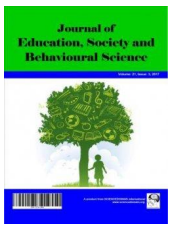

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From Access to Quality Secondary Education: Developing Language Supportive Textbooks to Enhance Teaching and Learning of Biology Subject in Tanzania

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Authors' contributions

This work was carried out in collaboration between all authors. Author PG designed the study, performed the analysis, wrote the protocol and wrote the first draft of the manuscript. Author ES managed the analyses of the study and proof read the manuscript. Author RA managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

This paper reports findings from the development of Language Supportive Biology Textbook (LSBT) for Form I students in Tanzanian secondary schools to address the challenge of language barrier to learning. The LSBT was thus developed to facilitate smooth transition from Kiswahili to English language medium of instruction in learning Biology. The study used a participatory action research design that involved 2 experts from Tanzania Institute of Education (TIE), 2 Biology specialists from universities, 1 language specialist from UDOM, a total of 12 Biology teachers and Form I students from 12 rural secondary schools located in Dodoma, Lindi and Morogoro Regions in Tanzania. Accordingly, we designed and prototyped a Biology textbook that is language accessible, supportive and relevant to Tanzanian context. We presented Biology content using a variety of illustrations and

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hands-on activities. The language features included English-Kiswahili glossary on each page and bilingual activities within which Kiswahili is used as a resource to learn English. Besides, the material has learning activities filled with examples drawn from the students' context. The study used classroom observations during prototyping process, analysis of experts' reviews, and the interviews with teachers and students to gather data to document the development and effectiveness of the LSBT. The overall findings indicated that students' interaction in learning through talking, negotiating meaning, forming sentences, and presenting biological facts increased than it was before. The paper recommends that it is necessary to use of action research that involves educational stakeholders to develop potential features of a language and pedagogical supportive textbooks for quality education.

Keywords: Language supportive textbooks; bilingual activities; participatory action research; educational stakeholders; quality education.

1. INTRODUCTION

Quality education largely depends on effective classroom interaction among teachers, students and learning materials. Communication enriches this interaction and enables students to draw upon previous experience to understand and evaluate the present, shape future actions, and formulate new knowledge [1]. It is further argued that effective communication brings about effective interactions, which in turn enables students to participate actively in constructing knowledge and practicing it for survival in their societies [2]. In this regard, the effective use of language during learning process is an important ingredient to achieving quality education.

Around the world, effective use of language has become an educational challenging agenda. It becomes even more challenging to countries such as Tanzania where the language used as a medium of instruction is neither the mother language nor the language which majority of students are fluent [3]. Tanzania, which has more than 120 ethnic community languages [4], uses Kiswahili and English as languages of instruction at different levels of education. While Kiswahili (a national language) is used as language of instruction throughout the Pre and Primary education (with exception of few English medium primary schools), English (a foreign language) is used in secondary and post-secondary education.

There is no doubt that the importance of English Language in the global market cannot be undermined. However, the use of this language which is insufficiently developed among learners in Tanzania, at the expense of Kiswahili language in which students are fluent has been indicated to hinder effective classroom interaction. Eventually, the use of insufficiently developed English as the language of instruction lowers the quality of learning in schools [5,6]. There are more adverse effects in Form I class since this is a class which learners experience an abrupt transition from Kiswahili to English. Consequently, students at this class learn through code switching and code mixing which do no help them to understand the subject content and communicate their competencies very well [1,7,8]. It is the time they have to struggle to learn English, the language of instruction, and at the same time learn subject content [9]. This challenge is further escalated by conventional textbooks which are not friendly to learners with regard to the level of language used and the kinds of assistance provided to learners in the textbooks.

The problem of textbooks in Tanzania draws from a dynamic situation in the design, development and approval process. Initially, since its establishment, the Tanzania Institute of Education (TIE) had two roles: to oversee the processes of curriculum development and textbooks writing. However, since 1990, the role of developing textbooks is left in the hands of the private sector. The market driven policy of textbooks empowers school committees to decide the kind of textbooks to buy and use [10]. Even though the educational material control organ (EMAC) was established by the Government of Tanzania to control the quality of the textbooks, the quality of the textbooks has never been guaranteed. HakiElimu [11] revealed a lot of content and language errors in various textbooks in schools. Consequently, the EMAC was dissolved and this creates a further loop hole of supplies of the low quality textbooks in the schools. Some of the textbook writers are more money oriented on the expense of the quality of the textbooks they write. This ground from the fact that the learners' background and language characteristics are largely overlooked

in the textbooks. The textbooks use difficult language, long sentences and have whole pages of dense text [9]. In a comparative analysis, Barret [9] observed that the fluent English native speakers at the same stage in England would struggle to read many Tanzanian textbooks.

This paper urges for a closer look on the environment at the language transition classes in which students are supposed to learn foreign language and use it to learn subject content simultaneously. We analyzed this learning environment by involving different key educational stakeholders to develop a language and pedagogical supportive textbook that potentially suits the language transition classes. This paper, therefore, draws from an action based research study that designed and developed a language supportive Biology textbook for Form I class for secondary school students in Tanzania. The paper begins by explaining the current education system in Tanzania, which has particular implication to textbook writers.

2. THE EDUCATION SYSTEM IN TANZANIA

The Tanzanian education system consists of 2 years of pre-primary education (5-6 years), 7 years of primary education (7-13 years), 4 years of Ordinary Level Secondary Education (14-17 years), 2 years of Advanced Level Secondary Education (18- 19 years), and 3 or more years of higher level (university) education [10]. The movement from primary to secondary schools depends on the successful completion of advanced level secondary education. This is also the case for the movement from ordinary level to advanced level secondary education. This education system is provided under the Education and Training Policy (ETP) of 1995. However, the new Education and Training Policy, which got its approval in late 2014 proposes a new structure. The new structure has not yet been put into implementation, hence the old one still holds to date. The official language of instructions differs at different levels with Kiswahili language being used as the language of instruction throughout all the public pre and primary education levels. On the other hand, English Language is used as a language of instruction in few pre and primary, all secondary schools and in higher education levels.

However, for two past decades now, there has been an ongoing debate on whether the country should change the language of instruction from English to Kiswahili. There are two camps with regard to this debate, one camp supporting the use of Kiswahili language throughout all levels of education. This camp holds that Kiswahili is the national language and the language which most students are fluent. The other camp is in favor of using the English Language in secondary schools with the argument that it is a global language and the international language of communication in the global economy. Regardless of the continuing debate, ETP-1995 is of the stand that English has to be used from secondary to university level. This provision is also supported by many parents and policy makers in Tanzania with an argument that, in addition to mastering of the curriculum content the students must also master English Language if we need to compete in the global economy [12]. However, the new ETP-2014 is a bit dynamic and suggests for the use of both languages, Kiswahili and English in all levels of education in Tanzania. Despite this suggestion, the new ETP does not provide how this is to be effectively implemented. Perhaps, in such language transition classes in Tanzania, a bilingual approach where Kiswahili is to be used strategically to support learning of English language and the curriculum content sounds to be promising.

While there is a challenge of the language of instruction and unfriendly books for learners, the ability of teachers to successfully guide students' learning in classrooms is hindered by the overcrowded classrooms in secondary schools due to the increase in enrollment. This significant increase is credited to the great role played by PEDP and SEDP programmes. As a strategy to realize the Millennium Development Goals (DMGs), the Government of Tanzania (GoT) launched the Primary Education Development Plan (PEDP) to revitalize the education system. Among the key achievements of the implementation of phase I of this programme (PEDP I – 2002/2009) was a tremendous expansion of access to primary education that lead into extra more primary school graduates moving into ordinary secondary education level. This achievement demanded a deliberate plan for development of secondary education tier in order to absorb a huge number of primary school graduates. So, in 2004, the Secondary Education Development Programme (SEDP I -2004/2009) was established. Like PEDP programme, improvement of access to secondary education was one of the key objectives for SEDP I [13].

The review of SEDP I in 2009 indicated great achievement made under access, as enrolment to Form I increased by 249 per cent (from **432,599** in 2004 to **1, 466,402** in 2009) while the transition rate from primary to secondary education improved from 36.1% in 2004 to 51.6% in 2009 [14]. This expansion of access to secondary education was largely due to the increase in the number of schools which rose from **1291** in 2004 to **4102** in 2009 (296% increase). In 2013, enrollment in secondary education stood at **1,804,056** in more than **4500** schools [15]. This success in the improvement of enrollment, which in turn increased access to secondary education, resulted in a number of challenges. Among them include a serious concern about the quality of learning by the students, which also depends on the quality of teaching. This concern is apparently more serious for Form I students transitioning from primary school level of Kiswahili language-medium to Form 1 of ordinary secondary level, English-medium. Thus, for the majority of these students in the medium transition classes are not conversant with the new medium of instruction [1,9].

There is enormous research-based evidence which shows that majority of secondary school students in Tanzania lack basic English language proficiency and literacy required for effective learning of concepts in various subjects. This problem is compounded further by textbooks whose language accessibility by the students is far less as they have too complicated sentence structures and vocabularies to be comprehended by learners [1,9]. Related finding are reported in a study by [16] and Twaweza [17] where they report to have noted low levels of English Language proficiency as an obstacle for students' learning in secondary schools. To address the above problem, Language Supportive Teaching and Textbooks (LSTT) project in Tanzania was developed as collaboration between four universities and the Tanzania Institute of Education (TIE) since 2013. The universities include the University of Bristol through the Graduate School of Education; the University of Dodoma through the Colleges of Humanities and Social Sciences, and the College of Education; Jordan University College of Tanzania and the Institute for Educational Development-Aga Khan University East Africa Campus.

The project is set to support effective learning of students at the language transition classes in three subjects namely English, Mathematics, and Biology. These three subjects are the challenging subjects and hence the country's priority in the efforts to improve its quality throughout the country. A study by Twaweza [17] further emphasizes that the aforementioned three subjects are the most challenging subjects among secondary school students in Tanzania. This paper is specifically focusing on the procedures to design and develop language supportive Biology textbooks (LSBT).

3. THEORETICAL FRAMEWORK

The social constructivism learning theory proposed by Levy Vygotyky in 1978 informed the researchers in the designing and prototyping of learning experiences in LSBT during the study. According to Vygotsky [2], learners construct their own understanding based upon their previous knowledge, beliefs and experiences in connection with the new knowledge. The theory is also based on the fact that learning takes place as learners interact with one another and through language [18]. The development of the LSBT needs to consider the experiences the learners bring into the learning process and connect it to the new knowledge through various engaging activities. These are important to provide effective interactions during the learning process. Thus, the combination of information, methodology, activities, and connections of ideas developed in the LSBT materials can promote learning.

Again, under social constructivism, learners' interaction, culture and language of instruction are the important aspects to be considered in learning process and thus the development of the LSBT. Language needs to be clearly understood by the students for effective learning to happen. Also, the learning experiences need to be related to the learners' contexts. Within this framework, learners construct their own knowledge; new learning depends on learners' prior knowledge; social interaction plays critical role in learning, authentic learning tasks provide meaningful learning and language of instruction plays a great role in learning [19]. Thus, the theory guided the characteristics of the LSBT materials. The material should be activity based, foster social interaction among learners, language supportive to both students and teachers, focus on learners' prior knowledge as well as reflect learners' life experiences.

4. DESIGNING AND DEVELOPMENT OF THE LEARNING MATERIALS

Various scholars in Tanzania have designed various curriculum materials as a strategy to overcome some specific learning challenges. For example, Teacher Education Assistance in Science and Mathematics (TEAM) in Tanzania designed exemplary materials for teaching and learning of Mathematics in secondary schools [20]. The learning materials aimed at supporting students with different hands on activities in learning mathematics rather than depending on theory only. In the similar vein, Maro [21] designed a programme to support activity based Biology teaching and learning in Tanzania. The use of activity based learning was thought important for students' effective learning and the two studies impacted positively in the learning process [14]. However, the learners' engagement in activities was observed to be obstructed by the language of instruction which is English [4,7,9]. The study by Gabrieli and Mastura [22] designed activity based learning in English subject for Form I students in Tanzania. The prototyping of the learning materials was conducted in Ng'ong'onha secondary school in Dodoma Region in Tanzania. To support teachers in using activity based lessons especially in Teaching short stories, Gabrieli and Elisa [1] designed teacher professional development programme for teachers and prototyped the program in three secondary schools in Dodoma. The analysis of students' and English teachers' learning in these two studies demonstrated positive learning. However, the teaching of other subjects such as Science and Mathematics needs an intervention to support students learning of the subject itself and English simultaneously.

Support learning Mathematics and English language simultaneously, the study by William and Ndabakurane [3] developed language supportive textbook for Mathematics learning in Form I students. The findings indicated that most students gained confidence and interest in Mathematics having used the textbooks. Studies [1,3,22] used bilingual learning theories and action research design to develop teaching and learning materials in English language and Mathematics subjects for Form I students in secondary schools in Tanzania. More effort is needed to develop teaching and learning Biology subjects to support students to learn Biology subject and at the same time develop English language proficiency. The current study is therefore intended to develop a Language Supportive Biology Textbook (LSBT) to support Form I students in secondary schools in Tanzania learning Biology subject and English language simultaneously.

5. STUDY LOCATION, SAMPLE AND SAMPLE SIZE

The design and development of the LSBT was piloted in twelve (12) wards secondary schools located in Dodoma, Morogoro and in Lindi Regions in Tanzania. These three (3) regions were observed lagging behind other regions in terms of the performance with reference to Form Four national examination results. In 2011, the above three regions ranked 21st, 12th and 13th respectively out of 21 regions in the Form Four national examination results in Tanzania [3,9]. The same regions have 53%, 34% and 29% respectively of households fall below the poverty line [23]. The majority of learners in these rural regions speak a local vernacular language (not Kiswahili), so English is a third language for students. Thus, students in these regions are fluent in their mother tongue languages (most cases vernacular language), Kiswahili (national language) being their second language and English language (foreign) being their third language. Therefore, any effort to improve the quality learning seemed worth to start from this end. The LSBT has been designed and developed as part of a wider language supportive pedagogy approach which focuses in supporting Form I students in secondary schools to learn the subject content and at the same time learn English Language. A total of twelve (12) Form I classes, one from each of the schools were used for prototyping and assessing the effectiveness of the LSBT. A total of twelve (12) teachers teaching these classes were purposely sampled to involve in the designing and assessing the effectiveness of the materials during the study.

6. RESEARCH APPROACH AND DESIGN

To come up with the effective textbooks that potentially can support students to learn both language and subject content simultaneously we thought that it was important to bring together science educators, language specialists, Biology teachers, and Form I students. The development of the LSBT uses the participatory action research design. In this design, the key players in the education system are involved in the process of planning, implementing with revisions, reviewing the plan to improve the material [24]. The process of planning, implementation and

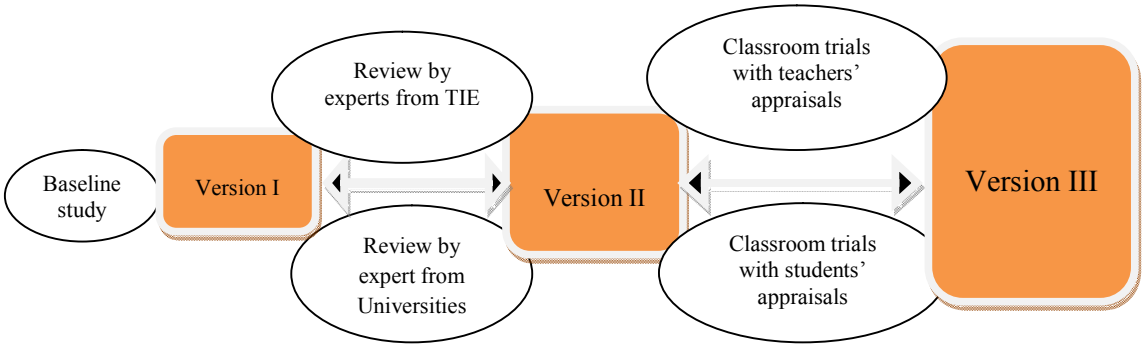

Fig. 1. Stages in the development of the biology textbook

Key: 1. The components in the Figure indicate the interactions of the key players
2. The increase of the size of the versions indicates the quality growth of the LSBT

re-planning have to involve the key players in the utilization of the material, which in our case includes researchers, curriculum developers, teachers and students. The interaction of these key education stakeholders is presented in Fig. 1.

The development of version I of the LSBT was based on the findings from the baseline study that included the analysis of both the conventional Biology textbook and the current syllabus. The baseline study was designed to generate recommendations for the design of the LSBT. Before writing the book, we needed to know the average and range of reading ability of Form 1 students, who are using the book. We also sought to know teachers and students' needs from a textbook. This was important to make sure that we address the gap that was not addressed by the conventional textbooks available in the market. The aim of the baseline study was to establish the kind of textbook, including teacher guide, which supports subject learning and English language acquisition for Form 1 students in secondary schools.

Version I was then reviewed by the curriculum experts from the Tanzania Institute of Education (TIE) and Biology experts from the University of Dodoma and Bristol University, and a linguist from the University of Dodoma. The review made by the experts enabled improvement of version I to the development of version II of the LSBT. Based on the teachers' and students' comments during the classroom implementation of the LSBT version II, the re-planning and revision of the materials were made to get the version III of the textbook. During all these stages, most of the qualitative data from the participants, that included their comments, suggestions and feelings, were sought through interviews. The observation during the classroom trials were also used to inform about the practicability of the learning experiences suggested in the textbooks.

7. FINDINGS IN THE DEVELOPMENT OF VERSION I

The development of the LSBT was preceded by a baseline study which was conducted between May and June 2013. In the baseline study, Form I Biology textbooks were reviewed, and students' reading ability was assessed to know their ability to interact with the particular textbook. The findings from this stage indicated that the conventional textbooks were not accessible to Form I students. The textbooks were found to have long and complex sentences and difficult words for learners. The textbooks use language that is beyond Form 1 students' level of understanding. There are few visuals in books most of which do not illustrate concepts adequately. Also, there are limited activities that support reading or hands-on-activities such as experimenting new ideas, discussions and other reflective activities believed to be important for science learning. Given these characteristics, the books did not support learners to learn.

No translations are given in the books for difficult terms used in the textbooks. There are few or no activities that support students to talk, write, or read in English. Nowhere in the textbooks analyzed that the students are offered text-based resources that support them to improve their English proficiency for academic purposes. Moreover, despite that the Biology content generally coincides with the national syllabus, it offers few or no activities consistent with the learning processes promoted by the syllabus and

consistent with language supportive pedagogy. Our critics of the conventional Biology textbooks ground from the fact that textbooks need to focus not only in developing the subject content mastery, but also on developing proficiency in English Language (language across curriculum) which is the language of instruction.

These findings indicate that Form I Biology textbooks in Tanzania use difficult language that is certainly not understood by the majority of students. Generally, a large part of subject content in Form I Biology subject is built upon or revised subject content from primary schools. The difference then is the change in language of instruction. This being the fact, it is fair enough to claim that the language of instruction used in Form I classes is the hindrance for learners to gain knowledge even when they repeat the same content they learned in primary school. In the same veil, the textbooks do not support interactive learning, feature of the 2005 Tanzanian syllabus which interprets interactive learning as involving group and pair work, discovery activities and discussion.

The interactive learning that involves students in exploring and processing ideas through talking, writing and reading in both language in which they are fluent and the language of instruction is known to support language acquisition [25]. Based on these findings, the design of the textbook that can potentially narrow the identified gaps was envisaged. The aim was to have an exemplary Biology textbook that is language and pedagogically supportive. Key characteristics of the book were proposed to be: use of simple language, short sentences and avoidance of long chunks of texts, use of illustrations, and the use of Kiswahili Language (which students are fluent) in learning English Language and the subject content simultaneously. All these are the preliminary design guidelines that assisted in developing version I of the Biology textbook.

7.1 Development of Version II

Version I of the Biology textbook was reviewed by two teams of experts; the curriculum experts from the Tanzania Institute of Education (TIE), the curriculum experts and language specialist from the University of Dodoma (UDOM), and Bristol University in London. All these experts were given a copy of the document and requested to give their recommendations for the refinement and the improvement of the textbook.

7.1.1 Experts from TIE

Two curriculum developers reviewed the first version of the textbook and brought fourth their suggestions for improvement. Their recommendations contributed to further improvement of the book regarding the current Biology syllabus published in 2005. They emphasized on the need of stating the lesson objectives on each chapter of the textbook. In addition, these experts appraised the strategies used in the development of this textbook by involving them. One of the experts confidently said:

> *"The textbooks developed in collaboration of the universities and the TIE is going to be an exemplary one. I am sure that the Biology team at the universities has the skills enough to come up with the book, but by incorporating our comments and other education stakeholders you are definitely making a wonderful and quality textbook".*

This quotation reflects that involving as many education experts during textbook development is a new practice in Tanzania. TIE people informed one of the authors that it is now common for people in the book market to develop a book without trying-out because it is a time and money consuming exercise. Thus, to maximize the profit, they just lock themselves in a room, sit on the table and write the content and print a book ready for supplying just without trying-out in the classrooms or even involving other key educational players.

7.1.2 Expert from Universities

Most of the comments given by experts from the University of Dodoma (UDOM) and Bristol University had significant input that helped to put the book in the learners' environment (Tanzania environment). It is obvious that science subjects, such as Biology, are reflected in the global scientific knowledge and facts. However, the experts insisted that the examples and illustrations could refer more frequently to rural contexts and portray people living with very modest means. This was suggested to enrich the book with more and diverse ecology that draws from Tanzania context. These suggestions were incorporated in the book by, among other things, developing activities and examples that take into account the context of schools in Tanzania by (i) referring to local fauna, wildlife and ecologies; and (ii) using only materials that are readily available in the local environment to avoid

penalizing students from poorly resourced schools.

Other suggestions that were incorporated in the book concerned the layout of the book where each page is divided into two main parts, namely the main texts and the guide parts. Accordingly, the main text sections had to include the introduction of the chapter, objectives, lesson's activities, illustrations, notes, and summary and conclusions of the chapters. On the other hand, the guide sections had to include some scaffolding hints to both students and teachers who are the users of the textbook. The hints included the key ideas, glossaries, did you knows, and the extension activities. Furthermore, the curriculum experts from the university which were incorporated in this book were that the main learning activities were tied with the reading, talking, writing activities. One of the experts said:

> *"Students are needed to develop reading, talking and writing skills so as to participate actively during the learning process. These skills are lacking in most of our students. These skills are very important for these students to develop English Language fluency and mastery of the subject content".*

Based on this, the book included these three components on the fact that the students need help with reading, talking and writing about Biology. The think-pair share, group work, and presentations during the learning process are some of the strategies used in the textbook to support students in Biology and language proficiency development. Moreover, there are specific areas in the preliminary pages where there is what we called useful teaching strategies thought to be helpful to teachers when teaching Biology using this textbook.

7.1.3 Language Specialist

The language specialist had a role to review and comment on the extent that the textbook is language supportive. Understanding that most of the Form I students have very limited knowledge in English Language, most of the comments were based in using of the simple terminologies and short sentences. For example, he advised that;

> *"It was logical and practical to have the designed book giving knowledge in short and simple English sentences".*

Giving simple terminologies in Biology textbooks sound to very good idea as many students and teachers perceived that Biology is a difficult subject to study as it is used difficult English terms that are derived from Latin language. In addition, the expert commented on the use of the Kiswahili language which most students are fluent. The expert urges that the total immersion approach in learning English language in for most of the day schools can hardly work and call upon the bilingual approach in learning English. In this regards, the Kiswahili has to be used as a resource during the learning process. He said;

> *"The need to put English-Kiswahili glossary on each page and bilingual activities within which Kiswahili has to be used as a resource to learn Biology content alongside learning English Language is strategically important to make students learn both English and biology content together".*

This is an important enrichment noted in this textbook. Through the book, teachers are therefore required to elicit knowledge through Kiswahili and slowly guide students to understand what they already know in English and then use Kiswahili language as a resource for students to gain knew knowledge in English. Furthermore, bilingual learning activities where students have to remember a word in Kiswahili and relate it to the English term were developed. Nevertheless, group work activities where students can talk in Kiswahili first and then discuss and write down in English as well as to report their findings in English language were also developed to ensure that the students develop English language proficiency and content acquisition in Biology concepts.

7.2 Development of Version III

Development of version III the LSBT was based on the teachers' and students' appraisal. During this stage, teachers got a one day workshop to learn how to make classroom implementation of the textbook. This was followed by the actual classroom settings where teachers implemented the lessons while the researchers were observing the classroom implementations no note areas for further improvements. Teachers implemented it in the classroom after having a briefing session with the researcher in a one day seminar before the classroom tryout sessions.

7.2.1 Appraisal from teachers

During the seminars, most Biology teachers were of the opinion that the diagrams and illustrations

needed to be colored and the photos in the book should display the natural view of the organisms. Teachers were really interested with the books; in particular, they liked the glossaries on each page of the book and argued that the glossaries will help their students to understand better since translation of difficult words were provided immediately in the same page. The teachers informed the researchers that some vocabularies were missing in the glossary and so they should be added. However, other teachers had the opinion that the textbook could have indicated specific areas where Kiswahili or English had to be used. However, during classroom observations, the researchers observed that some teachers had difficulties in effectively using the two languages for classroom teaching. Based on the observations made and the recommendations made by teachers, the researchers decided to put it clear that Kiswahili and illustrations in the textbook is to be used strategically to support English Language proficiency and the learning of the biology content. Also, some icons indicating some specific areas where Kiswahili or English Language should be used were inserted in the book. However, it is insisted in the book that English has to be used in all activities of writing and presenting some different tasks during the lesson.

Moreover, the teachers expressed their positive feelings concerning the use of the guides on the preliminary pages particularly on the tips on learning Biology and English together, using Kiswahili for learning, how the textbook helps students to learn, and the useful teaching strategies. The teachers also praised on the teachers' briefing seminar and the support provided to them before, during and after classroom observation. To them, it is of great help not only for this book, but also for their professional growth in general. One of the teachers said that:

> *"You made a good decision to involve us in developing this textbook. It was a great opportunity to meet with teachers in the neighborhood schools for the first time".*

This was supported by another teacher who said that even meeting with the people from TIE was another opportunity for their career development. In these two cases, teachers were of the opinion that the professional link established during the development of this book for them was extremely important. This is a very important opportunity for teachers to learn and hence contribute to the quality of education in their schools and the nation in general.

7.2.2 Students' comments

Findings obtained from students' group discussions and classroom observations during the implementation of the lessons were used to strengthen the textbook. At the beginning of trying out the textbook, students were worried and in most cases they were relatively quiet. Apart from the fact that the presence of the researchers and the new textbook with new ways of teaching could be one of the reasons, students informed the researchers this is the case when they are learning nearly all subjects. One female student said:

> *"Tunaogopa kuzungumza kwa lugha ambayo hatuijui na mara nyingi tunanyamaza darasani. Mwalimu anakuwa mkali sana tukikosea au kuchanganya na Kiswahili… [We are worried of speaking in the language we do not understand (English), we always keep quiet in most of the instructional time. Our teacher gets mad at us when we make mistakes in learning and when we use Kiswahili]".*

This informs that students' participation during learning is very limited when English Language is used. However, students revealed that when their teachers allow them to use Kiswahili and then assist them understand the subject content and guide them to express it in English Language, they understand the subject content alongside improving their ability to express ideas using English Language. With regard to this, one student made the following comments, which are translated into English as follow:

> *"As you see, we are nowadays talking freely using Kiswahili and English without worrying! I myself prefer to speak in English, but when I fail in the due process I can switch in Kiswahili freely and the teacher or my fellow students assist me. Sometimes, I look in the glossary or illustrations to make me go on speaking English…"*

With this revelation from students, the idea of using Kiswahili glossaries, illustrations, and help box along with allowing them to use the language they are fluent at to learn new language sounds to remove fear and thus become free to participate in the lesson using the new language. The students also recommended some words to

be in the glossaries to enrich the textbooks. They also advised that the activities would be more engaging when we bring into the classroom the real sample of organisms whenever possible, rather than relying also in the pictures and illustrations in the textbooks. The notes taken from the classroom observations during the tryout of the textbooks revealed an increased level of engagement of students during the lessons as days went on. Students' motivation to participate in the reading, talking, and writing activities in pairs or in their small groups were noted to be relatively increased. However, the observation revealed that the issue of pronunciation of the new words in English varies across the teachers depending on their cultural backgrounds. Students need support in the pronunciation of the terms and this is not in the textbook and depends entirely on the teachers' experiences. This was the main challenge of the textbook, which still needs to be addresses.

8. DISCUSSIONS OF THE MAIN FINDINGS

The findings presented in this paper were obtained from the study that developed a Biology textbook that is language and pedagogical supportive for students in the language transition classes in Tanzanian secondary schools. The study adopted a participatory action research method to develop the important features of the Biology textbook that can potentially support simultaneously learning of Biology and English Language. The method had facilitates and practitioners to study aspects of practice, whether it is in the context of introducing an innovative idea or in assessing and reflecting on the effectiveness of existing practice, with the view of improving practice [24]. Development of the Biology textbook that is potentially accessible, language supportive and relevant to the learners' context seemed to be a new approach in Tanzania. This implies that development of any innovative learning materials, such as Biology textbook that is effective for quality learning that is responsive to the learning context of the schools in Tanzania, is a complex process [26,27]. This is because features of such a textbook are still unknown. To bring this change, efforts are needed to change the attitude of teachers, students and other education stakeholders such as textbook writers and curriculum developers. Under such environment, timely and adequate information is required for the designer to make a right choice in such a complex situation.

The participatory action research design was therefore the appropriate approach in such a complex situation where different education stakeholders, including curriculum developers from Tanzania Institute of Education (TIE), curriculum experts from the universities, teachers and students were involved in the development of the textbook. The method allows us to "learn by doing." This revolves designing the baseline study, then designing the version I of the textbook and then tying-out of the version I textbook using the curriculum experts, teachers and students in the real classrooms to obtain version II and the final version respectively. The modifications for fine-tuning the textbook based on formative evaluation results contribute to the perfection components of the textbook. These are among the recommended potential approach for quality textbook and, hence, quality of learning in schools. This concern was raised by the TIE curriculum developers and the teachers involved in the study.

The development of the textbook created a network of teachers from different schools, accompanied by curriculum developers from TIE and universities. This group learned how to develop and evaluate an innovative textbook and use of methodological approaches in Biology education with the goal of generating teaching materials that would be supportive in both the Biology content and learning of English Language. Such development also contributed to change individual teachers' teaching practices and promote teachers' ongoing professional development via the action research process. On the other hand, the approach in developing the book was also assisted professional growth of the curriculum developers from TIE and universities. Their feedback also showed that they considered the programme to be helpful. This is supported by Gabrieli [27] who reiterates that the collaborative involvement of key education stakeholders in problem solving activities results in gaining professional knowledge. Again, Koshy [24] puts it clearer that the main role of action research is to facilitate practitioners to study aspects of practice which are very important for their career growth.

Due to the ongoing try-out of the textbook in the classroom and the long-term cooperation of the researchers, teachers, and students, there is continuous input from the research side toward the quality of students' learning. The findings indicated that the language used in the materials scaffold students and enabled them to

communicate what they are learning during the lessons using the textbook developed. According to [25], when there are contextual supports and props for language delivery we expect students to develop their second language acquisition successfully. Thus, students gain language proficiency using the materials that are language supportive. Moreover, the feedback given by students and those obtained from the classroom observation which indicated that there is gaining of the Biology contents. These are result of the active interaction of students during the learning process through the communication enhanced by the activities suggested in the textbook.

The findings indicated active engagement of students in reading, talking and writing during the lessons. Active engagement enabled students to learn Biology contents by participating in the lessons. According to [2], learning is stimulated by the active interaction of students in the learning process. As they interact by talking, writing, reading and presenting a certain topics as suggested in the developed textbook, students' understanding is likely to grow as they are able to communicate with their fellows. Moreover, the students were motivated to take part in the lessons as they feel that they are the part of the textbook as they were involved in developing it.

To sum up, the authors are of the opinion that the development of any learners' textbook is successful only when such a book suitably aid learners to learn and improve teachers' professional development. Through this Biology textbook, TIE and university instructors achieved higher levels of professionalism by taking ownership of new strategies for better reflecting upon and improving their teaching practices and students are enabled to learn both Biology and English language through the book. However, the developed Biology textbook had not yet need developed the pronunciation guides for teachers and students. For this matter, the teachers are expected to be creative and use other related resources such as dictionaries for effective implementation of the textbook during the Biology lessons. This will make students better able to cope with the challenges in learning the Biology content in the language transition classes through language supportive activities in the textbook.

9. CONCLUSION

Language transition classrooms such as Form I class in Tanzania need a language supportive textbook enriched with variety of learning experience that allows them to talk, read, write and perform different activities for effective and meaningful learning of both the language of instruction and the content of the subject. Also, the design and development of such a potential textbook requires the involvement of different key educational stakeholders such as teachers, students, language specialists and curriculum experts to work together in a classroom based research in order to have a quality textbook for quality education in our country and world at large. The experiences from this study convinced us to say that the participatory action research used to develop the supportive textbook for language and Biology content (LSBT) proved to contribute to quality education. This participatory approach in developing textbooks is confirmed to improve not only the students' learning but also professional development of the practitioners involved. The approach controls the quality of the textbooks and motivates the practitioners for effective, continuous, and sustainable implementation in the education system in Tanzania.

10. RECOMMENDATIONS

The findings revealed the successive development of the features of the Language Supportive Biology Textbooks (LSBT) using the participatory action research approach for Form I classes in Tanzania. The paper is hereby recommending for rigorous pre-service and in-service teacher education programmes for the successfully implementation of the developed textbooks. This is very important since teachers are the most important implementers of the textbooks and the quality learning emerged from their quality interaction during the lessons. Since the curriculum experts from the Universities are using the features of the textbooks to inform teacher education colleges, the experts from TIE need to use the features in developing Form I textbooks in other subjects so as to improve the quality of learning in language transition classes.

DISCLAIMER

This manuscript was the product of the research project called Language Supportive Textbooks and Teaching (LSTT). This paper was presented in the SACHES international conference in South Africa and thereafter was uploaded in the LSTT website in the available link is http://www.tanzania.word.press.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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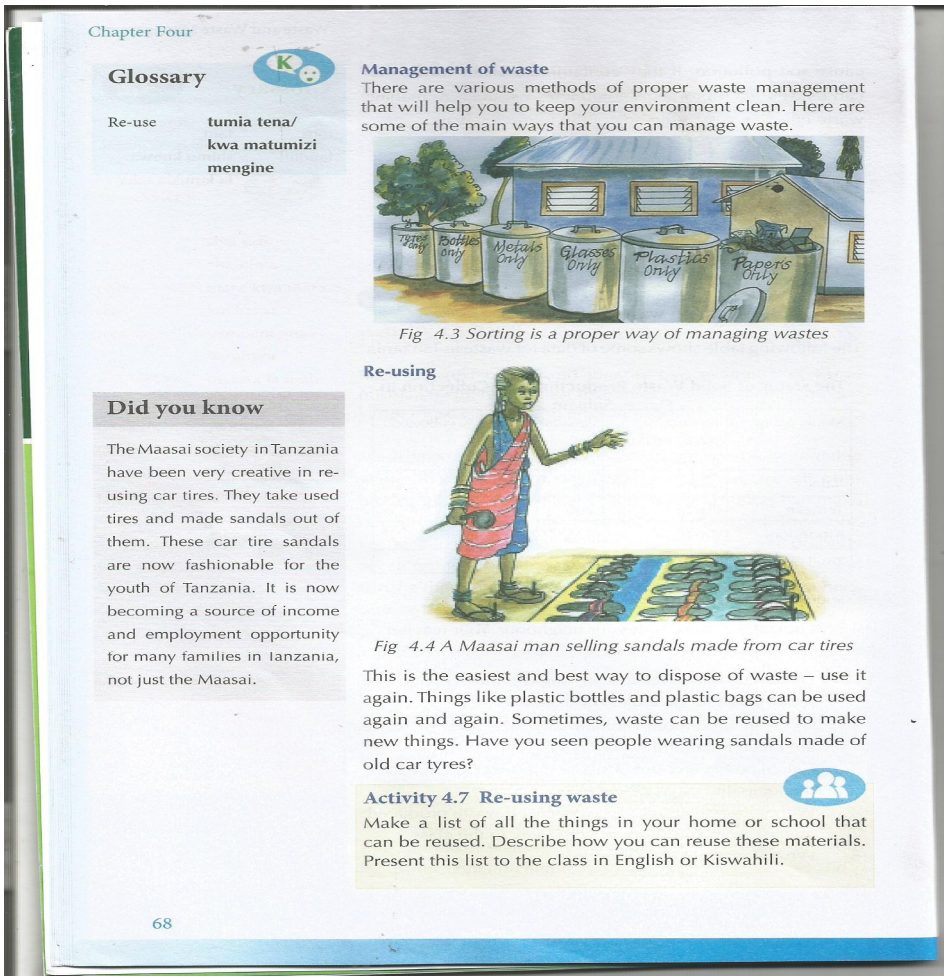
APPENDIX: THE SAMPLE OF THE LSBT



Chapter Four

Glossary

Re-use	**tumia tena/ kwa matumizi mengine**

Did you know

The Maasai society in Tanzania have been very creative in re-using car tires. They take used tires and made sandals out of them. These car tire sandals are now fashionable for the youth of Tanzania. It is now becoming a source of income and employment opportunity for many families in Tanzania, not just the Maasai.

Management of waste

There are various methods of proper waste management that will help you to keep your environment clean. Here are some of the main ways that you can manage waste.

Fig 4.3 Sorting is a proper way of managing wastes

Re-using

Fig 4.4 A Maasai man selling sandals made from car tires

This is the easiest and best way to dispose of waste – use it again. Things like plastic bottles and plastic bags can be used again and again. Sometimes, waste can be reused to make new things. Have you seen people wearing sandals made of old car tyres?

Activity 4.7 Re-using waste

Make a list of all the things in your home or school that can be reused. Describe how you can reuse these materials. Present this list to the class in English or Kiswahili.

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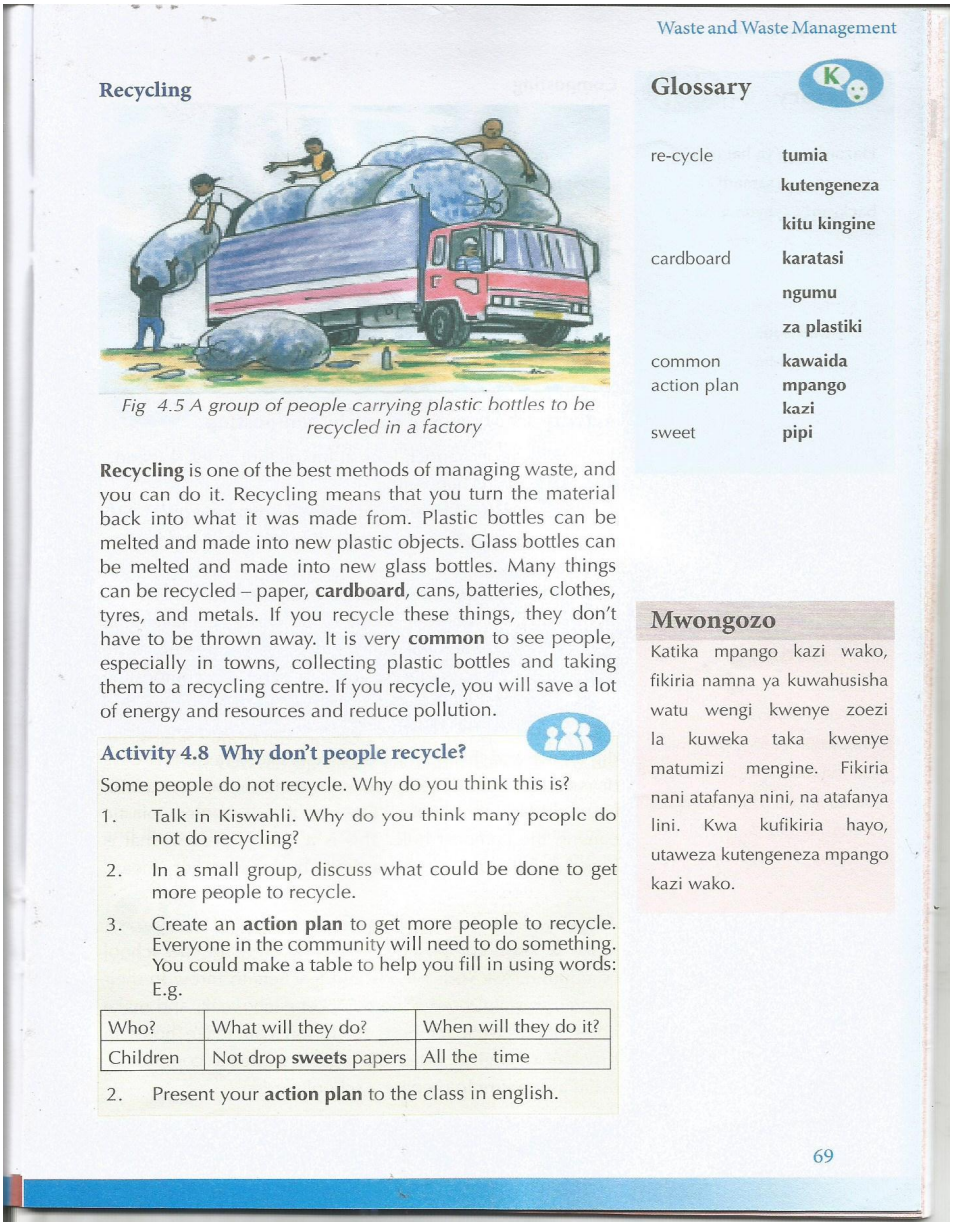

Waste and Waste Management

Recycling

Fig 4.5 A group of people carrying plastic bottles to be recycled in a factory

Recycling is one of the best methods of managing waste, and you can do it. Recycling means that you turn the material back into what it was made from. Plastic bottles can be melted and made into new plastic objects. Glass bottles can be melted and made into new glass bottles. Many things can be recycled – paper, **cardboard**, cans, batteries, clothes, tyres, and metals. If you recycle these things, they don't have to be thrown away. It is very **common** to see people, especially in towns, collecting plastic bottles and taking them to a recycling centre. If you recycle, you will save a lot of energy and resources and reduce pollution.

Activity 4.8 Why don't people recycle?

Some people do not recycle. Why do you think this is?

1. Talk in Kiswahli. Why do you think many people do not do recycling?
2. In a small group, discuss what could be done to get more people to recycle.
3. Create an **action plan** to get more people to recycle. Everyone in the community will need to do something. You could make a table to help you fill in using words: E.g.

Who?	What will they do?	When will they do it?
Children	Not drop **sweets** papers	All the time

2. Present your **action plan** to the class in english.

Glossary

re-cycle	**tumia kutengeneza kitu kingine**
cardboard	**karatasi ngumu za plastiki**
common	**kawaida**
action plan	**mpango kazi**
sweet	**pipi**

Mwongozo

Katika mpango kazi wako, fikiria namna ya kuwahusisha watu wengi kwenye zoezi la kuweka taka kwenye matumizi mengine. Fikiria nani atafanya nini, na atafanya lini. Kwa kufikiria hayo, utaweza kutengeneza mpango kazi wako.

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