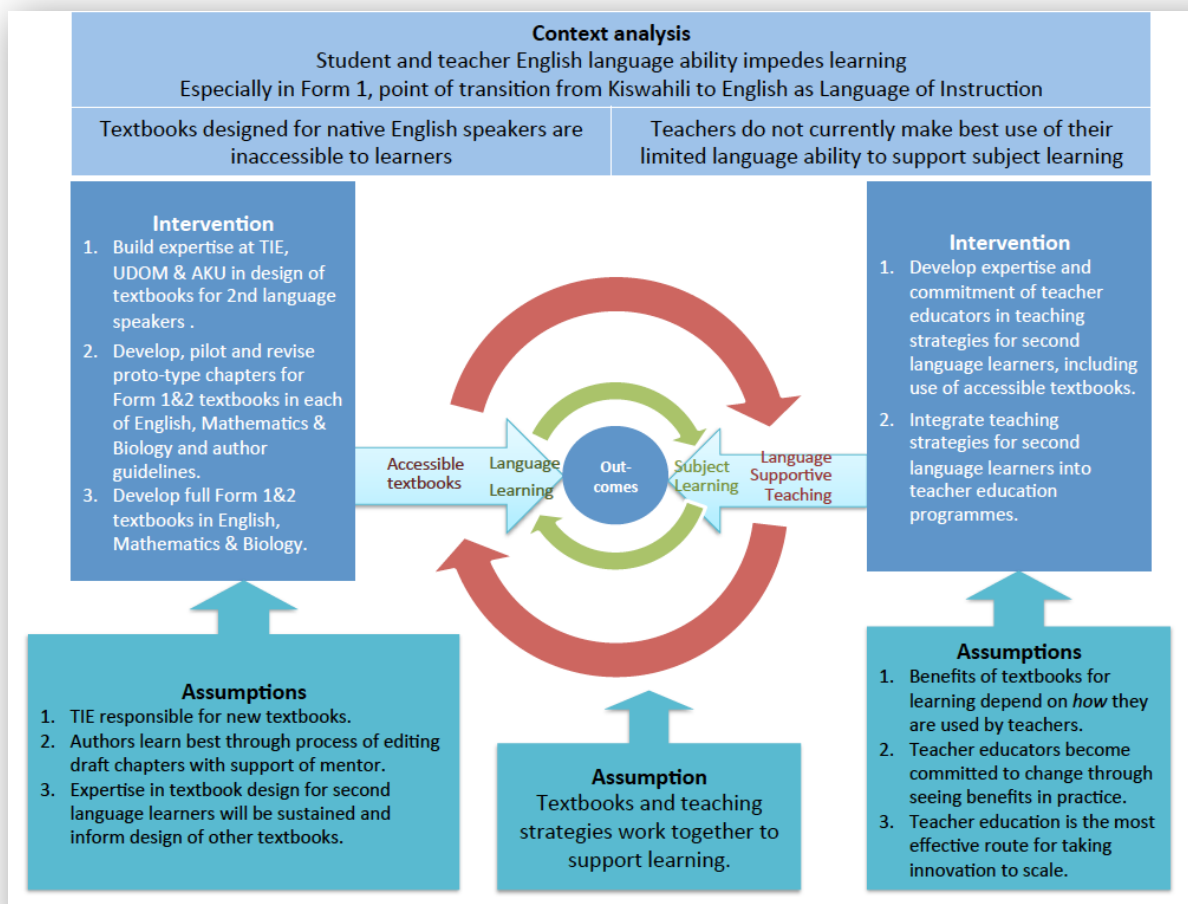
1.1.1 Rationale for LSTT

Previous research led by the University of Dodoma developed bilingual classroom strategies for teachers of Standard 7 and Form 1 (Rubagumya *et al.* 2011). In the course of this research it was noted that textbooks in Tanzanian secondary schools are too difficult for Form 1 students to read. This finding was replicated for primary school textbooks in Ghana and in Rwanda (Afitska et al, 2011; Language Supportive Textbooks and Teaching (LAST), 2013). Our experience in other parts of sub-Saharan Africa, suggests that this is an issue for textbook design and publishing across the sub-continent. The majority of students in upper primary and secondary schools in Africa are expected to learn in a European language that is not their first language, that they do not speak at home and that they hear very little in their local communities. Despite this, most of the textbooks we have seen within schools do not take this into account. They are written using a level and complexity of language that would not be acceptable in wealthier countries such as the United States and England, where English is a first language for the majority of school students. This project therefore aims to support the development of three Form 1 textbooks (one each in the subjects of English, Mathematics and Biology) that the majority of Form 1 students in Tanzania will be able to read. We expect the books to serve as a model or blueprint that will demonstrate how to design books with

second language learners in mind. As such, they should be of interest to curriculum developers and publishers across East Africa and other Anglophone countries in SSA.

Textbooks support teaching and learning but they do not work alone to improve the quality of teaching and learning. Textbooks designed to be accessible to students will have the largest impact when they are in the hands of teachers, who are able to implement teaching and learning strategies that support language acquisition. These include encouraging student talk in the classroom in Kiswahili and English (Clegg & Afitska, 2011). This allows Form 1 students to use Kiswahili in the classroom to digest and process new ideas and to articulate their own ideas in both Kiswahili and English, using spoken and written English. It means giving students opportunities to read and write Kiswahili in lessons as well as to speak and listen. The previous project led by the University of Dodoma found that short workshops and combined follow-up school-based support was effective in changing standard seven and form 1 teachers' pedagogy to make it more supportive of the learning of concepts in English (Rubagumya *et al.* 2011). This project, therefore, will also review INSET programmes to evaluate the extent to which language supportive pedagogy is already integrated into the provision and identify ways in which this content can be introduced or enhanced. The two-pronged approach to strengthening secondary education through textbooks and INSET is captured in our theory of change diagram in figure 1.1

Figure 1.1Ed LSTT Theory of Change



1.1.2 LSTT goal and objectives

The overarching goal of LSTT is to make textbooks and teaching accessible to second language learners through piloting innovations in disadvantaged rural schools and establishing expertise in key government institutions.

The overarching goal will be achieved through the project objectives, which are to:

1. Support TIE to develop sample chapters for three Form 1 textbooks in English, Mathematics and Biology that are accessible to second language learners;
2. Pilot chapters of new textbooks in 12 rural community schools in Lindi, Dodoma and Morogoro regions;
3. Integrate language supportive pedagogy into partner institutions' in-service teacher education programs;
4. Evaluate project impact on teaching and learning in rural community schools and on system capacity; and
5. Communicate findings to stakeholders within Tanzania and internationally.

The project focuses on English, Mathematics and Biology because these are amongst priority subjects within Tanzanian education policy. The textbook chapters designed within this project are intended by TIE to be suitable for all secondary schools. However, LSTT has piloted the textbook chapters in low performing rural community schools. These schools include the lowest performers in examinations and serve students, who are most disadvantaged by the transition to English-medium, as they live in communities where English is spoken little outside of school. Much of the content of the Form 1 syllabus also appears in the Standard 5-7 syllabus, the main difference being the language of instruction. So it is important that both textbooks and teaching support students to access what they have already learned in primary school and to learn how to express their knowledge in English.

The research will be conducted in three regions of Dodoma, Lindi and Morogoro. In 2011, these three regions were ranked 21st, 12th and 13th out of 21¹ regions for their Form 4 exams results. In the same regions 53%, 34% and 29% respectively of households fall below the poverty line (United Republic of Tanzania (URT), 2005). The majority of learners in these rural regions speak a local vernacular language (not Kiswahili), making English a third language for students. Each region includes rural districts where girls' participation in secondary education is much lower than boys and less than 1% of girls completing Form 4 qualify for the next educational level.

1.1.3 Context of the research

The project is being conducted in the context of recent rapid expansion of lower secondary (Forms 1-4) in Tanzania. Prior to 2006 secondary education had been the privilege of a minority (around 15%) of young people. Only two regions, Dar es Salaam and Kilimanjaro enrolled most of their primary school graduates in secondary schools. The government's Secondary Education Development Plan (SEDP) has, in less than ten years, increased the secondary enrolment rate to around 50%. This has been achieved through building a school in every ward (the lowest level of

¹ Four new regions have been created since 2011.

local government administration) in the country. These new community schools, known colloquially as 'ward schools', enrol three quarters of secondary school students (Ministry of Education and Vocational Training (MoEVT), 2012). Whilst they have allowed expansion access to secondary education threefold since 2006, they face serious quality challenges. The quality of education has become a matter of national debate as pass rates in the exit examinations taken at the end of Form 4, the Certificate in Secondary School Examinations, plummeted to 54% in 2011 (MoEVT, 2012). With the exception of the Kilimanjaro and Dar es Salaam girls are enrolled in lower numbers and do less well in examinations than boys throughout the country.

1.1.4 Baseline findings

A baseline study was conducted in 21 schools in the project regions, Morogoro, Lindi and Dodoma in 2013 (Barrett et al., 2014). It consisted of a survey of 420 students' reading ability and knowledge of specialist Biology and Mathematics vocabulary and collected information from teachers and students on textbook availability, use and preference. 15 textbooks were reviewed for language accessibility, support for language learning, representation of diverse groups and socio-cultural relevance. The books reviewed included textbooks designed for Form 1 and selected textbooks written for other country contexts.

The findings from the baseline study can be summarised as follows:

- Most Form 1 students struggled to read simple one-paragraph stories in English. With the exception of four schools, they could not identify the meanings of subject specialist vocabulary for Biology and Mathematics in English. Focus group discussions, in which students were facilitated to solve problems after reading a short explanation, showed how the English language acted as a barrier, preventing them from accessing and applying the Mathematics knowledge and skills they had acquired in Primary school.
- Most Mathematics and English teachers used only one or two textbooks in planning and delivering lessons whilst most Biology teachers used two or three. The majority of Form 1 students do not have a textbook in their hands. Less than half of schools had a class set of books for English or Mathematics and only three out of 21 had a class set for Biology. Only a small handful of students (less than 5%) had their own copy of a textbook. Shortage of textbooks was most acute in Lindi, where we did not find a single student who had access to an English or Biology textbook either in class or at home.
- Textbooks that were targeted at Form 1 and compatible with the 2005 syllabus made no concession whatsoever to fact that the large majority of Form 1 students are still learning English. They were written as if the readers were fluent in English. Biology textbooks used language that would be difficult even for native speakers in their eighth year of schooling. Tanzanian Biology textbooks used longer paragraphs, longer sentences and more obscure subject specialist vocabulary than textbooks designed for students in their seventh or eighth year of schooling (first and second year of secondary school) in England and Wales or North America. Those published within Tanzania had few images and some double spread pages contained only text with no images at all. Science textbooks developed through collaboration between the South Carolina State University and the Ministry of Education and

Vocational Training in Zanzibar had been designed with an objective of socio-cultural relevance and particularly in their selection of images were relevant to the ecology of Tanzania. However, these had not paid attention to the linguistic content of students and used difficult language and had sections of dense text. They also expected students to be able to answer open questions by writing short paragraphs in English. No textbook had bilingual content that would support students to connect Form 1 learning to their learning in primary school.

- Biology Teachers expressed a preference for the colourful textbooks designed for the Tanzanian syllabus published by international publishers Pearson Longman or the Oxford University Press books that were written by SCSU and MOEVT Zanzibar. These books were rich in images, professionally formatted and carefully defined, in English, the meaning of subject specialist words as these were introduced. The language however was inaccessible to Form 1 and the language demands of questions made them impossible for Form 1 students to attempt. English teachers preferred another Oxford University Press book (not written by the SCSU/MOEVT Zanzibar team) and a book published by a local publisher who appeared to be a local branch of the international publisher Longhorn. They found the pedagogy of the Pearson Longman book unfamiliar whilst students found the images and problems alien to their local contexts. This was despite the fact that the book aimed for activity based learning, consistent with the pedagogic aspirations of the curriculum, and made extensive use of texts from books written by African authors, including Ngugi wa Thiong'o and Nelson Mandela. Mathematics teachers preferred textbooks published or claiming to be authored by TIE. These books were clearly formatted in blue as well as black print with worked examples that were easy to follow and plenty of exercises. However, explanations and definitions of specialist Mathematical vocabulary used impenetrable English.
- Students expressed a strong preference for English to Kiswahili glossaries, with every single student focus group recommending their inclusion in textbooks. Students also paid close attention to illustrations. They preferred problems that relied on straightforward extraction of information from the text and wanted the information they would need to recall in examinations to be clearly and simply presented.

The study concluded that Form 1 students were not ready for English medium secondary education. Our findings do not support the continued use of English as the only language of instruction in a rapidly expanding secondary education sub-sector. Teachers and students have no access to teaching and learning materials designed to support the acquisition of English for academic purposes. The English textbooks we reviewed focused on informal English, not English for Academic Purposes. None of the Mathematics and Biology textbooks written for the Tanzanian context had any language support beyond defining key words in English.

It recommended that to be language supportive, textbooks designed for lower secondary students in Tanzania include bilingual material, which as a minimum consists in glossaries that explain the meaning of key subject specialist words and phrases in Kiswahili, using words and terms that will be familiar from primary school. Academic words that are not subject specific (e.g. observe, summarize, appear) also need to be translated for students. English text should be kept to short sentences, short

paragraphs using simple words and broken up by sub-headings and bulleted lists. Explanations need to be supported by well-designed illustrations that convey meaning. Wherever possible and especially for topics like Biology, these should be in colour. Writing activities need to be structured (e.g. filling in the blank, sentence starter type activities). Most Form 1 students struggle to put together a sentence in English and certainly cannot write a short paragraph to explain a phenomenon from Biology. Activities should permit students to talk in Kiswahili *as well as* English, to allow students to process information and build on their knowledge from primary school.

Textbooks need to be socio-culturally relevant. This means using examples and illustrations that are recognisable to children from low-income households and designing activities that can be completed using resources available in these environments. At the secondary level it also means including examples and illustrations that extend students' horizons beyond their local context and the national context of Tanzania. Socio-cultural inclusion means girls and boys are represented as well as Tanzania's different ethnic and religious groups. The achievements of famous women, as well as men, should be represented in textbooks. The work and achievements of African women and men should be represented alongside those of other leaders in their field from across the world.

1.2 The pilot study

The pilot study takes as its overarching objective project objective 2: **to pilot chapters of new textbooks in 12 rural community schools in Lindi, Dodoma and Morogoro regions**. A full description of the chapters that were piloted is given in chapter two. Draft chapters had been prepared for three subjects, one each in the curriculum subjects of English language, Biology and Mathematics. In designing the chapters, our main ambition was to design textbook chapters that would be accessible to Form 1 students and that would support them to improve their skills in reading, writing and speaking English at the same time as learning the subject content, skills and concepts. The focus therefore was on accessibility and acquisition of English for academic purposes. We knew from the baseline study that limited vocabulary posed a barrier to accessing meaning in textbooks for Form 1 students. Hence, the pilot chapters used features such as English-Kiswahili glossaries, diagrams and visual images as well as short sentences and use of non-technical words where possible to enhance accessibility. Following Setati et al. (2002), we understood the acquisition of English for academic purposes achievable through moving students from exploratory talk, conducted in a language in which they are fluent namely Kiswahili, to formal discourse-specific talking and writing in English. This involves the use of academic registers and subject-specific terminology. As Setati et al. point out, even for students who are already fluent in the language of instruction:

Learning mathematics and science has elements that are similar to learning a language since these subjects, with their conceptual and abstracted forms, have very specific registers and sets of discourses. (Setati et al., 2002: 135).

Hence, subject specific and academic vocabulary was carefully introduced and defined in the chapters. The chapters also included activities with explicit instructions for language used that moved from group discussion in Kiswahili to the production of written or spoken formal statements in English. Some activities also embedded structured support for writing for example through providing sentence structures or fill the gap type problems.

The use of activities was compatible with the aspiration towards activity based teaching and learning in the 2005 Tanzanian national syllabus, although we noted that the syllabus is still structured by definition of content. Hence, the activities that we initially designed for the purpose of developing English language abilities incidentally were compatible with curriculum intentions. Another condition that we set for the chapters were compatibility with the content of the Form 1 syllabus and the cognitive abilities of 14 year olds in their eighth year of schooling. Following recommendations that emerged from the analysis of a selection of textbooks during the baseline phase, we also aimed for socio-cultural and ecological relevance. This meant that activities must require only resources that are readily available in the largely resource-poor school settings of Tanzania (e.g. bottle tops, match sticks) and that pictures and contextualised examples should depict contexts and situations that would be familiar and/or of interest to Form 1 students. We also wished the books to promote equality and inclusion through their representation of marginalised and disadvantaged groups and socio-cultural diversity.

1.2.1 Research Questions

In order to evaluate the extent to which the draft chapters fulfilled these aspirations the research was designed to address the following research questions:

1. To what extent do the textbook chapters support language acquisition and subject teaching?
 - a. Are the books accessible to students?
 - b. What do teachers know about language supportive pedagogy?
 - c. How are the draft textbook chapters used in the classroom?
 - i. Are they being used by teachers to support interactive teaching and learning?
 - ii. Are teachers allowing students to process information in Kiswahili?
 - iii. Are students developing formal language skills needed for subject learning?
2. Are the textbook chapters attractive to (a) teachers and (b) students? (Would they use them if they had a choice between textbooks?)
 - a. To what extent are they seen by teachers as compatible with the syllabus?
 - b. To what extent are they perceived by students to support private study?
 - c. To what extent are they supporting interactive teaching and learning?
 - d. Are they perceived by students and teachers as relevant to them and their environment?
3. What improvements should be made to the chapters?
 - a. What changes might improve the way they are used in the classroom?
 - b. What improvements do students and teachers recommend?
4. What recommendations can we make to publishers of secondary school textbooks in Tanzania and other countries where there is a transition in the language of instruction?

1.2.2 Theoretical perspectives

Our understanding of learning is rooted within sociocultural approaches, which view learning “as a fundamentally social process” (Murphy & Wolfenden, 2013: 265). School subjects or disciplines are understood as sets of social practices. Learning then is not about memorizing and then reproducing set texts. Rather it is the social process of becoming members of a community of practice through producing and using knowledge. The set of shared practices within a discipline include language practices. Participation in a community practice then is not just about engaging in collaborative activities but engaging in processes of meaning making, including through individual interaction with learning materials. Moving from being a novice to an expert is not about learning *from* talk but rather learning *to* talk (Daniels, 2001: 72). Textbooks and other learning materials are regarded as “artefacts” that “allow [learners] to engage in certain activities in certain ways” (Murphy & Wolfenden, 2013: 265). Learners engage in a “situated negotiation and renegotiation of meaning in the world” through dialogic interaction with teachers and interaction with artefacts (*Ibid*).

Within the work of the leading sociocultural theorist Wertsch, language is regarded as cultural tool that mediates learning. Ability in learning therefore is related to mastery of language as a tool for learning. Across different multilingual classroom contexts, research has shown that dialogic participative processes of learning depend on learners being allowed to use a language in which they are fluent (Barwell et al., 2007). For example, research on multilingualism in Mathematics classrooms in South Africa shows that:

English tends to be used for procedural discussion (e.g. the steps in a calculation) whilst learners other languages tend to be used for conceptual discussion (e.g. why a particular calculation is required) (see also Setati and Adler, 2000). In classrooms where learners’ main languages are suppressed, conceptual discussion is likely to be lost, so that students only develop a more limited procedural mathematical understanding. (*Ibid.*: 48).

So, if learners are restricted from using a language in which they are fluent, their learning is constrained to memorizing methods and texts whilst ability to conceptual learning is constrained. In language classrooms also, students’ first language can be a valuable resource for learning a foreign of second language, particularly if they have low levels of proficiency in the language they are learning (Clegg & Afitska, 2011). In particular it can be important for extending vocabulary in the second language and mastering academic registers.

Clegg and Afitska (2011) point out that whilst specialised pedagogies have been developed within well-resourced education systems for teaching language through the medium of a second or foreign language, these rely on extended specialised teacher training and the resources that are not available across much of sub Saharan Africa. The textbook chapters that we are piloting are intended for poorly resourced secondary schools and students with low levels of proficiency and a very restricted vocabulary in English. In this context, learning that is participative in the sense intended by sociocultural theory depends on strategic use of Kiswahili to develop conceptual understanding whilst developing knowledge of English for academic purposes.

1.2.3 Research design

The research questions were met through a research design founded on an interpretivist understanding of research knowledge as socially constructed and culturally situated, which is compatible with the sociocultural theory of learning. It is expected that the final version of the books will be printed in large numbers and distributed to schools throughout Tanzania. It is important therefore that they contribute to strengthening pedagogic practice and improve learning within the conditions that prevail in the majority of secondary schools, particularly those in rural areas. The vast majority of schools in Tanzania and those with the lowest fees are community schools, many of which have been established in the last ten years. This research was therefore focused on 13 schools community schools in rural locations. The research questions are concerned with how teachers and students interact with the materials, how they are used in the classroom and their perceptions of the materials. Data collection centred on observation of a lesson using the materials. Each class was observed twice with a gap of three weeks between observations. This was so we could observe whether there was any change over time as teachers and students became accustomed to the materials. It also created an opportunity for teachers to discuss their practice over time with the field researchers, who themselves had all worked as secondary school teachers. Each observation was followed by an interview with the teacher and a group interview with around 12 students. In the interviews, we asked about their views on the draft chapters and researchers explored with participants their views on the lesson and the reasoning that had informed their actions in the lesson.

Data analysis was designed to bring out the advantages of this design. So analysts first read through and coded the first lesson observation with a teacher, then analysed the data from the teacher and student interviews. Most codes related to language use, activity type or features of the draft materials. A full account of the research design, including analysis, is presented in chapter 3.

1.3 Overview of the report

The next chapter describes the draft chapters that were used in the pilot, explaining how the aspirations to be language accessible, language supportive, relevant and inclusive were addressed in the design of the chapters in English, Maths and Biology. The process of drafting the chapters is also discussed. Chapter three then explains in detail the research design, including processes of data collection and analysis. Chapter three finishes with a section reflecting on the lessons learned from the writing and research processes. Chapters four presents findings from the classroom research and the associated interviews. Chapter five concludes by drawing out implications for textbook design and teacher education that can inform textbook design, education policy, the next phase of the LSTT project and further research.

Chapter 2 - Pilot Chapters

The design of the pilot chapters was informed by the LSTT baseline study (Barrett et al, 2014), which is overviewed in section 1.2 and in research brief (Barrett, 2014).

2.1 Objectives of pilot chapters

The main objectives guiding the writing process were that the textbooks should be language accessible and language supportive. A second objective was that the textbooks be compatible with the Tanzanian 2005 secondary syllabus and appropriate to the cognitive ability of Form 1 students, who are around 15 years old and in their eighth year of schooling. Two further objectives were that the textbooks should be socio-culturally and ecologically relevant to the students' contexts. Finally, representation of men, women, girls and boys should adhere to principles of gender equality and respect and recognition for diverse socio-cultural identities.

2.1.1 Language accessible

In writing the draft chapters we had an ambition that they should be language accessible to Form 1 students or, put simply, that Form 1 students should be able to read the books. This was challenging because of the very low reading abilities measured in the baseline study and the demands of a syllabus, which despite its activity-based aspirations is still largely content driven. The baseline study identified the following features of a language accessible textbook:

1. written in simple English avoiding obscure words and unnecessary subject specialist vocabulary;
2. short single clause sentences and no sentences with more than one sub clause;
3. text is broken down into short chunks through use of short paragraphs, short sections with clear sub-headings and bulleted or numbered lists;
4. glossaries that translate subject specialist words and difficult words into Kiswahili; and
5. explanatory text is supported by illustrations that convey the meaning of text, break up long chunks of text and engage students' interest in the books.

2.1.2 Language supportive

Language supportive materials are designed to support students to acquire English, particularly the formal registers and vocabulary that are used in the academic context of secondary school. This means that the chapters include activities that help students to talk, write and read English. As language-supportive teaching is interactive, this second objective was aligned with the aspiration towards activity-based pedagogy in the Tanzanian 2005 syllabus. Activities that support learning in English include the following:

Talking activities: Students learn concepts best in a language in which they are fluent. First students discuss in Kiswahili. Second, they write their conclusion as a simple sentence in English. Third, they read the sentence out loud. In this way they process the subject content three times and practice writing and talking about the concept in English.

Structured writing activities: Students in Form 1 struggle to write complete sentences in English. They need support to structure sentences. They have very little vocabulary in English, particularly subject specialist vocabulary. Textbooks can provide students with a short list of key words to use in a writing activity.

Reading activities: Students need to practice reading, including reading out loud so that teachers can correct their pronunciation. Limited vocabulary is a major barrier to understanding text so reading exercises need to be accompanied by a glossary and/or illustration to help them access meaning.

2.1.3 Appropriate to syllabus and cognitive ability of Form 1 students

A textbook for Tanzania needed to be compatible with the current Tanzanian syllabus. Given that the textbook will be published by TIE, the organisation that writes the all syllabi for state school education in Tanzania, the textbook should be seen as an elaboration of the syllabus. The baseline study had also shown that compatibility with the syllabus was a key criterion for teachers in selecting the textbooks that they used for planning and delivering lessons. Students also wanted textbooks to present the information that they would be asked to reproduce in Form 2 national examinations. Syllabus documents therefore guided content selection and organisation.

2.1.4 Socio-culturally and ecologically relevant to the Tanzanian context

Textbooks need to be socio-culturally relevant. This means using examples and illustrations that are recognisable to children from low income households and designing activities that can be completed using resources that are readily available in schools, including schools with only very basic resources in remote or rural locations. The secondary curriculum, however, aims to prepare students to participate as responsible members of Tanzanian society and prepare them for the world of work, in urban as well as rural locations. Socio-cultural relevance at the secondary level, therefore, is not just about local relevance but includes extending students' horizons to appreciate the natural environment and participate in the political, civic, cultural and artistic life of Tanzania, as an African country in the context of a globalizing world.

2.1.5 Representation of equality and diversity

Attention was also given to how girls and boys, women and men are represented in the textbooks. The achievements of famous women should be represented alongside those of men, both contemporary and in history. The work and achievements of African women and men should be represented alongside those of other leaders in their field from across the world. These concerns also extended to the representation of Tanzania's different ethnic and religious groups and relate to the national curriculum's objective to develop appreciation of national unity.

2.2 Subject specific challenges

The baseline study highlighted some of the implications and challenges of designing language accessible and language supportive textbooks for each of the three subjects.

2.2.1 Biology

Designing the Biology textbook was anticipated to present the greatest challenge. Biology textbooks were typically the hardest to read, making language demands well beyond the ability of Form 1 students. The syllabus is the most content driven and, when compared to that for the eighth year of schooling in England and Wales, overambitious. The following key points to bear in mind were identified:

- Avoid subject specialist terms. There seems to be a tradition within Biology teaching of focusing on careful definition of key words but these specialist terms make it harder for students to understand the concepts and processes they are supposed to describe.
- Illustrations will demand investment. Sourcing good quality images and photographs is likely to present copyright issues. It will be difficult if not impossible to match the quality of images found in the textbooks produced by international publishers for the Tanzanian market.
- Suggested activities and examples need to take into account the context of schools in Tanzania by referring to local fauna, wildlife and ecologies; and using only materials that are readily available in the local environment, so as to minimize the disadvantage of students in poorly resourced schools.

2.2.2 English

For English textbooks, the following points were noted:

- Include talking activities that develop students' ability and confidence in constructing English sentences. Ensure activities are relevant to rural and not just urban contexts;
- Focus on developing formal academic language that is used across the curriculum as well as social English;
- Give careful attention to how students progress from short structured questions to constructing their own sentences and stories; and
- Provide vocabulary lists to support exercises and activities.

2.2.3 Mathematics

It was noted that Mathematics teachers want textbooks with a good bank of exercises, which may be time-consuming to generate. To be original, however, the pilot chapters should focus on:

- Simplifying and contextualizing explanations;
- re-contextualising word problems and examples;
- Creating bilingual content in the form of glossaries, vocabulary list, short explanations and definitions;
- Supporting the interpretation of word problems but language development should not detract from learning Mathematics; and
- Enhancing access for students from under-resourced schools, for example, by providing templates of a ruler, protractor and circles on the cover as not all students will have their own geometry sets.

2.3 Chapter writing processes

The process of writing the pilot chapters started at a workshop in July 2013, for which there is a separate report (TIE, 2013). During this four-day workshop, findings from the baseline survey were presented and their implications for textbook design discussed. Researchers and authors also shared their findings from reviewing textbooks and identified design and writing features that could be adapted to the new books. The workshop included training on how to measure readability; writing textbook pages; designing visuals; designing design language supportive learning activities, all of which is captured in a 'Course for Textbook Writers' (Clegg, 2013). This workshop also drew up guidelines for style sheets and included a session on how to write an art brief. These and other guidelines are recorded in a project document (LSTT, 2014). Two illustrators were included in the workshop, who produced the artwork for the draft chapters. The workshop included writing sessions, when subject teams made up of TIE authors and researchers together produced the first draft of pages from the first chapter and then discussed these with colleagues in other subject teams.

Each subject had two lead authors from TIE staff, who generated the first draft of the pilot chapters during a one week writing retreat. These were then edited by members of the research team, who simplified language and, for Biology and English, reorganised the material and modified activities. Some of the TIE authors had written primary school textbooks in Kiswahili but all were writing secondary school textbooks for the first time and the writing process was slower than it would be for experienced authors. TIE took responsibility for formatting and printing the materials for the pilot. The draft chapters needed to be ready to start piloting in September before the Form 4 examinations in November and the end of the academic year. Schools in our baseline sample had told us that the 2014 Form 1 cohort for the following year would not be fully enrolled until sometime between February and May. This left little time to edit, revise, proofread, format and print chapters.

The time constraints had some negative consequences for the quality of the piloted materials. There was less attention to proofreading than was needed and the chapters had some errors, which were corrected on teachers' copies at the preparatory workshop. In the Mathematics chapters there were also inconsistencies in the numbering of chapters and sections. In Biology and English there was not time to produce an English to Kiswahili glossary, a feature that we knew was essential for language accessibility, particularly for Biology. Field researchers worked with teachers during their preparation workshops to hastily draw up a glossary for Biology but this did not reach all the teachers who piloted the chapters. Original artwork was in colour and coloured fonts and shading were used in the Mathematics chapters. Nonetheless the chapters were distinct from those already available in schools in crucial ways as detailed in the next section.

2.4 The pilot chapters

This section describes the main features of the pilot chapters and comments on the extent to which they fulfilled the objectives detailed in section 2.1.

2.4.1 Introducing chapters: drawing in readers

For all three subjects, chapters started with a short list of learning outcomes for the chapter, expressed as “what you will learn”. Biology and Mathematics chapters started with a picture, activity or contextualised problem that acted as ‘a hook’, intended to engage students, highlight the relevance of the topic at the same time as introducing a key concept in a memorable way. So, one Biology chapter started with the analogy of cement blocks in house construction, accompanied by an image of building site, to introduce the concept of a cells as the building blocks of living things. The second chapter started with the activity of organising bottle tops into groups, accompanied by an illustration of bottle tops to introduce the concept of classification. The first Mathematics chapter introduced the concept of algebraic expressions through an activity using matchsticks through which students were guided to ‘discover’ and write an algebraic expression. The remaining two chapters started with contextualised problems. English chapters also had a distinctive structure to early sections, discussed separately below.

Biology

Two pilot chapters were produced for Biology, chapter one on ‘cell structure and organization’ and chapter two on ‘classifying living things’. The writing style was informal, setting a friendly unthreatening tone, for example:

Have you ever been to the house construction site? Probably you understand that, in most parts of Tanzania, houses are made up of concrete blocks? (Biology pilot chapter 1)

Sentences were kept short and the meanings of new words carefully explained. The page shown in figure 2.1 demonstrates how diagrams and activities supported access to meaning.

Ways of Classifying Organisms

There are several ways of classifying living things based on various criteria. In this sub-unit you will learn about two systems of classifying living organisms. These are artificial and natural classification systems.



Figure 5.4: Animals with some similar Features

Activity 5.4

1. Study the organisms in illustration 5.4
2. Mention the feature(s) that make these organisms to be put in the same group
3. Talk to one another and agree if these organisms belong to the same group and why?

As you can see the organisms in the diagram are grouped by using only one feature, that is, the presence of wings. But grasshopper and bird are very different. They do not belong to the same group, although they both have wings. The classification system which uses a limited number of characters of living organism is known as **artificial classification**. It is used for simple identification of living organisms. For example, in classification of plants, they can be grouped into herbs, shrubs and trees while animals can be grouped into aquatic and terrestrial animals.

The tension between the need to communicate the heavy content specified in the syllabus and assessed in the Form 2 national examination and the ambition to be accessible became increasingly apparent as each chapter progressed. Tables were used to organise large amounts of information. Hence, the first two units in chapter one include within a space of six pages four activities and four images, which introduce a cell as the building block of life, the parts of the cell and two main types of cell. The third unit, however, is heavy on content. Over a space of three pages it introduces 13 subject specialist terms. Most of these have already been labelled on one of two diagrams that appear in unit two. Two tables are used to organise and 'warehouse' the information, the first of

which spreads over two pages (see figure 2.2). Whilst this table uses bullets, it is still dense with text and includes sentences that contain more than one academic or subject specialist words. For example:

- The mitochondrion is an oval shaped structure containing cells responsible for cell respiration.
- It helps eliminate foreign substances.

Figure 2.2 Page showing table ‘warehousing’ information

Table 2: The Components of the Cell

Sn	Component	Functions
1.	Cell Wall	<ul style="list-style-type: none"> ➤ This is the outermost covering of a plant cell made up of cellulose. ➤ It controls passage of water and minerals into the cell. ➤ It helps to protect and support the cell. ➤ It is rigid giving the plant cell its regular shape.
2.	Cell Membrane or plasma membrane	<ul style="list-style-type: none"> ➤ It is a thin layer which is the outermost covering of animal cell. In plant cell it is found under the cell wall. ➤ It encloses and protects the inner parts of the cell. ➤ It is semi-permeable allowing certain substances to go in or outside the cell.
3.	Cytoplasm	<ul style="list-style-type: none"> ➤ It is the fluid part of the cell. ➤ It consists of the mixture of water and soluble substances in the cell. ➤ It is a place where all the <i>metabolic activities</i> of cell take place.
4.	Mitochondria	<ul style="list-style-type: none"> ➤ The mitochondrion is an oval shaped structure containing cells responsible for cell respiration. ➤ It is the place where energy in the cell is produced by respiration process.
5.	Chloroplast	<ul style="list-style-type: none"> ➤ It is the oval structure found in plant cell with green colored pigments. ➤ It is a place where food is made in plants in the presence of sunlight by photosynthesis process.
6.	Lysosome	<ul style="list-style-type: none"> ➤ It is part of the cell that contains different enzymes for food digestion in the cell. ➤ It helps to eliminate foreign substances. ➤ It helps in destroying old and damaged cells.
7.	Vacuole	<ul style="list-style-type: none"> ➤ It a structure filled with fluids in both animal and plant cells. ➤ In a plant cell, it helps to make the cell turgid and firm. ➤ It secrete and excrete wastes from the cell

The unit ends with an activity that structures students' engagement with the tables, guiding them to look up specific information in the tables. So students are encouraged to use the tables as a reference, in which they can look up information, rather than as information to be memorised. The chapter then moves on to the topic of 'cell differentiation' and the style of the first two units.

In the second chapter, the progress in the complexity of the material presented is even more marked. The first three units focus on developing a conceptual understanding of the classification of living things. Over 13 pages there are eight activities and eight illustrations, half of which take up more than half a page. Seven of the activities involve classifying or grouping objects or animals depicted in the pictures. Only two pages do not have an illustration or an activity. However, from page 11 lists of information that use or communicate the meaning of subject specialist words start to appear. In the next four units that spread across 12 pages, there are four that hold information without images and activities to break it up. Extensive use however is made of bulleted lists and tables to organise and condense information. The activities in this second section of the chapter are directed at supporting students to look up, recall and process information. In total the chapter has 17 activities. Nine involve writing, of which five give provide structured support e.g. substitution table, fill the blank, words you may find useful (see figure 2.3). 11 involve discussion in small groups and seven require students to classify or group objects (see figure 2.1 for an example of an activity that does both of these).

Figure 2.3 Example of a structured writing activity

Activity 5.11:
 Use the substitution table to make complete and true sentences about the advantages and disadvantages of viruses.

Viruses	cause disease in	human being	for example small pox, measles, polio
		domestic animals	for example foot and mouth disease
		crops	for example tobacco mosaic, potato mosaic
Viruses	are used	for studying of cellular and molecular biology	
		for making vaccines	
		for controlling bacterial infections.	
		in genetic engineering to insert genes from other organisms into bacteria.	

The chapter contained no bilingual content although in the field, researchers and teachers in Dodoma did construct a glossary this was not distributed to all schools. Whilst subject specialist terms (e.g. nucleus, phylum) were carefully defined, often with support from illustrations and sometimes with support from activities, our baseline study suggested that non-subject specific academic would also be unfamiliar to Form 1 students (e.g. eliminate, tubular).

English

The two pilot chapters for English were directed at developing language skills and in particular the use of different tenses and therefore consisted in a mix of reading, writing and talking activities directed at developing an understanding of a grammatical rule and practice in its use. In addition there were some overarching learning objectives, not stated in the chapter learning objectives. These included expanding vocabulary and developing confidence in presenting in English. Chapter one consisted in total in 21 activities and chapter two in 18 activities. Passages of text and illustrations were used to stimulate practice of English language skills (for an example see, figure 2.4). They therefore needed to be topical to engage the interest of fifteen year olds.

Two English chapters were piloted, the first, titled 'Mwalimu Nyerere', aimed to develop students' ability to read, write and talk about past events and the second, titled 'The Headmaster's Speech', aimed to develop their ability to read, write and talk about future plans and activities. Near the beginning of each was an extended passage, the 'reading' that gave the chapter its title. In the first chapter, this spread over two pages and included two black and white photographs of Nyerere. For the second chapter, the reading was less than a page in length and followed an accompanying drawing in colour. The subject matter for the two passages was selected to be familiar to students and easy to relate to. However, the 'Headmaster's speech' was not socio-culturally relevant in terms of expanding horizons and holding the attention of Form 1 students. Other topics for activities and readings included a good brother, a car accident, a football match, a weather chart, a diary and a shopping trip. It was anticipated that Tanzanian teenagers would be able to relate to all of these despite a bias toward urban environments. However, none of the topics took them beyond the borders of Tanzania.

Figure 2.4 The use of illustrations to stimulate writing

10. Look in the newspaper and write a forecast for tomorrow, using the model in activity 10.
11. Study the pictures showing activities that will take place for five days from Monday to Friday. Write two sentences for each picture. Monday has been done for you as an example.

Monday



On Monday they will play volleyball.

On Monday they are going to play volleyball

Tuesday



On Tuesday.....

On Tuesday.....

Both chapters started with a pre-reading talking exercise, in which students were guided to talk about the topic of the passage, i.e. what they know about Julius Nyerere and speeches they had heard. In both these pre-reading activities and one other talking activity, the text guided students to talk in Kiswahili first and then express themselves in English. A shortlist of comprehension questions was presented before the reading, so that students could extract relevant information as they read.

A set of three questions followed the headmaster's speech with instructions to talk about the answers in a pair before writing them down. The next exercise asked students to identify within the passage examples of using the future tense. In the first chapter, the text was used as a starting point for a series of two writing, two talking, a vocabulary and a pronunciation exercise before moving onto other themes on page six. Students were given an opportunity to deduce grammatical rules before they were presented. For example, an activity that begins "Read this text. Then look at the verbs in the past tense and say what they have in common", ends with "You have probably noted that: they all talk about past events using the past simple; they all end in the **-ed** form."

Beyond three talking exercises mentioned above, there was no Kiswahili content in the pilot chapters.

Mathematics

Three Mathematics chapters were piloted, which covered the Algebra content of the Form 1 syllabus. The Mathematics pilot chapters had the most bilingual content although this tailed off in the second and third chapters. This content mainly took the form of a short glossary of key words that appeared just after the learning outcomes at the top of the first chapter only and short Kiswahili sentences explaining the meaning of key words, which are also defined in English. Both Kiswahili and English definitions are presented in the margins inside blue boxes (see figure 2.5) to make them easy to find quickly. In one place, near the beginning of chapter one, a rule that is explained in main body of English text is presented in Kiswahili in the margin and in another, also near the beginning of chapter one, an activity of filling a table with words has columns for writing the words in English and Kiswahili. Another bilingual table gave in words the meaning of mathematical symbols in English and Kiswahili. Each chapter ended with a revision exercise, some extension work intended as a challenge for 'faster' students, a summary of key definitions and procedures in the chapter and, finally, a checklist of the mathematical procedures covered in the chapter.

There were far fewer coloured drawings than in the Biology and English textbooks, only two pictures both diagrammatic, were included in the book. One was a picture of a matchstick pattern, intended to show how an activity should be attempted. The other was a beam balance used to support an explanation of 'balanced equations'. Two diagrams also appeared - number lines as a graphical representation of inequalities and an enlarged algebraic expression with labelled terms.

New concepts and procedures were introduced using activities or, more commonly particularly in the second two chapters worked examples. Most of the activities had instructions to work in pairs or small groups and talk about the problem without giving explicit instructions on which language to use in student discussions. Generally there was less support for language learning than in the Biology textbook. Figure 2.5 shows the only structured writing exercise across the three chapters. The text was also less dense with much shorter explanations, as is usual in Mathematics textbooks, and consistent with our view that language learning should not distract from Mathematics learning. However, the topic algebra was chosen because it includes turning word problems into algebraic expressions. A table presented the mathematical symbols that can be used to replace certain English words (e.g. addition, sum of, increased by, plus, taller than would all be replaced by '+'). A blue shaded box was also inserted containing glossary of mathematical words that commonly appear in word problems (e.g. equation, solve, unknown).

Figure 2.5 Snap shot of page showing Kiswahili definitions in the margin

Activity

Working in pairs, fill in blanks in the sentences below. When you have finished, find another pair of students, and compare your answers.

Given $6y - 3x + 7z + 9$

- 1) There are _____ terms.
- 2) _____ is the coefficient of $6y$.
- 3) -3 is the _____ of _____.
- 4) 7 is the _____ of _____.
- 5) _____ is the second term.
- 6) $7z$ is the _____ term.
- 7) $6y$ is the _____ term.
- 8) $6y - 3x + 7z + 9$ is _____ times y _____ three times x _____ seven _____ z plus _____.

Term maana yake ni kila kijisehemu cha mtajo.

Constant inavyotumika kwenye mitajo na milinganyo maana yake ni namba isiyobadilika .

Coefficient maana yake ni namba inayozidishwa na herufi kwenye mtajo.

1.2.3 Multiplication and Division of Algebraic Expressions

The letters are multiplied in the same way as numbers. For example,

- 1) $4 \times 2 = 8$
 $2 \times 4 = 8$
- 2) $a \times b = ab$
 $b \times a = ba$

Therefore, $a \times b = ab = ba$

9

So whilst the Mathematics textbook had the most bilingual content this was nearly entirely directly at developing students' vocabulary, either through offering direct translations into Kiswahili or 'translations' into mathematical expressions. This was in response to the baseline study findings showing that the mathematical vocabulary of Form 1 students was very limited and that Kiswahili translations can enable them to make connections with the mathematical knowledge acquired in primary school.

Figure 2.6 Worked example of turning a simple word problem into a mathematical expression

Worked example 1

Three times a certain number gives 72. Find the number.

Solution

Let the number be x

$3 \times x = 72$

Three Times Certain number Gives

Therefore, $3x = 72$

2.5 Summary

The piloted chapters were distinct from other textbooks that are available to teachers and students in three main respects:

1. English language was simple and easier to read. The contrast in language difficulty between the pilot materials and available textbooks was greatest for Biology.
2. Long paragraphs of text were avoided. Where large amounts of information had to be communicated, this was organised using tables and accompanied by activities to support students to extract information.
3. Contextualisation of examples and problems enhanced accessibility for Tanzanian students.
4. The materials were activity-based. They did not only provide information to be learned but also a series of learning activities. The English chapters consisted entirely in a series of activities. This again created the greatest contrast with existing Biology textbooks.
5. The activities were designed to support learning the English language needed to communicate and debate concepts in Biology and Mathematics through the use of both Kiswahili and English. Writing activities structured support for writing sentences. Talking activities guided students to process information in both Kiswahili and English.
6. The Mathematics textbook only had limited bilingual content that explained the meaning of key words in Kiswahili and translated key definitions and mathematical rules into Kiswahili.

Our baseline study did find examples of locally published textbooks that were contextualised to the Tanzanian context and textbooks for English that were activity based and took a similar pedagogic approach to the pilot materials. It did not find any examples of books that did both.

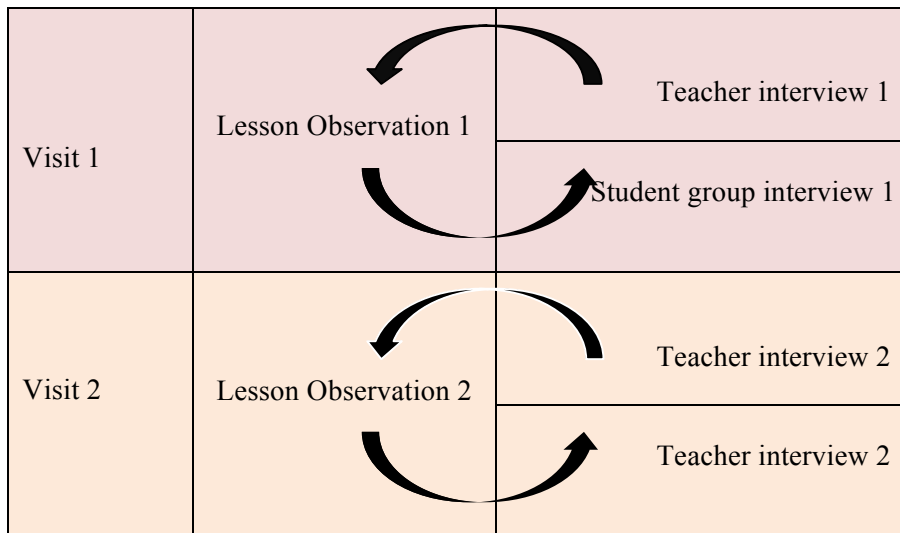
Chapter 3 - Research Design

3.1 Research Design

3.1.1 Methodology

The research questions (presented in section 1.3) were concerned with how teachers and students used the draft chapters, most especially in the classroom, and their views on the materials. As the draft textbook chapters were being piloted in real classroom contexts, researchers wanted to gather information regarding how the textbook chapters were used in the classroom and how the textbook chapters were used and viewed by both teachers and students. Researchers also wanted to hear from teachers and students if there were any improvements that could be made to the draft textbook chapters, which would then be fed into the final versions of the chapters. These research ambitions, suggested a research focus on collecting qualitative data on classroom processes, obtained through lesson observation, and the subjective views of individuals, obtained through interviews. The focus on qualitative data was in line with the interpretivist research approach and the exploratory nature of a pilot study. Johnson and Christensen (2012: 34) state that qualitative research allows both a ‘wide-angle and “deep-angle” lens. This research achieved breadth through collecting data in 13 schools across three regions and depth through detailed observations and qualitative interviews with those schools.

Figure 3.1 data collection for one subject in one school



The nature of the research questions required the use of observation and interviews as the main data collection strategies. Teachers were first introduced to the materials and the principles of language supportive pedagogy at a one-day workshop. This was also an opportunity to gather first impressions of the materials from practicing teachers through facilitating a critical discussion of the materials. The first visit was within a week of the workshop, giving us an opportunity to observe how classes managed when still new to the materials. The lesson observation was followed immediately by an interview with the teacher and another interview with a group of 12 students from the class.

This allowed us to discuss the classroom processes and the specific sections of the materials that these involved with reference to the researchers' observations and whilst the lesson was still fresh in the memory. The second visit followed after a period of around three weeks and the same cycle of data collection was followed. The data from an observation, teacher interview, and student group interview were taken to represent a stratum of the data set and analysed as a unit, as represented by the arrows on figure 3.1.

3.1.2 Sampling

It was vital to pilot the draft chapters in the same kind of conditions that we anticipated the completed materials would be used. The research was framed as 'real world' research. Hence, schools were not sampled on the basis of the professional skills or reputation of teachers but on the basis of rurality and status as a community school. Researchers' presence in the classroom was limited to two observations so as to limit the effect of professional connectivity, supervision and collegiality on classroom implementation of the chapters. Real world conditions in Tanzania included conditions of overcrowding and large class sizes, understaffing particularly in science subjects, high levels of teacher absenteeism and teachers, particularly in Biology, with limited subject specialist education or teacher education.

The pilot of the draft textbook chapters was conducted October to November 2013 in 13 schools, four in Turiani district, Morogoro Region, four in Dodoma Urban district in Dodoma region and five in Lindi Municipality in Lindi Region. All the schools were community schools and all but one was officially classified as a rural school. None were in the top performing 10% within their regions. The highest performing school was ranked between 500 and 1000 in the national Form 4 examinations in 2013 out of 3256 secondary schools in the country. The other schools were all ranked between 1400 and 2500. The schools mainly served children of people working in the informal sector, engaged either in small-scale business or small-scale farming. The schools had between roughly 80 and 200 students in Form 1. As far as was possible sample schools were selected in geographical clusters of two or four so that the initial one day workshop for teachers could be conducted at a site within easy reach for all participating teachers within one district.

Table 4.1 Number of observations

	1 st Visit observations	2 nd Visit observations	Total observations	No. of teachers observed
English	11	9	20	11
Biology	8	5	13	10
Mathematics	12	12	24	13
Total observations	31	26	59	34

In total, 59 lessons were observed delivered by 34 teachers across 13 schools in three regions. All the schools were community schools in rural districts and class sizes were typically between forty and eighty, with a gender imbalance in favour of boys in Lindi and Morogoro but roughly equal numbers of boys and girls in the Dodoma classes. Each observation was followed up by an interview with the teacher and a group of 12 students. 23 teachers were observed twice with a gap of two to four weeks between observations, giving them time to become accustomed to the learning supportive pedagogy (LSP) style of the pilot materials. Teachers observed on the first visit had all participated in a one-day workshop to introduce the principles of LSP and discuss the materials with the teachers.

Two of the English teachers, two of the Biology teachers and one Mathematics teacher were not available at the time of the second visit. Teacher absenteeism, much of it authorised (e.g. due to sickness, study leave or administrative duties), is high in Tanzanian schools. In all but one instance another teacher in the school took their place, and the replacement Mathematics teacher was given a brief on LSP by a field researcher in lieu of the workshop. The low number of participating teachers for the Biology pilot chapters was a consequence of a shortage of science teachers. Four of the 12 sample schools did not have a Biology teacher. Additionally, data was not collected during a second visit to Lindi due to the unavailability of a field researcher. One Lindi School did not have a Form 1 Mathematics teacher, however field researchers recruited a teacher from another school, in which only the Mathematics chapters were piloted.

One English replacement teacher did not have a class set of the pilot chapters but only his own copy and the students claimed they were using the chapters for the first time. This lesson contrasted with all others observed in following the pattern of an archetypal teacher led 'talk and chalk' lesson, with the teacher writing questions on the board and prompting students to respond verbally either individually or as a group. The teacher mainly spoke in English, translating into Kiswahili to emphasize a point. All student talk was in English and in response to closed questions from the teacher. Whilst, within our data this lesson was an aberration, it does highlight how absence of learning materials for students and the denying them the opportunity to use a language in which they are fluent impoverishes the teaching and learning process.

For Biology, students had access to individual copies of the pilot chapters, with the exception of one school in Lindi where only the teacher had the pilot chapters. The pilot Biology chapters did not contain glossaries but field researchers supplied two schools in Dodoma with a supplementary glossary, created in collaboration with teachers. Students shared English and Mathematics textbooks in groups of between two and five. The English materials did not have glossaries. Sentences, in Kiswahili, supplied translations of the key words in the Mathematics textbooks (see chapter 2). Teachers regarded the availability of textbooks to students as supportive of students' learning. One teacher noted that individual access to textbooks reduces unnecessary movement and disruptions due to competition for books. Students also requested that they be given a book each.

3.2 Data collection methods

3.2.1 Field researchers' workshop

Field researchers were prepared through a one-day workshop, during which they were introduced to the principles of LSP and had an opportunity to study the pilot chapters and the data collection tools. The scale of data collection, geographic spread of the sample schools and the need to collect data within a small window of opportunity meant that a separate team, made out of different researchers was sent to each region. In these circumstances, comparability across research sites depends on consistency in the use of the data collection tools.

The field researchers all had at least one postgraduate research degree, and hence experience of dissertation research. All had recent experience of classroom teaching at the secondary level, either as a teacher or classroom researcher. Their professional experience meant that they quickly grasped the pedagogic ambition of the draft chapters and indeed, were able to give critical feedback on these. It also meant that they were able to relate to participating teachers as peers and generate a collegial rapport within the teacher interviews. Field researchers also had skills for facilitating students groups that assisted in the student interviews. One disadvantage was that they shared with teachers some taken for granted assumptions about classroom teaching and learning. Although the interview guides (see section 3.2.4 below) included prompts for following up on teachers and students responses, scrutiny of the data showed that in many instances, field researchers tended to accept teachers' responses without probing or challenging their assumptions. However, there were also examples of researchers asking teachers to explain specific practices or to comment on student actions and behaviours in the classroom. This was done most consistently with respect to observations of gender bias and the use of language for different types of activity. There was also some variation in the amount of detail that was given in lesson observations with the consequence and a small number of observations gave very little information that could be used in the data analysis. Using a smaller number of more experienced researchers or providing a more extended period of training would have addressed these issues but both have time and cost implications.

3.2.2 Teachers' preparatory workshop

A one-day workshop for participating teachers was conducted within each district. The purpose of the workshop was to introduce the research and ensure that participation of all was voluntary and with consent; introduce the principles of the LSP; collect a first level of feedback on the chapters and create an opportunity for teachers to raise queries. We wished to avoid giving extended training or other forms of professional development support, as this might create an artificially conducive environment that would not reflect the actual conditions in which the textbooks will be rolled out. On the other hand, communicating the purpose of the research and the textbooks was necessary for ensuring the teachers understood the research and the professional development benefits of participation was a way to reciprocate teachers for their participation. A short teacher guide of one to one to two pages had been compiled for each subject and the workshop was also an opportunity to ascertain through consultation with the participant teachers whether the information provided in these was useful. We hoped that this kind of light touch teacher preparation could be achieved at

scale through integrating LSP into national in-service training programmes and ultimately pre-service training programmes.

During the workshop, teachers were systematically taken through the features of the new draft textbooks and given an opportunity to discuss and raise questions about these. The reasons for the new features in the draft chapters were explained and the rationale behind language supportive pedagogy that capitalises on students' Kiswahili proficiency to develop skills for learning concepts English. After this general overview, teachers were next grouped into their respective disciplines to critically examine the draft textbook chapters along with the corresponding teachers' guides. Granted the teachers' subject matter knowledge and their teaching experience in real classroom contexts, their critical examination of the drafts yielded comments that were instrumental in revising the first drafts. Their comments ranged from the suitability of the content vis-à-vis the cognitive development level of the target learners to the overall sequencing of the content.

The teachers examined the drafts with the facilitation of the field researchers in their respective disciplines. This helped the field researchers to consolidate their understanding of the new features in the draft textbooks and hence equip them with more knowledge and skills to make informed choices, during interviews and classroom observations, of the kind of information that was significant for the language supportive teaching and textbook project, generally speaking and the piloting exercise in particular.

3.2.3 Lesson observations

Qualitative observation was appropriate in this pilot study since the research questions that the pilot study set out to answer were exploratory in nature and the study was taking place in the classroom during the teaching and learning process. Johnson and Christensen (2012) posit that qualitative observation is usually used for exploratory purposes and studies that are conducted in their natural settings. The piloting was taking place in the natural setting of a classroom with teaching and learning in progress using the draft textbook chapters as a resource. The field researchers were therefore able to collect first-hand information in these natural settings of the classroom (Johnson and Christensen, 2012: 220).

The observation guide constructed each activity within a lesson as a unit of analysis, hence mapping observation data onto the activities, exercises and subsections within the draft chapters. The guide was subdivided into five sections (see appendix 1). The first section collected background information, which could be filled in before the beginning of the lesson e.g. name of the school, subject taught, duration of the lesson, name of the teacher, the name of the school. The second section focused on how the lesson was introduced. The third section was concerned with the lesson activities, how the learners interacted with these activities, and how the teacher mediated student-student interactions, student-content interactions, and student-teacher interactions with a focus on the language used. The fourth section was for recording how the lesson was closed. The fifth and last section was where researchers could record their impressions of how learning outcomes were achieved.

3.2.4 Teacher Interviews

Qualitative interviews allow the researcher to discuss with the participant “in-depth information about a participant’s thoughts, beliefs, knowledge, reasoning, motivations and feelings about a topic” (Johnson and Christensen, 2012; p. 202). The interviews with the teachers were an opportunity to reflect on the lesson that had just been observed, to explore the reasoning behind actions and decisions they had made during the lesson and hear their views on the pilot chapters. Field researchers were asked to ensure that the interviewees were relaxed before the interviews began and to set the tone of a conversation was that between two professionals.

All interviews were conducted in Kiswahili, as the most natural language to use in a discussion between professionals. All interviews were audio recorded. The interview schedules for the teacher interview were sub-divided into three major sections (see appendix 1). The first section focused on intended student learning outcomes and the extent to which these had been achieved. The second section focused on the lesson and the activities that had been implemented, including gendered interactions. The last section focused on the draft textbook chapters, eliciting the teachers’ views on the draft materials. The interview schedules included prompts that could be used flexibly in the interview to probe issues further if teachers gave restricted responses or to adapt questions according to what had been observed in the lesson.

3.2.5 Student interviews

Students were interviewed in groups of around 12. Participants were purposively selected on the advice of their teachers and drawing on the researchers’ own observations during the teaching and learning process. The groups included roughly equal numbers of girls or boys, although given the strongly gendered nature of participation observed in some classrooms this is unlikely on its own to have ensured equality of representation. Teachers tended to select more articulate students and this is likely to have created a slight bias towards students with more positive schooling experiences.

Group interviews allow for quickly collecting the views of a number of individual participants (Cohen, Manion and Morrison, 2011: 432; Bogdan and Biklen, 1992). When skilfully facilitated, they may provide opportunities for cross-checking and complementing of the participants’ ideas and opinions leading to more trustworthy data. Cohen, Manion and Morrison (2011) further point out that group interviews are appropriate and useful whenever that particular group of participants have been ‘working together for some time, or for a common purpose’ (p. 432). In the case of the piloting of the draft textbook chapters, the students had been interacting with their teachers and with the chapters together with a common purpose of accessing and learning the content. Group interviews are often used with school students to redress the power imbalance between an adult, who in the school environment can represent authority, and the children or young people. However, they require skilful facilitation as the group context can also act to silence some participants. When, as in these interviews, the members of the group already know each other, power imbalances may exist of which the researcher is unaware and these may influence group interactions in ways that bias the data. For the purposes of this research, the advantages of group interviews were judged to outweigh these disadvantages.

As pointed out above, interviewing is the best strategy to get at what people think or feel if certain interview conditions are fulfilled. Apart from sharing the purpose of the study with the student interviewees, the interviews were supposed to be conducted in a manner that would not have been threatening to the students. The interviewers needed to establish trust with them, to put them at ease and help them to feel confident and make the interview non-threatening and enjoyable. To this end, the interviewers had been asked to satisfy themselves that the students were neither thirsty nor hungry and that their teachers were not seen in the vicinity of the interview venue during the interviews. All interviews were conducted in Kiswahili, as the language in which students could express themselves most freely and were audio-recorded so that the field researcher was not distracted from facilitating the interview by the need to make detailed notes.

The interviewers used semi-structured interview guides, designed to be used responsively to elicit from students information about what features of draft chapters were new to them and what the students liked about these draft textbook chapters. Like the teachers' interview schedules, questions included prompts that the field researchers could choose from. The schedule was divided into two sections (see appendix 1). The first focused on lessons and the second focused on the design and content of the draft textbook chapters. Although a small number of the student group interviews were characterised by restricted responses, it was notable that in many others students talked in more detail about the draft chapters than their teachers, discussing specific exercises, illustrations and, even, specific words that appeared in the text.

3.3 Data analysis

Interviews were transcribed and translated into English and, together with lesson observation schedules, imported into NVivo 10. As the purpose of the research is to inform the design of the textbooks, analysis started by coding lesson observations according to activity. Lessons in which the same activity was implemented were then grouped together and read alongside the corresponding teacher and student interviews. A report was then produced for each subject organised by chapter section, which described how the chapter sections had been used in the classroom and summarised teachers' and students' comments on the section, including any suggestions for improving or modifying the activity and the support in the text for accessing meaning. A second level of analysis scanned across interviews and lesson observations. This level of analysis used codes informed by the research questions. For lesson observations this analysis focused on the language used for different stages of the lesson and activities and gendered interactions. It also looked at how certain types of activities, e.g. worked examples in mathematics, were used across lessons. This analysis was cross-referenced with the 'by section' reports to identify patterns in how languages were used for different types of activity, reported in section 4.2. Interview data was coded according to features in the textbook and also cross-referenced with the 'by section' report to overview views on the draft chapters, reported in section 4.3.

3.4 Ethical issues

The proposal for the research project as a whole has passed through procedures for ethical clearance at the University of Bristol and the Aga Khan University. Three issues that were considered that are relevant to the pilot are as follows. First, necessary permissions were obtained. The District Education Officers were informed of the research and, when available, consulted on the school sample. Second, teachers and students were at all times treated respectfully, were informed of the research purpose and what participation involved and offered the opportunity to opt into, rather than opt out of, the research. All participants were informed of the right to withdraw. These explanations were given orally in Kiswahili to all participants. Third, all participants were assured confidentiality, which has been ensured through withholding the names of participating schools in this report and other research outputs.

Additionally, an ethical consideration for educational research is to ensure that there is no negative impact on student learning. We expected the materials to support interactive lessons that improved learning. The selection of chapter topics for the draft chapters was informed by information from teachers in the sample schools regarding the subjects they planned to teach in September to November. Two to three chapters were prepared so that there would be enough material to cover approximately four weeks. Teachers' preparatory workshops were restricted to one day and conducted within the district where the sample schools were located to minimize absenteeism from class.

Ethics, however, is not just a matter of procedure but relationships of trust and respect between researchers and participants. As indicated in section 3.2.5, this entailed interacting with all teachers as professionals and peers and conducting interviews with teachers as collegial conversations. It entailed facilitating conversations with student interviews so that, as far as possible, they felt free to express their views and opinions. . It also entails sharing the benefits of the research with participants. In this research, students and teachers kept the draft chapters to continue to use in their teaching or study. Teachers were given modest financial 'thanks' according to normal conventions for public sector employees in Tanzania and reimbursed the costs of attending the workshop.

3.5 Research design and data collection: lessons learned

This chapter has explained the research design and detailed methods of data collection and analysis. Data collected across research sites was not as consistent in its degree of detail as we would have liked. One lesson learned from this is the need to invest more time and money preparing field researchers for classroom research. This has been identified as a potential area for capacity building activity at a later stage in this project. We will also explore the possibility of working with a smaller data collection and analysis team in the final phase of research, although this may mean concentrating research in fewer districts.

Chapter 4 - Findings: Bilingual Learning Materials for Bilingual Classrooms

This chapter presents findings from the analysis of qualitative data. The first section reports on processes observed in the classroom and what teachers and students said about these, focusing on how and which languages were used for different types of activities. The second section presents teachers' and students' views on the draft materials. The analysis also generated detailed findings on how various chapter sections were implemented in the classroom, which are presented in separate subject reports for internal use within the project.

4.1 Bilingual classrooms: prevalence and perceptions

All the classes observed were bilingual. No lesson was completed without talk in Kiswahili. In interviews, teachers and students talked about why they used Kiswahili but did not feel a need to justify the use of English. The status of English as the official language of instruction meant its use was taken for granted:

English is the language of instruction that is why I used it. And I used Kiswahili so that they can understand me better. (Mathematics teacher)

4.1.1 Teachers' views on bilingual instruction

Teachers claimed that their use of Kiswahili was a response to Form 1 students' level of English proficiency:

If I speak English only in the classroom, they will all end up looking at me. They will learn nothing. (English teacher)

The lessons, in which the teacher mainly spoke English (two Biology lessons, one Mathematics and one English lesson), were dominated by teacher talk in a lecture style delivery, with little participation from students. Most teachers, however, wanted interaction with students during the lesson, if only to monitor their learning:

In my experience, sometimes if you explain in English they become so quiet. But when explaining in Kiswahili you find them saying Ahaaa! Kumbe ndio iko hivi! (Biology teacher)

Teachers generally were committed to a broadly social constructivist view of learning, although they made no explicit reference to theory. They valued student participation and recognised the importance of students building on their previous knowledge. For Biology and Mathematics teachers this meant building on knowledge encoded in Kiswahili:

Students know many things but in Kiswahili, mixing the two languages enables them to understand the concept better than when using the language they don't know. (Biology teacher)

... when you limit [students] to use only one language, English, somehow you may fail to give them an opportunity to share various ideas. (Mathematics teacher)

Teachers, including English teachers, also recognised that student talk in Kiswahili helped them to process new information:

I see it helps them when they use Kiswahili first in sharing with a partner and then use English in repeating. I see it helps because even he himself remembers. And it is easier for him to put it in Kiswahili and then English than telling him straightaway to express in English. See, that gives him some trouble. (English Teacher)

Teachers of Form 1 found themselves trapped between the official policy of English medium education and their commitment to interactive learning. Form 1 students did not have the language skills in English to engage in the kind of interactions teachers wanted to instigate in the classroom. Pragmatically, teachers resolved the contradiction through using two languages but they did this with a sense that their teaching practice had ambiguous legitimacy. One Biology teacher commented that inspectors frown on bilingual practice. Another stated, “at the end of the day, what is wanted is English” (Mathematics teacher), implying that bilingual strategies were a stepping-stone to the ideal of monolingual English education.

Introducing bilingual learning materials into this context was not perceived as innovative but as legitimizing, or “formalizing” (informal conversation with a deputy head teacher, Lindi) existing practice:

we realized that even the teacher has been given a chance to use Kiswahili contrary to the books we have been using. Therefore, the use of Kiswahili enables all students to have the ability to understand what is being taught in class and not only a few students. (English teacher)

The Mathematics chapters had the most bilingual content but even these were not seen as radical or innovative. Indeed, two Mathematics teachers drew on their own repertoire of bilingual strategies to make recommendations for improving the materials.

A minority of teachers were sceptical of the over-use of Kiswahili in the classroom. Whilst they were supportive of some bilingual element to learning materials, most especially the English to Kiswahili glossaries, they warned against too much Kiswahili content. One English teacher viewed the use of Kiswahili as a barrier to learning English. A Biology teacher was concerned that raising the status of Kiswahili in the classroom might mislead students into answering examination questions in Kiswahili. Another expressed the view, often expressed in media and popular debate, that the Kiswahili language did not have the requisite range of vocabulary for learning Biology.

Other teachers, however, perceived pedagogic potential in the use of Kiswahili. One Biology teacher, recognised that specialist terms in Biology are taken from ancient Latin and Greek and which can be translated directly into Kiswahili. A Mathematics teacher, who exceptionally spoke mainly Kiswahili in the lesson, viewed the use of English as an unnecessary barrier to mathematical learning. Whilst he acknowledged that teaching and learning of Mathematics used language, he nonetheless viewed mathematical knowledge as existing independently of language:

I am a follower of Kiswahili because I believe that knowing Mathematics is not based on language. You can use any language to instruct a child and he understands. (Mathematics teacher, visit 2, Morogoro)

In Mathematics, specialist terms signify precisely defined concepts. One teacher highlighted the importance of establishing a shared definition of these terms in Kiswahili:

there are some terminologies that are used in Mathematics that even we teachers ourselves fail to understand. But in this book there are some that have been translated into Kiswahili which gives even I as the teacher an opportunity to understand the terminologies that I had been only telling the children, which led to them not understanding the meaning of 'variable'. (Mathematics teacher interview, visit 1)

4.1.2 Students' views on bilingual classrooms

Students expressed similar views to teachers on the necessity of Kiswahili for comprehension and to enable their participation in the lesson. However, they expressed these views more strongly, conveying their contrasting experiences of learning in English and Kiswahili:

Really, if it was to speak English only, the teacher would ask questions and we would be completely silent, we would remain looking at each other. Speaking Kiswahili really gives us freedom. (Biology student group, Morogoro)

For students, Kiswahili was the language of inclusion. Across subjects, students' small group and pair discussion was conducted entirely or mainly in Kiswahili. In one Mathematics lesson, the teacher spoke mostly in English but students only spoke in Kiswahili throughout, whether they were in small groups or addressing the whole class. When asked about this, the interview group explained:

Even if we know English, we speak Kiswahili. We would speak English but others, who do not know English, would be left along the way. (Mathematics student group, Morogoro)

Students across schools claimed that the teachers' use of Kiswahili allowed everyone in the class to understand the Mathematics. Section 7.1 of the Mathematics chapters had more Kiswahili content than any other text and its use was observed in three lessons in different schools. Language was the central focus of discussion in all three student interviews that followed the lessons:

We understood everything because all the difficult English words were translated into Kiswahili.

...

The teacher taught well and used two languages English and Kiswahili.

...

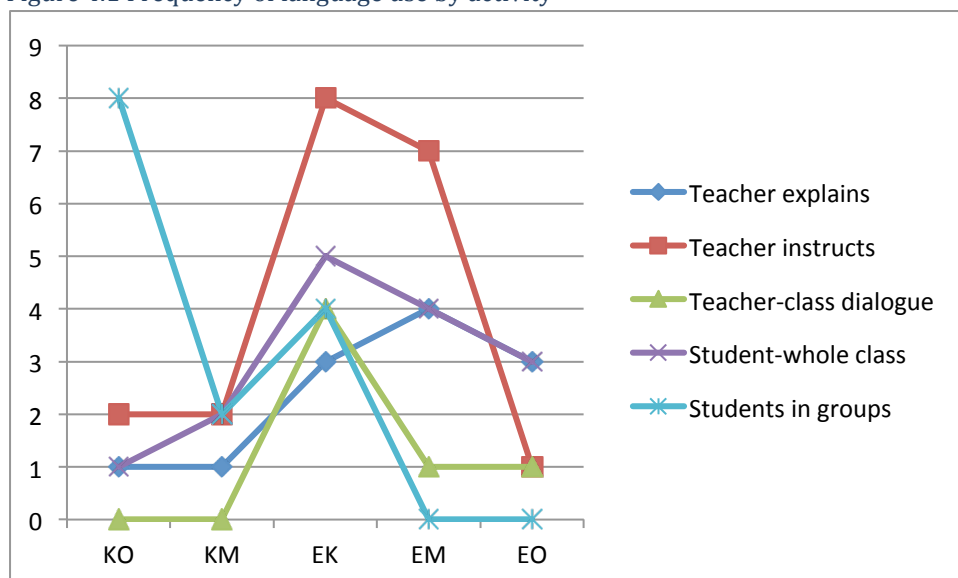
It was simple because the teacher translated it in Kiswahili.

(Mathematics student group)

4.2 Bilingual classrooms: practices

This section outlines patterns observed in language use in relation to the kind of activities undertaken. Across all three subjects, English was more likely to be used in teacher talk to the whole class and Kiswahili predominated in student-to-student interactions (see figure 4.1 for an illustration of this trend in Mathematics classrooms). English was rarely spoken without being mixed with Kiswahili as teachers code switched to ensure student comprehension. Nonetheless, a range of language practices was observed with minor variations between subjects.

Figure 4.1 Frequency of language use by activity



4.2.1 Introducing the lesson

Most teachers formally introduced lessons using mainly English or a mix of English and Kiswahili. English teachers were most likely to use English only to introduce a lesson. Three Mathematics lessons were introduced using only Kiswahili. In expressing learning objectives, teachers took a cue from different places in the textbooks. Some reiterated one or more of the chapter learning outcomes, others reiterated sub-headings and, in some English lessons, the activities to be undertaken in the lesson were given as learning objectives. There was little consistency in reminding students of the last lesson or asking students to recall prior knowledge. Teachers were more likely to elicit prior knowledge from students when starting a new topic or chapter section and most likely to remind them of what was covered in the last lesson if resuming midway through a topic. When Mathematics or Biology teachers tried to elicit prior knowledge, students only responded if the invitation was made in Kiswahili.

4.2.2 Instructions and explanations – teacher talk in English and Kiswahili

Teachers had developed their own patterns of language use in the classroom but were variously able to articulate how they adapted to the language abilities of the class in front of them. Across all subjects, teachers mixed English and Kiswahili when explaining concepts or when giving instructions for activities. Nearly all English teachers explained in English first and then appended a Kiswahili translation or summary to ensure everyone in the class had understood. After reading an exercise, some teachers summarized the content in Kiswahili:

Sometimes I use English and Kiswahili because sometimes when teaching I notice the students have not understood at all because I used English. I have to use Kiswahili to explain to them even if I set an exercise. They may fail to do it but they cannot say they did not understand. (English teacher).

The use of deliberate strategic use of code switching was most evident in Mathematics teachers' demonstration of worked examples on the blackboard. Two teachers sandwiched the presentation of a worked example mainly or only in English between a first and last worked example, in which Kiswahili predominated. A third teacher recommended that the textbook present alternate worked examples in Kiswahili and English. Even a teacher, who predominantly used English, in the second of three examples, mixed a little Kiswahili. Other teachers code switched within the presentation of a worked example in a more or less systematic way. So, for example, one teacher demonstrating a word problem translated the question into Kiswahili and then proceeded to explain each step of the solution in Kiswahili whilst naming the steps in English.

4.2.3 Breaking the ice with student talk in Kiswahili

Group or class discussions in Kiswahili at the beginning of English lessons acted as ice breakers, getting every student active and talking. Conversely, in some classes students were reticent to participate before they were given permission to speak in Kiswahili. The benefits were most evident for girls in Morogoro and Lindi, particularly when they were a minority in the class (see section 4.3.7). Each English chapter started with an activity that gave explicit instructions to talk in Kiswahili before constructing a sentence in English. In interviews, teachers rarely commented on students' use of Kiswahili. However, in two schools observers judged that teachers had permitted students to speak Kiswahili in front of the whole class as a strategy to build confidence in speaking out loud and sharing ideas. Exceptionally, in one Biology lesson, the teacher broke the ice at the beginning of the lesson by teaching the students a song in English about the classification of living organisms.

This finding corresponds to research in Malta (Camilleri, 1996), which observed teachers' attentiveness to the symbolic value of languages. They used Maltese to indicate warmth, friendliness and reduce social distance whilst English was the language of the textbook and indicated social distance.

4.2.4 Group or pair discussions in Kiswahili: a step to speaking or writing English

Because, we don't know English, we discuss in Kiswahili then later we settle and try to construct meaning in English.... (Biology student group)

Within the English materials, activities instructed students to discuss in Kiswahili as a first step in a collaborative process of constructing sentences in English, which were then either written down or presented to the class. In one lesson, the teacher asked the students to present in Kiswahili and then translate the sentences in English.

Most students interviewed were positive about the opportunity to talk in Kiswahili, describing it as the national language in which Form 1 students are fluent and able to express their ideas in class. Most agreed that using Kiswahili helped them to learn the topic and increase their knowledge of English vocabulary:

We used Kiswahili when discussing in groups and English for the presentation because we wanted to understand each other and the activity itself instructed us to do so. By doing so, learning English becomes easy for us since we transfer the knowledge from Kiswahili to English. (English student group)

As this quote illustrates, the suggestion within the English materials that discussions start in Kiswahili had two effects. First it enabled collaboration, as Kiswahili was the medium through which students communicated with each other. Second, it engaged them in a two-step process of formulating sentences first in Kiswahili and then translating them into English. Generally, students were positive about the opportunity to speak in Kiswahili, viewing it as necessary to participation. However, one group of students and two English teachers expressed the view that speaking in Kiswahili did not help with learning English.

The Biology and most of the Mathematics materials did not give explicit directives to speak in Kiswahili. Nonetheless, use of Kiswahili dominated students' discussions in pairs or groups. There was only one instance of students discussing a Biology problem mainly in English. In Mathematics all group work was entirely or mainly in Kiswahili. When asked about this, students attributed their language choice to their fluency in Kiswahili and a determination not to exclude those with lower levels of English proficiency.

4.2.5 Students present in English to the whole class

Student talk in English was always a presentation of a short sentence or statement that they had spent some time preparing usually in pairs or groups. In most schools, students' English talk was described as 'awkward' or 'with difficulty'. Occasionally teachers had to step in to support with constructing sentences. For teachers these presentations were an opportunity to evaluate learning. When asked whether learning objectives had been achieved in the interview, they referred to the group presentation to the class as an indicator of how many students had "understood". The other opportunity for student talk in English in English lessons came when individuals were asked to read comprehension passages out loud. Pronunciation was then noted to present a challenge. Individual words identified as difficult to pronounce are listed in Appendix 2.

In Biology, most student presentations to the whole class were in English but in some Morogoro schools students were observed to mix English and Kiswahili. One student group identified uncertainty over English pronunciation as a barrier to participating in English medium lessons:

There were others who spoke Swahili because there are some words you quite know how they are pronounced, but other words you do not. For example, I can pronounce 'Cell membrane' but there is someone else, who cannot. So someone, who cannot pronounce a word in English, has to use Kiswahili. (Biology student group)

Field researchers noted that students in Biology classes in Dodoma presented in English with more confidence on the second visit, as they became accustomed to talking in front of the whole class in English.

Mathematics was the subject in which students found it most difficult to express their ideas in English. They were most likely to use English when a group was reporting back their solution to a problem but even on these occasions some classes used Kiswahili. It is common practice to ask a

student to demonstrate the solution to a problem on the board. When put on the spot in this way, most students struggled to express their mathematical reasoning in English or simply opted to speak in Kiswahili.

4.2.6 Reading in English, understanding in Kiswahili

Talk in Kiswahili was used as part of the process of digesting information presented in English and evidencing understanding of the English text. Typically in English lessons after reading a passage in English, either the teacher summarized in Kiswahili or asked the students to offer an interpretation of the passage in Kiswahili. Some English teachers, however, went directly to the comprehension questions instructing students to discuss these in their groups in Kiswahili and then present answers either in English or first in Kiswahili and then in English. Sometimes reading was preceded by a whole class activity of interpreting the comprehension questions. Teachers would check students understood the comprehension questions by asking them to translate the questions into Kiswahili. Kiswahili, therefore, was used as the language for processing information and the language in which understanding was demonstrated.

In Biology, when students were required to read from the Biology chapters in groups or individually, the discussions and presentations that followed generally took place in a mix of English and Kiswahili. For example, in one lesson, an individual reading activity was followed by whole class question and answer on the passage. As in other whole class question and answer sessions that were observed, the teacher and students used a mix of English and Kiswahili.

In Mathematics chapters, explanations in English were short and interspersed with diagrams or worked examples. Nonetheless, most students engaged only minimally with text written in English. They navigated the chapters by looking at the illustrations and the short pieces of Kiswahili text. They would then look at the worked examples and attempt exercises. One student group explained that they mainly learned through looking at worked examples.

4.2.7 Gendered interactions

Gendered interactions were patterned by region. Gender differences were most apparent when it came to presenting to the whole class in English. In Lindi and Morogoro, boys were an outspoken majority and participated more frequently and with more confidence than girls. When students were invited, for example, to present sentences they had constructed, girls were reticent and would wait until selected by a teacher. In one Mathematics lesson, the majority of presentations were by boys, even though in the small group preparation girls had been more active than their male peers. Across the Dodoma schools, girls participated more readily than boys, although the contrast was not as marked as that between boys and girls in Lindi and Morogoro. About a third of teachers actively sought to balance participation by boys and girls through selecting individuals to present or read. Most teachers did not consider gender when grouping students. However, one Lindi teacher claimed that he did try to ensure the girls in his class were in mixed ability groups, stating that they benefited from discussing with the 'quicker' students, who were all boys.

When invited to comment on gendered interactions that favoured boys, teachers in Morogoro and Lindi generally concurred with observations and acknowledge the dominance of boys as a norm. They attributed the phenomenon to girls being shy, fearful or in a minority. One teacher in Lindi related girls' reticence to the socio-economic status of the community. In two of the Dodoma schools, where researchers observed that the boys did not participate as fully as the girls, teachers implied the responsibility lay with the boys:

Because learners do differ they cannot all of them concentrate, it is normal to find some stubborn student. Sometimes we see and ignore the behaviour. At the end you find that these are the failures. (Biology teacher, Dodoma)

During a group activity in one lesson in Morogoro, the researcher observed that students formed gendered groups.

It should be noted that the researchers had not received training in gender analysis and their judgements of gender were largely restricted to noting, who was participating.

4.3 Teachers and students views of the textbooks

Students' and teachers' general views on the textbooks were mostly in agreement. Illustrations, "simple English" and glossaries were the most frequently commented upon features of the chapters. For the English materials, these were mentioned in 26, 23 and 17 interviews respectively. Five English teachers commented on the learner-centred nature of materials.

4.3.1 Language accessibility

Students and teachers frequently mentioned the "simple English" as a positive feature of the pilot chapters. English and Biology teachers compared the language favourably with other textbooks they use. Ten of the eleven Biology teachers referred to the simplicity of the language in the text as a reason for selecting the LSTT materials over another textbook:

The difference is that the simple language used in this book [is] very helpful to understand the matter described. (Biology teacher)

Nine out of 12 Mathematics teachers stated that the book supported students' learning of English for the purposes of Mathematics. Four Mathematics teachers described the language as clear and simple.

As well as simple language, the contextualisation of material contributed to accessibility. One English and one Mathematics teacher pointed out that readability was further enhanced by content and, in Mathematics, word problems, to which students could relate. In the English materials, the Nyerere comprehension was described as accessible although some passages were identified as harder than others

For English teachers, accessibility of the text had implications for their workload:

The choice of vocabulary and the grammatical construction of the sentences is easy for them to understand. This makes it easier for me not to use too much energy in teaching. (English teacher)

Despite this consensus on the relative accessibility of the text, one of the most common recommendations for improvement was to make the language even simpler, with some participants specifically mentioning vocabulary. This suggestion was put forward by five student groups discussing the English chapters (two at the same school) and three English teachers. English teachers were observed to support students in accessing the text, particularly through giving instructions for all activities in Kiswahili and demonstrating writing activities on the board.

For Biology, whilst five student groups claimed that they found the language in the Biology pilot chapters simple, other groups admitted that they found some of the words difficult. Biology teachers pointed out the density of subject specialist terms in the Biology draft chapters. Whilst, they viewed the use of specialist language as a feature of Biology, they recognised the difficulty it presented to students:

The normal English is simple though students may find it difficult because of the use of many Biological terms, which cannot have alternative simplified words. For example, the word prokaryotic is there you cannot change it. (Biology teacher)

When I started using the book I told students to read the book and explain in Kiswahili what they have understood, they managed with the exception of some Latin (Biological terms). (Biology teacher)

Three Mathematics teachers recommended that the amount of explanatory text in English be reduced and kept simple:

they should improve on the issue of explanations because the foundation of students is not good; therefore if there is a lot of explanation it confuses a student in solving these questions. But when explanations are few, a student will understand what to do. (Mathematics teacher)

Students, when asked what they found difficult to understand in the Mathematics pilot chapters, simply said the parts without Kiswahili translations.

4.3.2 Content by subject

Other features that supported students' access to content varied between subjects. The English chapters were the lightest in terms of content and the most focused on skill development through a series of activities. In Biology, which was heaviest on content, vocabulary and the density of subject specialist terms presented a barrier to accessing meaning. In Mathematics, presentation, particularly of worked examples was identified as a key feature for enhancing accessibility.

Organisation and topicality in English

Organisation of the English chapters was commented upon less frequently than the other two subjects. Two English teachers commented positively but briefly and without elaboration on how organisation of the draft chapters enhanced accessibility for students:

The flow and arrangement of topics are in such a manner of simplicity to make students understand what they have learned contrary to the books I would usually use. (English teacher)

Students found activities in the English materials more engaging when these were viewed as relevant to their social context and when they built on their existing knowledge. The Nyerere story built on pre-existing knowledge that had been presented to them in bits and pieces during school assemblies. One student claimed that the picture of the car accident showed them “how [an accident] causes a traffic jam”. Sports were popular with the volleyball picture being mentioned by three student groups but none of the pictures that followed in the same activity. Students in two schools expressed appreciation for the football dialogue because it was about the teams Simba and Yanga (the two biggest teams in Tanzania) and it is possible that this could be made more engaging through including images of footballers in their team colours. A few students and teachers made suggestions for topics they would like to see covered in the book. Some of these were ‘more of the same’ type recommendations, e.g. “history of Mwalimu Nyerere should be expanded”, “history of many famous people”. One group wanted material that stretched their horizons, “add events from different areas to know more about Africa as a whole.” One student group asked for “topics like poems and letter writing”, one teacher for letter writing and one teacher for content on “opinions and feelings”.

Content and organisation in Biology

Biology teachers talked the most about the amount of content but did not agree on whether the chapters had too much or too little. Three teachers commented that the content of the chapters was relevant to the syllabus. One noted that the syllabus includes teaching about types of cells but many other textbooks available to the teachers do “not offer much on this.” However, he also commented that the chapters should provide more specific information such as lists of types of cells and corresponding examples. Another recommended more clarity without elaborating. Two teachers, however, believed that some concepts are too advanced for the students’ level. These include the cell components such as *ribosomes*, *lysosome*, *Golgi apparatus* and *endoplasmic reticulum*. So whilst this teacher thought diagrams were important, he thought some were better suited to the Form Three level in the detail that they provided.

Biology teachers were generally positive about the organisation of the chapters. However, one teacher thought that the links between the chapters were inadequate and that chapters should be organised in keeping with the syllabus, although this had indeed guided organisation. This teacher also suggested the inclusion of a summary at the end of each chapter. One teacher reported that the inclusion of activities at the end of each section rather than at the end of a chapter was helpful to teachers in assessing the achievement of learning objectives:

Also, in other books activities are located at the end of all topics. But in this book after finishing a small section there is activity, it is very easy for a teacher to teach a small part and you ask questions that are different from other sections. (Biology teacher, Morogoro).

One group of students suggested that there should be more questions in each section of the Biology chapters.

Content, presentation and worked examples in Mathematics

In Mathematics, organisation and worked examples were seen as key to supporting access to meaning. Mathematics teachers used terms like “simple” and “easy to understand” with reference

to the overall presentation of the material, particularly the frequency and presentation of worked examples:

this book shows procedures that a student has to follow when solving different questions for example in simultaneous equations ... but in other books there is nothing like that. (Mathematics teacher)

Two teachers commented favourably on structure and flow of the material:

Also in the draft book, a concept is built first and then the details come later. It helps the student to build a picture or understanding of the contents, contrary to other books. (Mathematics teacher)

However, one teacher did suggest that the exercises in one particular section (section 2.1.1) did not progress from less to more difficult.

Students frequently identified exercises, activities and worked examples as interesting, showing how they learned Mathematics through engaging with mathematical problems. They were able to engage with the exercises after they had seen the procedures demonstrated, either by a teacher using Kiswahili in the classroom or through their study of worked examples in the pilot chapters. Two teachers and five student groups recommended the inclusion of more worked examples. Another student group requested greater contextualisation of subject matter by asking for more “real-life” examples. Two student groups recommended more exercises.

4.3.3 English-Kiswahili glossaries

The piloted English chapters did not include any glossaries. Four teachers and three student groups requested that English to Kiswahili glossaries be added to the book. Several teachers had strategies for supporting acquisition of vocabulary, which involved students noting down words and then the teacher providing a translation orally or on the blackboard. In Biology, all student groups demanded translation of subject specialist vocabulary. Biology teachers were supportive of inclusion of an English-Kiswahili glossary but, with two exceptions, thought that the text should primarily be in English.

Mathematics books did have glossaries integrated into the text (as opposed to being placed at the end of chapter or back of the book). Students commented on the glossaries more than any other feature of the book, always positively and frequently asserting that these helped them to access the text. Nine groups recommended that they should be extended and another group asked for whole sentences to be translated into Kiswahili. Just over half the teachers also commented favourably on the bilingual features of the textbook:

The draft book is exceptional because it is bilingual and there are some words that are difficult when teaching Mathematics in English that have been explained in Kiswahili; something that helps [students] know the meaning of words, contrary to other books. (Mathematics teacher)

Two teachers spoke with considerable enthusiasm about the Kiswahili content. One teacher mentioned that the glossaries clarified his own understanding of English “terminologies”. Another suggested that national examination papers include English-Swahili glossaries. Two teachers recommended extending the use of glossaries:

In chapter seven, when we read there are many words in Swahili, which helps the student but remember in this chapter nine, algebra three, there is no translation as words are becoming more complex and therefore this becomes more difficult than where we began. (Mathematics teacher)

One teacher was ambiguous in his view of the glossaries, representing the conflicting tensions that Mathematics teachers were trying to balance in their classroom teaching:

Yes, it helps, although it is not good because they use too much Kiswahili, while they are supposed to use English even if they make mistakes. (Mathematics teacher)

Teachers and students made various suggestions on the positioning and presentation of glossaries. These included moving the glossary to the end of chapters or the end of the book, printing the different languages in different colours and displaying the glossaries in a list or table format. One Biology teacher suggested that the glossary should only appear in the teacher's manual. Lists of words that students recommended glossing are given in appendix 2.

4.3.4 Learning activities

All the draft materials were designed to support interactive learning, in line with the expectations of the syllabus. However, as the learning objectives differed between subjects so did the nature of the learning activities and the ways in which they were used in the lessons. This section, therefore, is organised by subject.

English

The English chapters consisted entirely in a series of activities. Teachers commented on the activities in a general way, whilst students commented on individual exercises. Teachers described the activities as "student centred". They discussed activities together with simplicity of language as features that made the book accessible to students and hence reduced their own work:

The text is very good and useful since it has so many activities for students to do, it is a student centred text and even the students themselves like it. (English teacher, first visit)

Indeed, five groups of students claimed they had used the books independently or with friends outside of the classroom.

Two teachers thought more exercises could be included to develop listening skills and two wanted more content on grammatical rules. Two teachers suggested that questions could be simpler, indicating that their students struggled to answer open-ended comprehension questions and two wanted the comprehension questions to only appear after the reading passage.

Biology

The teachers referred to the learning activities specifically in terms of monitoring learning:

Okay, the fact was, when I looked at the activity, it focused entirely on what we have learned in our presentation. So I gave it to them so I would discover what they have understood. (Biology teacher)

The activity was good as it reflects the whole unit from the beginning to the end, so it [assesses] their ability to understand the lesson (Biology teacher)

One teacher said that the activities were adequate for developing skills in students but did not elaborate or specify on specific skills. Two teachers complained that they could not do the activity that required looking at a leaf through a microscope because their schools did not have microscopes.

Students referred to specific activities in terms of levels of difficulty. They also referred to activities as “fun” or “interesting”. For example, two groups of students claimed that they did not have any difficulty with the activities they had done. Students at one Dodoma school reported that they enjoyed the activities that involved group work. They also enjoyed presenting to the whole class because it helped to build their confidence. At another school in Dodoma, students indicated that they enjoyed Activity 4 in Unit Two of Chapter One, a fill the blank type activity. However, other groups reported difficulty with specific activities, which related to language demands:

The difficult thing was to write names of some animals in English because the names were not provided there. (Biology student group)

Mathematics

In Mathematics only, teachers generated opportunities for collaboration beyond those suggested in the materials by setting exercises as problems for group work. One teacher in particular seemed to over use group work, giving students no time in the lesson to practice new methods individually. It was quite common for lessons to focus on explanations, worked examples and group work and individual work to be set as homework. Without having their own individual textbooks, students would have no opportunity to consolidate new learning through individual practice.

The one practical activity in the chapters, the matchstick activity, was at the start of the first chapter (chapter 7) and was observed in three lessons. It proved to be a powerful tool for supporting students’ to grasp the concept of a ‘variable’ and ‘algebraic expression’. However, in one school it did make visible the need to design such tasks for mixed ability groups, as students completed the activity quickly and were then off-task for some time. There was an extension activity at the end of each chapter one of these was an extension to the matchstick activity but without signposting neither students nor teacher connected with this when it would have been useful.

Activities in Mathematics that made the greatest language demand, such as the ‘everyday variables’ table and word problems, presented the greatest challenge to most students. Teachers and students described the table, which mapped common English words onto mathematical symbols (e.g. ‘add’, ‘plus’, ‘increase by’ can all be represented by ‘+’), as useful. ‘Fill the blank’ activities were popular with students. However, there is a need to look for more strategies for supporting students to decode word problems including activities that guide students through the process of replacing words with symbols.

4.3.5 Illustrations

Illustrations were also a popular feature of the books. Some of the most common suggestions by students and teachers across subjects were to include more illustrations, print them in colour and improving their quality. In addition one student group and a Biology teacher suggested better use of captions. Some students pointed out that when they picked up a book their attention was first

drawn to the illustrations and their captions. Illustrations served different purposes in the three different subjects and so each subject is discussed in turn.

English

Illustrations in English were indirect, supporting reading passages, or part of an activity. Students described the illustrators' drawings in the English chapters as "pleasing and attractive" ("zinafurahisha na kuvutia"). The images that went with the Nyerere story enhanced the text and engaged students, who were alert to their implied social messages. The car accident and the game of volleyball were favourites with the students and the exercises that they were most likely to attempt outside of the classroom:

The activity of saying what we have observed in the picture was very interesting to us. What made us interested in the activity was to look at the picture of an accident and how it causes traffic jam. (English student group)

Eight English teachers commented positively on images in the text. Teachers asserted that the illustrations supported the learning in the classroom without elaborating on how, other than to say students found them interesting. One teacher did suggest that they supported autonomous engagement with the text:

Yes, the illustrations helped the students to understand the text because they can construct many sentences by looking at a single event represented in an illustration. (English teacher)

Biology

In Biology, students said the illustrations helped them understand the concepts. In particular, the drawing of a house under construction was singled out:

It helped us to understand that cells are smallest units, like a house, which is made up of combination of small bricks. Therefore, it gives us a good example to understand that the cells are the smallest units of life. (Student Biology group)

One group of students commented that the illustrations should be much clearer, giving the example of the illustration of muscle tissue in Unit Four, Chapter One. Another group referred to the lack of colour in the illustrations and pointed out that this presented a challenge to them in doing one activity, which required them to categorise bottle caps according to colour.

Biology Teachers also stated the illustrations were helpful. However, one Biology teacher thought the illustrations could be more specific. Another teacher thought that the diagrams were helpful but should be better labelled, while another noted that some diagrams were not correctly placed in terms of their relevance to the content:

...like the diagram of plant and animal cells; these are located in a wrong place (under cell and cell theory).

Mathematics

In Mathematics, the illustrations all related directly to the content and conveyed mathematical information or, in one instance, directions for executing an activity. This last illustration of matchstick patterns was mentioned the most frequently by students followed by the beam balance figures, which acted as a metaphor for a mathematical concept. The matchstick diagrams smartly and quickly communicated the "stick pattern concept" (student group interview) so students knew

what was expected in the activity. These were the only pictures in the text but one group talked about the diagram of a labelled algebraic expression, which one student observed provided additional information to the text:

I liked illustration in activity 7.2.2, because I knew that if you want to count the terms in algebraic expression you start from left. (Student group interview)

Two students commented positively on a bilingual table, which gave the meaning of mathematical symbols in English and Kiswahili. Two groups mentioned fill the blank exercises.

4.3.6 Book production

Only with respect to Mathematics was the overall design of textbooks raised by students and teachers. Five student groups and three teachers recommended answers to exercises be placed at the back of the book, although one teacher and one group of students suggested that for at least some exercises, the answers should be withheld. Two student groups recommended the book be given a hard cover to make it durable.

4.4 Summary

In agreement with previous research in secondary schools in Tanzania, we found that teaching and learning in Form 1 is bilingual. Our baseline study showed that students in Form 1 do not have the reading ability or the knowledge of vocabulary needed for learning in English at the secondary level and concluded that they are not ready for English medium education. Teachers' pragmatic response is to use both Kiswahili and English in the classroom. On the few occasions when lessons were taught mainly in English and students were not encouraged to talk in Kiswahili, the lesson was dominated by teacher talk from the front and students were largely passive.

There was little resistance to the use of pilot chapters, largely because their benefits were immediately evident to teachers and students and they supported the kind of interactive learning that they value and that are promoted in the syllabus. However teachers only welcomed the materials when a class set was available and their effectiveness as learning materials depended on them being placed in the hands of learners.

Although all teachers used both Kiswahili and English in the classroom, they did not talk about how they used bilingual strategies to support learning of English. English teachers could appreciate how the activities in the pilot chapters did this but Biology and Mathematics teachers did not demonstrate an understanding of language learning in the context of their subject. This is not surprising given that it was not addressed in their teacher education, which just like the textbooks currently in circulation, proceeds on the assumption that lower secondary students are ready for English medium education. The implication is that language supportive materials need to provide guidance to teachers on how to use language and develop English language skills.

Introducing language supportive learning materials into this context therefore, improves existing bilingual practice so that all the language resource in the classroom is used more systematically to support learning. Well-designed activities with explicit directions for use of language support

students to access their prior learning in Kiswahili and develop their English language skills so they can articulate and build on their subject knowledge in English. However, the pilot did highlight the pilot chapters can be improved so that more consistently support language supportive teaching across all three subjects. This will be discussed further in the next chapter.

The analysis generated detailed findings on how different activities in within the pilot materials were implemented in the classroom. These are presented in separate subject reports. The implications of these findings for the design of learning materials are discussed in the next chapter.

Chapter 5 – Conclusions

This final chapter draws out the implications of the pilot findings for the design of learning materials, education policy and further research. The pilot materials were organised as chapters of a textbook. However, they were designed to be learning materials, with which learners can interact and make possible a series of learning activities. Our findings therefore can be extended to the design of other types of learning materials besides textbooks, for example worksheets, and could be adapted for online use.

5.1 Implications for design of language accessible learning materials

The features of the language accessible textbooks are summarised here. The pilot highlighted the importance of all these features and showed how they made the chapters easier to use in the classroom and that, when they had their own copies, students could also use them independently outside of the classroom. Outside of the classroom, however, students showed a preference for activities and sections that they considered topical.

Glossaries: Language accessible textbooks for Form 1 have to include glossaries that translate key words into Kiswahili. Students did not have vocabulary to read texts in the English chapters and to read Biology and Mathematics textbooks. Glossaries need to appear next to the text where the words appear. However, there is scope to include a glossary or vocabulary list at the back of the book to look up academic or subject specialist words.

Visuals: Form 1 students rely extensively on illustrations that convey meaning to interpret the meaning of texts. Language accessible texts are suffused throughout with images. Clever use needs to be made of legends to communicate key information. Interesting colourful illustrations are attractive and encourage engagement with the text.

Accessible text: Writing in short sentences limited to one and two clauses and avoiding use of the passive voice made the texts easier to read and to use in the classroom. However, they were nonetheless challenging for Form 1 to read. Writing in simple English alone is not sufficient to make the texts accessible, they also need to include glossaries, visuals and activities that support engagement with the written text. The Biology materials introduced a high frequency of subject specialist words. Whilst Biology necessarily demands the acquisition of a more extensive subject specialist vocabulary than Mathematics or English, there is scope to reduce the content and vocabulary demand of the Tanzanian Form 1 syllabus and Form 2 examinations, which exceeds that of the curricula for the eighth year of schooling in many countries, where English is a the first language for most of the population.

Subject matter for reading passages in English textbooks, illustrations and examples across all subjects should be topical. For example, students in the pilot were attracted to images and stories that concerned sports. When they could relate to subject matter, as in the reading passage about

President Nyerere, they found passages easier to read. However, subject matter should not be too familiar or mundane. Images and stories about school life were not considered interesting and did not encourage engagement even though they were familiar to students. So, subject matter needs to expand horizons through introducing students to new information but in ways that allow them to relate to the material.

Bilingual content, Kiswahili translations: Mathematics is characterised by a high level of abstraction, making mathematical concepts particularly challenging to comprehend and express in a language in which one is not fluent. Most students quite simply did not read explanations presented in English and interacted only with the visuals and their legends, the short translations into Kiswahili, the worked examples and exercises. Extra support for understanding the concepts and procedures in Mathematics can be provided by translating key sentences into Kiswahili.

5.2 Implications for design of language supportive textbooks

A key feature of the English and Biology pilot chapters was the extensive use of learning activities to support talking, writing and reading in English. The Mathematics chapters included activities to support talking about Mathematics in English but no reading and writing activities. These activities imposed more structure on bilingual talk. Most student discussion in Form 1 classrooms is conducted entirely or mainly Kiswahili. The talking activities with the pilot chapters made this a first step to writing or presenting a sentence in Kiswahili. A consequence of this was that as teachers and students became accustomed to the LSP the students presented in English with greater regularity and increasing confidence. Kiswahili discussion was often the first step of an activity because this allowed students to access knowledge from primary school and to process new information in a language in which they are fluent. Classroom observations showed how Kiswahili talk was used by teachers to serve a third person of 'breaking the ice', creating a climate in which all students felt able to contribute their ideas and join in the teaching and learning dialogue. Once, students were already speaking and contributing in Kiswahili it was easier to persuade them to attempt expressing their ideas in English.

A key principle of sociocultural theory is that learners construct knowledge from various sources of information, including their prior knowledge from previous school learning and from outside of school. For Form 1 students just starting out in English medium education, their prior knowledge from primary school and outside of school is encoded in Kiswahili. Hence, they are only able to access this knowledge through the medium of Kiswahili. This was most apparent when Biology and Mathematics teachers attempted to elicit prior knowledge at the beginning of a new subject and were consistently, across all classes, met by silence until the invitation was made in Kiswahili. Large parts of the subject content for Form 1 have already been covered in primary school or build on the primary syllabus. The task of teaching Form 1, therefore, is not about presenting new information but building on what they already know through eliciting that knowledge in Kiswahili and supporting learners to acquire their vocabulary and language to translate that knowledge into English. A standard textbook, including a high quality textbook that presents information clearly, concisely, in a socio-culturally relevant and engaging way does little to support the learning process of students navigating a transition in the language of instruction. This requires the use of bilingual strategies that

initially encourage students to talk in Kiswahili but then supports them to re-code their knowledge in English.

The Mathematics materials contained very few activities designed to support language learning. Mathematics teachers displayed a preference for collaborative learning processes, tasking groups of students with the exercises. However, this collaborative learning was sometimes at a cost to individual learning activities that would allow students to consolidate new knowledge, through attempting questions on their own. Individual problem solving can be followed by collaborative evaluation of the work. It is fairly common for teachers to interpret participative pedagogy as collaborative learning rather than participation in the practices of a discipline (see section 1.3) (Schweisfurth 2013). This finding suggests that the Mathematics materials need to include more explicit direction to guide teaching, including activities to support reading and talk in English about Mathematics.

Students and teachers repeatedly told us that if teaching was only in English, students would just be “quiet”. It is important to note that the use of language supportive activities within bilingual classrooms resulted in students composing sentences, talking and writing in English. By contrast, in the few lessons we observed that were dominated by monolingual English practice students did not speak in any language, and did not write other than to copy. In other words, bilingual language supportive strategies can result in Form 1 students using English more and learning English faster than in monolingual English classes at the same time as learning the subject matter, as they talk their way into being part of a community of inquiring Biologists of Mathematicians.

5.3 Implications for policy and teacher education

The formal policy of English medium education in Tanzania is at odds with the universal practice of bilingual teaching and learning across the community schools that serve the majority of the population. In a context in which parents demand English medium education, the policy may be politically justifiable but it takes a naïve view of education theory, research and practice. Simply put, monolingual English medium education is not implementable with the resources teachers have available within the Tanzanian education system. Secondary education in Tanzania is an experiment in implementing an English immersion programme. Research has shown these to be highly successful on much smaller scales in resource rich high-income contexts and with teachers who have had highly specialist extensive training in the techniques of immersion education. Such resources and training are not available and are unaffordable in Tanzania.

A bilingual policy that allows for the use of both English and Kiswahili in the classroom would have the immediate effect of legitimizing existing practices. Improving those practices, however, requires the development and roll out of language supportive materials designed for the Tanzanian context together with the integration of language supportive pedagogy within pre- and in-service teacher education. This, however, would be much cheaper and quicker to design and roll out than an English immersion programme for four reasons. First, teachers and students recognise that low levels of proficiency in English are a barrier to learning and welcome innovations that they can see address this issue. Second, teachers are broadly committed to the implementation of activity-based learning, which is promoted within the current syllabus. Language supportive pedagogies are also activity

based and so represent an adaptation of existing practices rather than a radical or effortful transformation of practice. A change to language supportive bilingual practice places a much lower demand on teachers in terms of time and effort. Third, teacher education programmes, both pre-service and in-service, already aim to develop activity based learning so here also the goal would be a modification of existing programmes so that graduating teachers have an understanding English for Academic Purposes and a set of classroom strategies for supporting its development.

Learning materials enable activity based learning, including language supportive pedagogy. Over the last 20 years, a number of donor and NGO supported programmes have promoted the participative teaching and learning, particularly at the primary level. These together with the 2005 syllabus revision have resulted in widespread understanding and appreciation of these practices by teachers. However, schools have not been provided with materials with which learners can directly interact, leaving teachers in a position of trying to implement participative pedagogies in classrooms resourced for transmission teaching (teaching from the front). This can lead to an over-use of discussion and insufficient time in the lesson given to individual work on reading and writing. Well known initiatives such as the *Escuela Nueva* programmes in Latin America all place learning materials such as workbooks, flash cards, counters and simple mathematical games and even blackboards, into the hands of learners.

The introduction of language supportive practices and materials has the potential to improve secondary school students' learning of English and their learning of other school subjects through English. However, they are not a panacea for education quality at the secondary level. Understaffing, high rates of authorised and unauthorised absenteeism were challenges that affected data collection in this study. Accommodating an over-loaded syllabus, particularly in Biology, and meeting the goal of preparing students for over-demanding Form 2 examinations, was a challenge when writing chapters that are usable by students with low proficiency in English. The Tanzanian syllabus for Form 1 includes content that, in England, is not taught until the twelfth year of schooling. Form 2 examinations would also be considered suitable for much higher year groups in England. Recent research has associated low learning outcomes with overloaded national curricula (Pritchett and Beatty, 2013). In trying to memorize a large amount of detailed information, students can fail to develop a deeper conceptual understanding of fundamental principles. So whilst distributing learning materials to learners will contribute to improving learning, they will not work alone to improve examination performance.

5.4 Implications for further research

5.4.1 Implications for LSTT research

This pilot research has highlighted the need to thoroughly revise the pilot chapters and when writing new chapters to consistently use language supportive activities and visuals throughout. Mathematics textbooks should have only minimal explanatory text in English and the use of glossaries should be extended. Biology and English textbooks need to include glossaries and become more topical through the choice of subject matter for reading passages, visuals and case studies that engage fifteen year olds. The materials for Biology and Mathematics were, like the syllabus, largely

content driven and reflected the distance of the authors from the classroom. Including teachers and classroom researchers on the team should generate a wider range of ideas for learning activities.

Sufficient time and money needs to be set aside for editing, revising, formatting, proofing and printing the next set of draft materials prior to final piloting in 2015. Writing secondary school materials is a time intensive task and the original ambition to write whole textbooks may have to be scaled back to a set of specimen chapters. Generating materials that are innovative in the Tanzanian context, language supportive, supportive of participative pedagogies and well produced should be a priority over producing quantity.

In the pilot, we found short workshops enabled teachers to understand the principles behind the materials and implement them more effectively. The continuing professional development demand for language supportive pedagogies is relatively light but nonetheless this is an area of enquiry that should be developed. In year two, therefore, we should seek to pilot revised chapters in collaboration with an in-service provider to allow research into the design of continuing professional development and how it can be integrated into existing programmes.

5.4.2 Implications for education research in Tanzania

Research has consistently shown that language is a barrier to effective teaching and learning in Tanzanian secondary schools (Arthur, 2001; Oyoo, 2007; Brock-Utne *et al.*, 2010). However, so far there has only been limited research into how teaching and learning can support learners attempting to navigate the transition from primary to secondary (Rubagumya *et al.*, 2011). Although there is considerable activity currently in Tanzania, much of it funded by donors and NGOs, focused towards developing learning materials (e.g. Ngwaru *et al.*, 2013/4; the UKAid funded EQUIP programme) this is almost entirely focused on the primary level. At secondary level, initiatives have tended to focus on developing materials for teachers (e.g. TESSA). This pilot has shown that language supportive pedagogies supported by well-designed materials build on teachers' existing practices and are consistent with their educational values. This suggests that language supportive teaching can be feasibly introduced into secondary schools as long as it is supported by learning materials. However, there is a need for research to go beyond documenting the difficulties of English medium education to innovate and trial language practices in order to find out what can work in the material, educational and political context of Tanzanian.

One large-scale research project, Language of Instruction in Tanzania and South Africa (LOITASA), did seek to explore the potentials of monolingual Kiswahili medium education. However, this section of the research was constrained to small-scale research in the private school by a policy environment that insists on English medium secondary education (Brock-Utne *et al.*, 2010). Research on examinations and assessment in Zanzibar suggested that transition to monolingual Kiswahili education might not be straightforward, at least for students who have already had part of their education in English. Research in other African countries has extensively explored language use in multilingual classrooms and much of this research identifies bilingualism or multilingualism as realistic language of instruction options for multilingual African societies (Setati *et al.*, 2002; Hornberger, 2002; Benson, 2004; Chimbutane, 2011; Clegg & Afitska, 2011). However, research in the Tanzanian context is much more limited (Rubagumya *et al.*, 2011). There is a need therefore for

further research that seeks to build on and develop existing bilingual practices to bring about stepwise improvement in teaching and learning.

This research highlighted Mathematics and Biology teachers' limited knowledge of how to develop language and the role of language in the teaching and learning of this subject. Teacher education research could usefully explore ways to develop the knowledge and skills for integrating language and subject teaching and fostering collaboration between language education experts and subject experts.

We observed sharply gendered classrooms in two out of three districts in which we collected data. We recommend that language in education research pay attention to how the symbolic value of language, noted to influence social relations in other schooling systems, (Creese *et al.*, 2011) interacts with gender to produce strongly gendered classroom dynamics, particularly in classrooms where students are in the minority and teachers' conscious and unconscious roles in perpetuating gendered classroom norms.

Finally, there is considerable expertise in the international publishing industry in developing teaching and learning materials that support the development of English for Academic Purposes (EAP). However, there appears to be little articulation between EAP publishing departments and departments producing secondary textbooks for Africa and other contexts where English is a second language for the majority of learners. We strongly encourage publishers to draw on the expertise they already have in-house to develop language accessible and language supportive school textbooks for Anglophone African countries.

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Appendix 1 – Pilot Tools

Lesson Observation schedule

Guidance notes

Only consider pedagogic interactions.

Only count interactions or activities that are part of subject teaching. Do not count or comment on interactions that are mainly about regulating or controlling student behaviour (i.e. discipline).

Codes for language used in an activity:

Use the following codes to indicate the language used for an activity:

English only	EO
Mostly English	EM
English & Kiswahili equal mix	EK
English & Vernacular equal mix	EV
English, Kiswahili & Vernacular equal mix	EKV
Kiswahili only	KO
Kiswahili mostly	KM
Kiswahili & Vernacular equal mix	KV

Section B: if you have placed ✘ in 2nd column, leave 3rd column (language) blank.

Section C: Use as many sheets as needed. This will depend on number of separate activities during the lesson. You will need to take 4-5 sheets into each lesson although you may not use them all.

Sections D: if you have placed ✘ in 2nd column, leave 3rd column (language) blank.

Insert school identifier codes if being used:

Section A - Observation Details			
A1 School:			
A2 District, Region:			
A3 Researcher's name:			
A4 Teacher's name:			
A5 Subject:			
A6 Planned Duration:	40 mins <input type="checkbox"/>	120 mins <input type="checkbox"/>	Other: mins
A7 Time lesson started:			

Section B - Lesson introduction	✓/✗	Language code
B1 Teacher jumps straight into lesson content.		N/A
B2 Teacher reminds students what was covered in last lesson.		
B3 Teacher asks students to recall what was covered in last lesson.		
B4 Teacher finds out from students' what they already know about topic		
B5 Teacher states topic and learning objectives for lesson.		
List learning objectives:		
B6 Links are made to previous topics		
B7 Teacher explains or asks students why the topic is relevant, useful or interesting		
B8 Students appear interested in topic from the beginning		
B9 The text was used in: Introducing topics		N/A
Making links to previous learning		N/A
Arousing students' interest or showing relevance of topic		N/A
Further observations:		

Section C. Lesson Activities

ACTIVITY No. language code	Activity type (ring)		Time Start	Time Finish	Text ref. e.g. Ex. 7.2, p. 6	No. students working together	
ACTIVITY ____ Language:	Listening	Talking				1	3-5
	Reading	Writing				2	> 5
What did the teacher do? Note language used.							
What did students do? Note language used:					Gender or other inequalities in participation:		
Evidence of student learning:				Evidence students' not learning/understanding			
ACTIVITY ____ Language:	Listening	Talking				1	3-5
	Reading	Writing				2	> 5
Description of activity & support given:							
How was language used?							
Observations of student participation:					Gender or other inequalities in participation:		
Student learning evaluated? Yes No How?							
Did teacher record student learning?			Yes	No			

Section D. Lesson closure	✓/*	Language code
D1 Lesson ends abruptly		N/A
D2 Main learning points are re-capped.		
D3 Teacher refers back to learning objectives		
D4 Student learning is evaluated		
D5 Links are made to previous topics		
D6 Teacher explains or asks students why the topic is relevant, useful or interesting		
D7 Students appear interested in topic at end of lesson		
D8 The teacher set homework		
D9 The text was used in:		N/A
Recapping learning points/checking objectives		N/A
Making links to previous learning		N/A
Highlighting relevance of topic		N/A
Setting a writing activity for homework		
Setting a reading activity for homework		
Further observations, e.g. how was student learning evaluated?		
TIME LESSON FINISHED:		

Section E. Overall student learning	
E1 Overall, what was your impression of student learning?	
Most of students achieved all learning objectives	
Around half of students achieved all the learning objectives	
Most of students achieved some of the learning objectives	
Around half of students achieved some of the learning objectives	
Most of students did not achieve the learning objectives	
What makes you think this? Any further comments:	
E2 Which activities or pages from the text covering the lesson topic were not used?	

Interview Schedule for teachers

Guidance notes

Interview the teachers after the lesson observation.

Try to keep the interview relaxed. It should feel like a discussion between two professionals and not like a researcher asking questions.

Use whichever language (English, Kiswahili or mix) is easiest and most comfortable.

You may not need to use all the prompts in all interviews. Some teachers will give full answers to the first question. Others will want you to give more guidance on how you would like the questions answered, then you can use the prompts.

Starting interview

Explain that the purpose of the interview is to find out the teachers' views on the draft chapter and how well it supports students' learning.

Student learning in the lesson

1. What were your learning objectives for this lesson (What did you want the students to learn)?

Prompt 1: You have mainly talked about subject content. What skills, if any, did the students develop in this lesson?

Prompt 2: You have mainly talked about subject-specific skills and content. Do you think the lesson helped the students to develop knowledge and skills that are useful for other subjects?

Prompt 3: Do you think it helped them to develop the English language they need for learning *insert subject*?

Prompt 4: Do you think it helped them to develop English language skills that are useful across other subjects?

Prompt 5: What about ...*insert other subject-specialist skills or topic-specific skills/knowledge* ...?

2. How well did all the students achieve these learning objectives?

Prompt 1 : How do you know?

Prompt 2: What did they find difficult? Why?

Prompt 3: Which skills and knowledge are they still learning?

Prompt 4: Which student did not achieve learning objectives? Why?

3. I noticed [*girls, boys another group of students – refer to notes in section C of observation*] were not participating as much as other students. Did you notice this?

Prompt 1: Does this normally happen in your lessons? Why?

4. Will you continue with this topic in next lesson or move to new topic?

The lesson activities

I noticed that you used the following activities in the lesson.

List the activities. You may show the completed section C of the observation schedule to the teacher and use this to guide the conversation.

For each activity ask:

5. How did this activity help achieve the learning objectives? (Or, Why did you choose this activity?)
6. In your opinion did the activity work well?
 - Prompt 1: What did you like/not like about this activity?
 - Prompt 2: How well do you think the students participate?
 - Prompt 3: What did the students find difficult?
 - Prompt 4: What might have been done differently?
 - Prompt 5: I noticed that students/you spoke Kiswahili when ... , students/you spoke English when [refer to notes in section C of schedule on language use]. Would you normally do this? Do you think it helped?
 - Prompt 6: The text/teachers' guidance notes suggests students use Kiswahili for student discussion and they report to the whole class in English. I noticed you did/didn't allow this. Did you think it worked doing it that way?

The draft chapter

7. Did you find the text useful? Yes/No
 - Prompt 1: In what ways was the text useful?
 - Prompt 2: Were the English-Kiswahili glossaries useful? How might they be done differently?
 - Prompt 3: Did the illustrations help the students to understand the text?
 - Prompt 4: Should more or less content be in Kiswahili? Why?
 - Prompts 5: Was the level of English simple enough for the students to understand? Should it be more or less simple?
 - Prompt 6: Were the ideas for activities useful? Which ones? Why did you like them?
8. Do you think the activities are enough to develop students':
 - Listening skills? Yes/No Please comment.
 - Speaking skills? Yes/No Please comment.
 - Reading skills? Yes/No Please comment.
 - Writing skills? Yes/No Please comment.
 - Vocabulary? Yes/No Please comment.
 - Grammar? Yes/No Please comment.
 - Anything else? *Add subject specific skills here*

9. I noticed that you did not use the following activities/exercises/pages from the draft chapter?
[Refer to E2 in observation schedule – the very last item].
10. How does this chapter differ from the book you would usually use?
 - Prompt 1: Which book do you prefer and why?
11. How could we improve the chapter?

Interview schedule for students

Guidance notes

Interview the students in a group of after the lesson observation. Try to make sure that students are relaxed and are not thirsty or hungry. Their teacher should not be in the room.

Starting interview

Explain that the purpose of the interview is to find out their views on the lesson and the draft chapter.

The lesson

1. Have you covered this topic before? Where and when?
2. What new things did you learn in the lesson?.....
3. Was there anything you did not understand?
4. What was interesting in the lesson?
Why?
5. What did/didn't you like in the lesson?
Why?
6. Which activities were easy for you to do?.....
What do you think made them easy?
7. Which ones did you find difficult?
What do you think made them difficult?
8. Which activities were more interesting/fun to you?
What made them interesting/fun?
9. I noticed that most students in the lesson used Kiswahili when ... and English when
Why did you do this?
Did it help you learn the lesson topic?
Did it help you learn English?

The draft chapter

10. Did you completely understand the English text?
Which parts of the text were easy for you to understand?
Why?
Which parts were difficult?
Why?
11. Which illustrations did you like?
Why?
Did it help you to understand the written text?

12. Which ones didn't you like?

Why?

13. Did it help to have some of the English words explained in Kiswahili?

Did you know some of the English words already? Which ones?

Which words did you not know?

Are there other words that should be translated into Kiswahili?

14. Have you used this chapter or other chapters for study outside of the classroom?

What sections have you used?

Were they easy to understand?

Were they helpful?

15. Have you tried any of the exercises/questions?

Which ones?

Could you do them?

Did they help you to learn the topic?

How?

Add any questions specific to subject or topic here or earlier in this section.

16. How could we make this chapter better?

Appendix 2 – Vocabulary for glossing

English vocabulary

Table Ax2.1 Vocabulary in English chapters that students identified as difficult

Words observers noted were difficult to pronounce	Difficult words identified by students	Other words that should be translated	Examples students gave of familiar words
Exercise 1.2			
returned Edinburgh history St Mary's St. Francis career politics chairperson	believe, believed, carrier, travels, completed, spoke tradition, both, like, dead, teaching, on-behalf, today, sure advocate Edinburgh, Britain, Scandinavia, OAU Retirement, retired Communal, political, economic, independence & Independent, citizen, united, republic, organization University, taught, speech Diploma, president, although, service, tradition, Union,	Africa, Tanzania, Mozambique, United, National, republic Economic, Political, Government, Citizen, Services, communal, political, independence, the first president of Zanzibar, Suffering, conflicts Believe, believed, Travel, vigour, sentence, writing, live in, born, continued, retirement, respect, people, work University, education	born, life, lived, death, dead, like, liked, complete, happy, walking, energy, village, drink, mother, story, children, retirement, traditional school, primary, secondary, return, teaching, teacher, primary, secondary, university, college, staff, studies African, Mozambique, country union, government, TANU, citizen, political, economic, independence, chairperson
Exercise 2.1			
	achievement, congratulation, pleasure, serious, vocation	hesitate, journey	
Exercise 2.6-2.10			
	Forecast, model		

Biology Vocabulary

Words and expressions cited by Biology teachers and students as difficult were:

- mitochondria
- digestive system
- endoplasmic reticulum
- genetic material
- paramecium
- ribosome
- plathelminthes
- flagellum
- endoplasmic reticulum
- chloroplast
- cytoplasm
- vacuole
- lysosome
- Golgi apparatus

Mathematics vocabulary

Table Ax2.2 Student feedback on Mathematics

	Words students say need translating	Words students said they knew
Front matter	acknowledgement	
Section 1.1-1.2	patterns, quantity, required algebra, total, should, small, depending sticks, patterns, replace, squares, matchsticks variable, multiply, constant, term	definition
Section 1.3	Multiplier	value
Section 1.4	Tablet, consecutive, horizontal, inequality, certain, corresponding, illustrated, arithmetic, harvested, reciprocal	Equation, solution, true, solve, value, unknown, example, sum, product, time and many more
Section 2.0-2.1	Because, write, Activity, less than, greater than, solution, letter, formula, the model statement , consider, expression, something, algebra, typical substitute, represent, summary, division, variables	Greater than, Mathematics, John is a boy, exercise, now, explain, language, so. false, true, Because, why, of course, Activities, multiply, division
Section 3.1	Summary, unknown, extension, project, inequality, word or phrase, prove, ignoring, coefficient, simultaneous, throughout	Formula, simplify, algebraic equation