

**Curriculum Reform and Implementation: Secondary
Science Teachers' Responses to a Competency-Based
Curriculum in Tanzania**

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Abstract

The gap between the intended and enacted curriculum is a major concern for many stakeholders in education. This research explores the detail of teachers' responses to and enactment of a competency-based curriculum (CBC) in Tanzania through four areas of teachers' focus: beliefs and perspectives on the science and CBC, factors influencing a CBC enactment, and a comparison of responses to a CBC from teachers of Dar es Salaam and that of Zanzibar. The study was carried out in two parts of the United Republic of Tanzania: Dar-es-Salaam in the Tanzania Mainland and Unguja in Zanzibar. These regions have similar curricula at the secondary level and above, they have different cultural backgrounds and distinct educational authorities. An exploratory sequential mixed research was carried out with the secondary science teachers. This included two semi-structured interviews carried out with 21 teachers in separate visits and an additional four focus group discussions with other teachers than those involved in the interviews. A written survey was completed by 267 teachers. The analysis of this research was guided by a consideration of the different factors influencing teachers' enactment of the curriculum, and the interaction of institutional context with the teachers' personal factors. Overall, the study identifies three key findings. 1) Teachers talked about pairs of aims (couplet aims) which often pulled them in opposite directions. 2) Teachers' autonomy is severely impacted by pressures from the authorities including inspectorates and school administration, which in turn contributes to teachers' inability to enact the curriculum as intended. 3) The socio-geographic and cultural context is significant in shaping how teachers adapt specific elements of the reform. This study argues that teacher's response to a curriculum is a process in a particular context drawn upon the interaction of teachers with multiple external demands.

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Abbreviation

CBC	Competency-Based Curriculum
EFA	Education for All
INSET	In service Educational Training
KBC	Knowledge-Based Curriculum
MoEVTZ	Ministry of Education and Vocational Training Zanzibar
OBE	Outcome-Based Education
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
SDG	Sustainable Development Goals
STEM	Science, Technological Engineering and Mathematics
TIE	Tanzania Institute of Education
UNESCO	United Nations Educational, Scientific cultural Organisation
URT	United republic of Tanzania
ZIE	Zanzibar Institute of Education

Chapter 1 Introduction

1.1 Background of the study

After the great success of primary education enrolment achieved by many countries, developing ones in particular, in response to the goal of Education for All (EFA) set in 2000 by the World Education Forum in Dakar, the next major focus was on improving secondary education to ensure that it not only responds positively to individuals' needs, but that it also suits the development of science and technology. For the purpose of improving the quality of education, the school curriculum should be reviewed and designed to ensure that it is relevant to the cultural and socio-economic needs of the students (UNESCO, 2014). Different countries, through various donors such as World Bank, have focused on improving and reforming their curricula at secondary levels in order to ensure that education not only responds to the labour market, but also prepares responsive citizens for a better life and the environment in which they live. Tanzania, like many other countries, has not remained submissive during this wave of reform in its education sector. The first concern was to expand access to secondary education by increasing the number of secondary schools, which in turn increased secondary-school students' enrolment rates. The second was to reform the curriculum in order to meet the needs of students, and the nation in general.

The importance of curriculum reform has a direct relationship with social, economic and technological change. In this sense, reform is not knowledge alone, but rather a world phenomenon that can have a direct impact on a particular country in relation to social and economic gains for its citizens. Kelly (2009) recognised the importance of curriculum reform, asserting that any curriculum is likely to change as other aspects of society are changing. Thus, in the current world, where we observe economic, social and technological potential for radical change, reform in the school curriculum is highly predictable. For instance, the 'No Children Left Behind' Act commenced in 2001 caused many education reforms in the US, and was influenced by a political agenda (Darling-Hammond, 2006). The reform was put in place to ensure that quality education was accessible to all children, including the underserved, for the purpose of raising the standard achievement of all children. On the other hand, technology was one of the factors that led to curriculum reform in China in 1978. The English language was introduced at Grade Three in all public schools in order to prepare students with the broader English skills used globally in information technology (Fang

and Warschauer, 2004). The theory behind a curriculum reform was to improve the quality of education and respond to the rapid change of our complex world (Halinen, 2018). However, achieving the intended goal of the reform is a very complex process which leaves major concerns and questions for many scholars.

In the late 1990s, many African countries responded to a wave of curriculum reform from international organisations, such as USAID and the World Bank, with the purpose of improving the quality of education (Tabulawa, 2003). Different names for the reforms were given to different African countries, such as outcome-based education (OBE) in Southern African countries (Botswana, Namibia and South Africa; Chisholm and Leyendecker, 2008; Tabulawa, 2003), and competency-based curriculum (CBC) in Eastern African countries (such as Kenya, Tanzania, Rwanda and Uganda). The major concern was to change the teaching approach from a teacher-centred approach to student-centred teaching. However, there was criticism from many African scholars that student-centred teaching is a representation of Eurocentrism or a Westernisation educational process, which is not relevant to the African learning context (Gauthier, 2013; Tabulawa, 2003). Tanzania was not exceptional in trying such reforms. Thus, in 2005, Tanzania underwent an extensive reform of its curriculum from the content-based curriculum, which was teacher-centred, to the CBC focus on student-centred teaching, like many other African countries, as indicated above.

A CBC is not a new curriculum; it has been in existence in education for many years, in different countries. For instance, in the US, the CBC started to be employed in teacher education in the 1970s in order to enable teachers to effectively facilitate interactive teaching activities; whereas in the UK, its emphasis began at higher learning institutions in teacher education, and has now spread to secondary education (Byrne et al., 2013). In Germany, a CBC began in 2000 in order to respond to the complex nature of the changing world (Glaesser, 2019). Ideally, the main purpose of a CBC is to develop competencies for students that will have a direct application to their natural world (Jones and Voorhees, 2002). In Tanzania, a CBC was developed which requires teachers to move from knowledge transmission to knowledge development. For Kelly (2009), knowledge transmission focuses on mastered content, while knowledge development focuses more on developing student understanding. In the Tanzanian educational context, it was expected that if a CBC could be implemented effectively, it could result in a substantial beneficial impact on society, and the whole nation, compared with the former content-based curriculum (TIE, 2007).

The ultimate goal of most curriculum reform is to improve teaching and learning, which in turn can improve the quality of education. However, the implementation of such reform presents a common question to many researchers: why the implementation of curriculum reform fails to comply with the intended goal, or is not enacted as intended by the reformer (Lee and Yin, 2011; Roehrig and Kruse, 2005; Ryder and Banner, 2013). Today, the relationship between the intended curriculum and teachers' practices is constantly under great tension because of the multiple demands which sometimes interfere with the intended goal of the curriculum reform. It is important to emphasise that whatever the reasons for the reform, the lesson gleaned from extensive research is that the reform of the curriculum cannot be realised if teachers fail to integrate it into their beliefs, knowledge, skills, and disposition (Smith and Southerland, 2007). Thus, in considering curriculum reform implementation, it is crucial to understand teachers' responses to such reforms.

In most African countries, the implementation of a CBC or student-centred teaching emphasises the inconsistencies between the intended policy and actual teacher responses (Chisholm and Leyendecker, 2008; Gauthier, 2013). Kopweh (2014) focused on the formulation, management, and development of a CBC in Tanzania. His findings criticised the implementation of CBC and revealed that in some cases there is variation between the enacted and intended curricula. He argued that the variation occurs because teachers' autonomy has been removed; they cannot freely apply their professional skills to craft the curriculum as they see fit. Of course, there is no doubt that the curriculum prescribes all learning content to be taught and competencies to be developed at every level, but when it comes to the issue of how content should be taught, the teachers themselves decide. Therefore, to more fully understand how the CBC is implemented, it is important to understand the teachers' ability to translate the theory of the curriculum into teaching practice.

1.2 Research Problem

Research on curriculum reform has been carried out by many scholars (Chan, 2010; Ryder and Banner, 2013; Smith and Southerland, 2007). There is clear acknowledgment that the enactment of the curriculum reform largely dependent on teacher response but also the internal and external school social settings apply (Goodson, 2003). The teacher response to curriculum reform is dependent on several factors, including beliefs, teachers' knowledge of the reform, and resource allocation. For example, a study in the US by Smith and Southerland (2007), based on elementary teachers' responses to curriculum reform, found the implementation of reform was shaped by the teachers' beliefs. In the UK, Ryder and Banner (2013)

showed that science teachers differ in their responses to science curriculum reform – specifically of teaching socio-scientific issues and the nature of science – because of the teachers’ identities, as well as their internal and external audiences. The difference in teachers’ responses might be explained by the large variation of teachers’ subject and pedagogical knowledge and teaching experiences: “Because of these, certain teachers will be more amenable than others to the changes required to implement new reform” (Bybee, 1993, p.103).

Within the existing body of literature, it is suggested that implementation of curriculum reform also depends on the teachers’ understanding of it (Kelly, 2009). Teachers might each have their own understanding of the curriculum, which could differ drastically from that intended by the policy-makers. Teachers’ knowledge of the nature of their students, as well as the learning context, are important contributing factors to informing teaching decisions (Darling-Hammond and Bransford, 2005). Hence, to understand how and why teachers implement the curriculum in the way that they do is to allow them to reflect on the curriculum, while enabling them to analyse their teaching practices (Goodson, 2003). My view here is that teachers’ reflections on their practices by linking them to the intended goal of the curriculum will help to provide measurable information on how curriculum reform is implemented and valued by teachers.

In Tanzania, despite the government’s effort to transform the curriculum from the dominant content-based to a competency-based, performance in science has yet to meet the expectations of educational stakeholders. In Tanzania, the issue of poor science performance continues to be a popular debate, not only among researchers, parents, and the community at large, but also even to the ministries responsible for education. The Ministries of Education both in mainland Tanzania and Zanzibar, through their education sector plans, have expressed their dissatisfaction with performance in science. The shortage of science human resources, including teachers, continues to be the main challenge (MoEVTZ, 2017; URT, 2018). This is similar to Tikly et al.’s (2018) observation, regarding supporting STEM in Sub-Saharan Africa, that the shortage of qualified human resources in the STEM-related fields including the qualified science teachers lag further behind. Such challenges are linked to the poor teaching methods used during science classes, predominantly continuing to focus on mastering content and not the competencies as identified in the curriculum (MoEVTZ, 2017; TIE, 2007). Such claims argue that teachers obstruct curriculum implementation as intended by policymakers because of lack efficacy and commitment.

It was expected that if implemented effectively, the CBC is considered to be an appropriate curriculum to make science teaching and learning more attractive, while motivating learners to take an interest in science. However, it is a decade since the inauguration of the CBC in Tanzania, low students' performance in science remains a major concern for both government and society. The 2014 policy for education in Tanzania identifies that for every 100 students entered in Forms three and four (Years 14 and 15 in the UK), the levels at which students start to specialise in science subjects, only 30 to 35 students opt to study science subjects (URT, 2014). These numbers are expected to drop further at A-level (Years 16 and 17) because of the final Certificate of secondary examination results.

The implementation of a CBC is still a serious concern in the Tanzanian education system, particularly in the science field where there has been little focus on teachers' responses to the curriculum (Kafyulilo et al., 2012; Kopweh, 2014; Paulo and Tilya, 2014). One of the reasons for this is that, "in practice, policy writers cannot control the meaning of their text" (Ball et al., 2012, p.22). Since the inception of the CBC, a large number of studies, both nationally and internationally, have been carried out in Tanzania, and many of these focused on the process of reform and challenges that teachers face in the enactment process (Haelimu, 2010; Kopweh, 2014; Vavrus, 2009). In fact, many of the studies are on the enacted curriculum, how the teachers enact the CBC in their classrooms. As a result, the inadequate supply of teaching and learning resources, including laboratories, and lack of professional development, are the recurring challenges identified, among others, as the major cause of poor CBC enactment. However, how teachers link the intended and enacted CBCs, based on personal understandings has been given insufficient attention.

In fact, teachers would translate the CBC in different ways, maybe emphasising some areas while de-emphasising others. One teacher might focus more on content and knowledge acquisition than the competency aspects of teaching and learning science. The questions of whether the CBC has achieved the intended objectives or not can be also be answered through deep interrogation with teachers by understanding the factors condition their practice. The enactment of the CBC requires teachers to respond to multiple demands related to their different internal and external interests. It relies on how teachers internalise all curriculum aspects – goals, intended content, pedagogy of teaching, and assessment practices – within their personal knowledge in response to those demands. In addition, how the quality of teachers, as well as teaching and learning, is judged by those supervising curriculum enactment might impact teachers' response to the curriculum. In responding to such contexts, to understand how the CBC is implemented and its

impact, or why teachers enact the curriculum as they do, it is crucial to receive the information from those who enact it: namely, teachers. Moreover, the secondary curriculum is shared by both parts of the United Republic of Tanzania under different educational administrations. I have not come across a single study that studies the curriculum on both sides; hence, this study was designed to understand the science teachers' responses about the CBC in terms of policy and practices by involving teachers across both parts of Tanzania: Zanzibar and the Tanzania mainland.

1.3 Context and Tanzanian System of Education

Geographically, Tanzania is in East Africa, bordered by Kenya and Uganda to the north, Rwanda, Burundi, and Congo to the west. In the south, Tanzania is bordered by Mozambique and Zambia, while in the east it is surrounded by the Indian Ocean (see Figure 1-1). Tanzania is a sovereign country made from the union of two countries in 1964 – mainland Tanzania, formerly known as Tanganyika, and Zanzibar. This union leaves the respective countries with partial sovereign autonomy in some matters. This is per the constitution of the United Republic of Tanzania, which states that for efficiency and managerial purposes there shall be union and non-union matters (URT, 2005, p.90). Based on that constitution, there are about 22 union matters, among others are citizenship, policing, currency, higher education, and the National Council of the Examination. These union matters are controlled and administered by the coalition government, while each respective state has its policies and administration, and works independently over all non-union matters. Pre-primary, primary, and both lower and higher secondary education (O-level and A-level) among others fall under non-union matters.

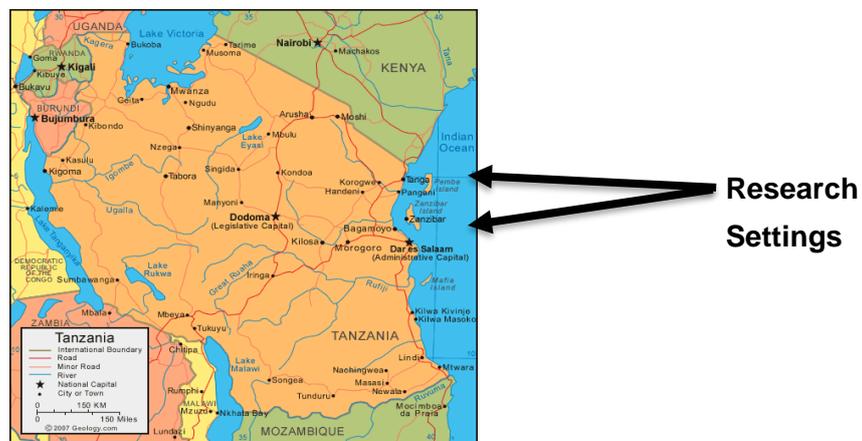


Figure 1-1: Tanzania Geographical location

As mentioned earlier in the paragraph above, education is not a union matter. Each country has their educational policies and responsibilities: for example, the system of

mainland Tanzania is 1 – 7 – 4 – 2 - 3+, that is, one year of pre-primary education (age 5), seven years of primary (ages 6 to 12), four years of O-level secondary education (ages 13 to 16), two years A-Level secondary education (ages 17 to 18), and three or more years of higher education depending on the field of study (URT, 2018). On the other hand, in Zanzibar, the educational system is 2 – 6 – 4 – 2 - 3+ (MoEVTZ, 2017). However, Swahili is the most widely and commonly spoken language in Eastern African countries, including Tanzania (Mwinsheikhe, 2007; Swilla, 2009), but in mainland Tanzania, Swahili is only used as the language of instruction at pre-primary and primary level, while English is used throughout secondary education and above, as a language of instruction (LoI). This is slightly different in Zanzibar, where the policy known as EP06 results in the Swahili language being used as a LoI only from pre-primary (ages 4 to 5) to primary four (age 9), and the English language being used from primary five onwards (Babaci-Wilhite, 2015).

In mainland Tanzania, the curricula from pre-primary, primary, secondary, and teachers' training at certificate and diploma levels are coordinated, developed and administered by the Tanzania Institution of Education (TIE, 2013), while the responsibility of the internal and national examination is under the National Examinations Council of Tanzania (NECTA). This is slightly different in the case of Zanzibar because it has its curriculum board called the Zanzibar Institute of Education (ZIE) (MoEVTZ, 2006). However, at the secondary level and teacher training, the development of those curricula are in the hands of the TIE, while their implementation remains the responsibility of the ZIE. At secondary and teacher-training levels, the national examinations are also regulated, constructed, and supervised by the NECTA, while the Zanzibar examination board remains responsible for the Form Two (Year 9) examination. In addition, all primary issues about the curriculum and examination at the primary level in Zanzibar are coordinated and regulated by Zanzibar itself. In short, these states share similar O-level and A-level curricula, as well as the teacher training curriculum at certificate and diploma levels, but feature different curricula in pre-primary and primary education. Furthermore, in both states, basic compulsory education ends at O-level; that is, basic and compulsory education runs from 5 to 17 years of age and from 4 to 16 years of age in the Tanzania mainland and Zanzibar, respectively (MoEVTZ, 2017; URT, 2010). Reflecting on these differences in terms of policies and educational systems, especially at the primary level, might result in different responses from teachers about secondary curriculum enactment.

1.3.1 Secondary Curriculum Reform in Tanzania

Soon after mainland Tanzania gained independence in 1961 (1964 for Zanzibar) and became an independent sovereign country, Tanzania adopted political socialism. The first curriculum reform started in 1967, aiming to transform the colonial educational system to fit into the new cultural and political system of Tanzania. This reform was much influenced by the policy of education for self-reliance, recognised by Julius Nyerere, the first president of Tanzania. This policy focused on vocationalisation, in both primary and secondary school curricula, and linked the school curriculum with the development of patriotic manpower citizen. The goal was to have a capable citizen that could participate in the development of the nation, fighting against poverty, hunger, and disease (Mosha, 1990). In relation to secondary science education, general science was divided into three main science subjects: physics, chemistry, and biology (TIE, 2013).

The second curriculum reform was in 1979. Although this reform focused on practical-based teaching, the main concern was the preparation of future middle-class experts in the fields of agriculture, animal husbandry, fishing, and business. The reform resulted in some secondary schools being categorised as agricultural, husbandry, fishing, and business schools, where students were enrolled based on such specialisations. This change was intended to transform the colonial educational system to fit into the cultural and political system at that time, the school science curriculum emphasised and concentrated on Western ideologies about the Industrial Revolution, focusing more on industrial and transportation literacy (O-saki, 2002). Before the third curriculum reform in 1997, which was influenced by what is known as the world order of multi-parties (TIE, 2013), the science curriculum experienced a small reform in 1991. The 1997 reform did not change the science curriculum, but, instead, Politics (called *siasa* in Swahili) was replaced by the subject Civics at O-level and General Studies at A-level. Civics and General Studies were introduced because the school curriculum was pinpointed as lacking knowledge about citizens and how to function within a multi-party system (URT, 2011).

Due to the scarcity of laboratory resources and the government's failure to support their schools with them, in 1991 the science curriculum changed, so that science subjects were taught through theory, with the integration of alternatives to practical instead of real practical teaching. The alternative to practical focused on learning science laboratory experiments through secondary data without students interacting with real laboratory activities. This reform received high criticism from teachers for failing to prepare competent future scientists, and for the decline in numbers of

students choosing science (Ndalichako and Komba, 2014). The argument was that teaching practical aspects using theory, where students are not given an opportunity to be involved and interact with real laboratory experience, was not at all realistic and did a disservice to knowledge and learning. This reform was regarded as ineffective for teaching and learning science because it became apparent that many secondary science graduates lacked competence in science skills.

It was said that although Tanzania became independent, the effects of colonialism on the school curriculum were still in existence. A large part of the school curriculum lacks contextual relevance to the cultural, environmental and economic values of Tanzania and its citizen. This was especially evident in the science curriculum, where natural science seemed to have a significant Westernising influence (O-saki, 2002; Wandela, 2014). The majority of the content in the science curriculum appeared more Eurocentric, with teaching and learning being defined by teacher-centred teaching, and students being encouraged to learn by memorising scientific facts, theories, and laws (TIE, 2007a). Moreover, even the science textbooks for most African countries, including Tanzania, were illustrated by examples and diagrams that directly related to Western culture, something the students were unfamiliar with (Otulaja and Ogunniyi, 2017). The school science curriculum in Tanzania was said to focus more on content knowledge and was failing to respond to the job market in science and technology (TIE, 2007). Hence, responding to such demands, in 2005 the knowledge-based curriculum was replaced by the CBC.

According to the Ministry of Education in Tanzania, the CBC was introduced in secondary education to equip secondary school leavers with the necessary knowledge, skills, and attitudes which could help them transform their society (URT, 2014). Through CBC reform, the ICT and Computer Studies, among others, being introduced in the school curriculum to prepare students for technological literacy and they could be used to facilitate teaching and learning science. Some of the current scientific issues, such as renewable energy, health including HIV and AIDs and reproductive health, were included in the science curriculum. The goal was to prepare students to respond positively to their current world and to become well-informed citizens in science and technology. Through this reform, science was to be taught through interactive approaches, whereby the laboratory's practical and hands-on activities were positioned at the centre of teaching.

The CBC was seen as one of the best paradigm shifts that Tanzania made in its educational system, as it could completely change the traditional mode of teaching. Despite the effective theory and principles of the CBC, emphasis on interactive

teaching, science teaching in this context has not yet produced interesting outcomes. Students continue struggling more in science subjects and score lower in science than in social science subjects (MoEVTZ, 2006). The teachers are blamed for poor teaching methodologies due to low teacher efficacy and inadequate resources, including ICT.

1.3.2 Secondary Science Curriculum and Teaching in Tanzania

Tanzania, like any other African country, and Sub-Saharan African countries in particular, in response to sustainable development goals (SDGs), has set a vision of reaching a middle-class economy by 2025. The issues of industrialisation, trade and sustainable use of the environment which will improve people's lives rather than destroy them, have been prioritised. Drawing from the context of secondary education, while talking about the quality of STEM education in Sub-Saharan Africa, Tikly et al. (2018) argue that the school science curriculum plays a vital role in building communities with the competent citizens for sustainable development. This is particularly true for the case of the Tanzanian secondary school curriculum, as it intends "to prepare a competent student to participate effectively in multiple social roles in order to have a well-functioning society" (TIE, 2013, p.13). However, achieving such competencies depends on how successfully the CBC will be implemented.

As previously mentioned, in Section 1.3, in Tanzania, the secondary education is divided into two levels - ordinary secondary education (O-Level), equivalent to GCSE in the UK, and advanced secondary education (A-Level), equivalent to sixth-form. This research is based on science teachers of the O-Level secondary education. In the Tanzanian, the secondary school curriculum is based on five learning areas – namely language, natural science and technology, social science, business, and aesthetics – where each learning area includes varied learning subjects (TIE, 2007, pp.17–19). In science, in particular, there are eight science subjects including physics, chemistry, biology, information and computer studies, technical education, agriculture, home economics and mathematics. However, in this study, the science curriculum is defined through three subjects – physics, chemistry, and biology – because they are the most accessible science subjects to many students across the whole country. The rest are only taught in specific selected secondary schools.

Student-teacher ratio, along with teachers' instructional time, define how long teachers can interact with individual student. The lower student-teacher ratio, the more time teachers have to interact with students in the teaching and learning. According to the present CBC, the student-teacher ratio should be 40:1, and each

teacher should have a maximum of 30 teaching sessions per week, of 40 minutes each. This is equivalent to four contact hours per day. Theoretically, this meets the international standard for less developed countries like Tanzania (Singh, 2012). However, reflecting on the findings of many studies, this curriculum criterion proves to be illusory. The shortage of science teachers and of infrastructure, including school buildings, which results in overcrowded classrooms, contributes them struggling to achieve effective teaching (Hakielimu, 2010; Kafyulilo et al., 2012; Kitta and Tilya, 2010). For example, in Zanzibar, they have double shifts; morning and afternoon due to the shortage of classrooms. As a result Zanzibar loses two hours' instruction time as compared to the mainland. This might have a significant difference of CBC enactment between these two regions.

The CBC has emphasised scientific ways of teaching that include laboratory experimentation, as well as learning by inquiry. Secondary students are required to develop curiosity and become motivated in learning science to prepare themselves for their science specialisation in post-secondary education. However, studies conducted in this context indicate that teaching science through inquiry or discovery not feasible. Science is taught focusing on canonical knowledge with the integration of a cookbook experiment, an experiment that neither reflects CBC policy nor was intended by the policy-makers. For instance, Mosh's (2012) study involving multiple educational stakeholders, including educational officers from the MoEVT, TIE and NECTA, argues that despite the school curriculum changing from KBC to CBC, teachers continue to teach in the traditional mode, the approach deemed irrelevant by the reform. It is very important then to understand why the teacher teaches the way they do or what condition their resistance.

1.3.3 A Competency-based Curriculum in the context of Tanzania

Tanzania has a centralised educational system wherein the school curricula across both levels from pre-primary, primary, secondary as well as teachers' training college are developed by the central government. The Tanzania Institute of Education (TIE) is the assigned government institution responsible for the development, publication and dissemination not only of the curricula but also supporting documents. Among others, the syllabus and textbooks are the key distinctive official documents developed by TIE to help teachers translate the CBC text into practice. In the Tanzanian educational context, a CBC itself and other supporting documents are statutory documents necessary for facilitating the enactment. In secondary education, the CBC received its recognition in 2005 when the former Content-based curriculum was found to no longer be able to respond to current demands of the

country, including responding to world economy of science and technology (TIE, 2007). Thus, in 2007 TIE developed a 40-page document with nine sections providing the general descriptions of CBC from educational aims to how curriculum should be enacted and evaluated.

The CBC document itself stated the aims of secondary education in a broader and general terms. Amongst others, the document illustrates the four distinctive aims to be attained across school secondary education- prepare students for post-secondary education, prepare individuals to be responsive members of society, promote the acquisition of literacy in science and technology to the students, and prepare competent, innovative, and creative students that could able to integrate and analyse scientific knowledge to be effectively used in their society (TIE, 2007, pp. 12-13). In the CBC document, science is characterised as essential for nurturing the intellectual, scientific, social and technological ability of students to foster economic development and face other social challenges. However, in practice a “policy text can only achieve its meaning through practice” (Ryder and Banner, 2011; p. 711).

The focus of post-secondary education and preparing responsive citizens is not something new; the former content-based curriculum had a similar focus. The distinctive nature of this current CBC is the emphasis on the third and fourth aims which is actually the core idea of the science CBC in particular. These aims articulate clearly the broader aims of science education as in the existing literature; developing professional science knowledge and developing science for everyday life (Fensham, 2009; Hoodson, 2014; Robert and Bybee, 2007). In the document, a CBC has been characterised as:

As a curriculum that focus to prepare a competent, creative and innovative student in the areas of science and technology, but also be able to face the social challenges and other emerging socio-scientific issues, career opportunities and other life skills for the advancement of individual and nation. It is the curriculum that largely focus on developing problem-solving skills to ensure that secondary education has impact not only to the individual but also across the entire nation to achieve sustainable economic growth (TIE, 2005; pp.13-14)

With the named aims above, developing competencies is the key idea of this CBC which is defined within three sets of learning domains; cognitive (knowing and understanding), psychomotor (doing-investigation) and affective (valuing) which can be measured based on performance outcome. TIE (2007) demonstrates that in the CBC the teaching instruction should be emphasised and characterised into three sets of ideas:

- Flexible pace: the instruction should consider and start from the student's level of competency rather than the overall age-level for the entire classroom
- Personalising based: the instruction should encourage and fully foster student's engagement in learning because students learn at different paces to acquire the required skills
- Proficiency based: the instruction should focus on developing on application knowledge and skills. The knowledge should be measured from what students are able to do in relation to the underlying objective standard rather than the time they have spent on learning.

Kelly (2009) indicated that the question about what knowledge the curriculum is intended to achieve is more crucial than delivering curriculum content. The idea here is that to attain the intended knowledge defined in the curriculum, a clear guideline is needed to lead those who enact it is needed. Thus, the CBC document prescribed a student-centred approach focusing on discovery and argumentation rather than lecturing and memorisation. Assessment is to be formative-based where the use of portfolio and rubric-based feedback are considered important. In this, the teacher is encouraged to provide feedback using different ranges of criterial skills or different level of performance the students have achieved rather than relying on tick and cross. Thus, multiple participatory teaching and assessment techniques are prescribed within the document to give teachers a road map to put the policy into place. For example, inquiry and problem solving, analysing a case study and scientific information, group work discussion and presentation and laboratory experimentation are prescribed pedagogical approach listed in the document (TIE, 2005; pp.29-30). In case of assessment, a project work, oral presentation and written report as well as analysing text and online information are the recommended assessment techniques to be applied in the teaching process. Moreover, portfolio and rubric which could give student opportunities to assess their progress over a period of time also emphasised. (TIE, 2005; p. 32). However, teachers find responding to those suggested teaching and assessment techniques elusive because the context in which the CBC is enacted is highly challenging (see, Kafyulilo et al., 2012; Moshia, 2012; Semali and Mehta, 2012; Vavrus, 2009).

Outside of stating the educational aims in its broader terms together with the prescription of teaching and assessment techniques, the CBC document does not include the intended content. The intended content is available in the respective syllabus of the subject. The syllabus is officially developed to define and illustrate all intended content and provide a guideline for the teachers on how to teach it. The

syllabus also prescribes the standard objectives (competencies) for the whole journey of secondary education as well as the competencies at every level of subject learning. It defines the enactment in the format shown in the figure 1.2. This example is directly extracted from the physics syllabus. The purpose of this syllabus, among others, is to help the teachers implement the curriculum. Even though the syllabus prescribes a clear road map of the way teacher should enact the CBC, using this document for lesson planning and enactment of the curriculum is not straightforward. This is because teacher's practices, including planning, are results of negotiation between the teacher's professional beliefs and desire, and the imposed aims of the curriculum together with the interaction of other social forces internally and externally exerted (Ball et al., 2012; Goodson, 2013; Hyun, 2006).

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
5.0 SIMPLE MACHINES 5.1 Concept of Simple Machines	The student should be able to: a) explain the concept of a simple machine;	i) The teacher to lead students to do a library search to deduce the meaning of simple machine. ii) Students to explain the concept of a simple machine.	i) Bolts and nuts ii) Spanners iii) Single fixed pulley iv) Different masses v) Stone vi) Rope vii) Bottle and bottle opener	Is the student able to explain the concept of a simple machine?	4
	b) explain the terms applied in simple machines; and	The teacher to facilitate the students in groups to deduce the meaning of the terms Load, Effort, Mechanical Advantage, Velocity Ratio and Efficiency as applied to simple machines.	i) Bottle openers ii) Crow bars iii) Wheel barrow iv) Heavy stone v) Capped bottles	Is the student able to explain the terms used in simple machines?	

Figure 1.2: Section of Physics syllabus (O-level Physics syllabus, p. 42)

Figure 1.2 demonstrates the prescriptive nature of the curriculum where the syllabus aims to guide teacher how they teach for every topic within the curriculum. This has been done purposefully in order to bring out uniformity of curriculum enactment across all countries. In fact, the syllabus places teachers accountable for curriculum enactment to attain the stated objectives. In order to strengthen the curriculum enactment, TIE published textbooks for every subject to help teachers with their practice. Teachers are strongly recommended to use the textbook published by TIE because it matches exactly with the national syllabus. However, the physical distribution of these documents is not the same across all countries because of geographical conditions. As a way of tackling the problem of physical distribution of such documents, TIE tried to upload all syllabi to their website to ensure that teachers could access it at any time. However, this does not fully resolve the problem of access which depends on internet access which is still not available across all schools in the Tanzanian context. But the distribution of the textbook is still done physically, and

this brings inequality of availability, where remote and community schools suffer most (Hakielimu, 2010).

1.4 Research Aim

The aim of this study is to investigate the CBC reform and its enactment in the educational context of Tanzania through the lenses of secondary science teachers. The specific focus is largely on two aspects of the curriculum: the intended and enacted curricula. All elements of the curriculum; goals, content, and pedagogy have been considered together with the assessment and how they feature within teachers' perspectives and practice. This involves identifying teachers' reactions to the curriculum including conformity and consistency with the reform, resistance and any acts of negotiation within their professional comfort zones. Furthermore, it is important to recognise the interplay of sociological perspectives on teachers' decisions and actions. Therefore, the research also look to identify all influences across broader sociological perspectives in which the teachers are interacting. Moreover, the study is conducted across two parts of Tanzania; Tanzania Mainland and Zanzibar which use similar curricula under two different educational authorities. The research also focuses on comparing the responses of a CBC between the teachers of the mainland and that of Zanzibar. Indeed, the aim of this research has been investigated through the following four research questions, which will be elaborated on in more detail in Chapter 3. The research questions were derived from two broad areas of teachers' responses: 1) conceptions of the CBC in responses to teachers' personal theories; and 2) teacher agency in response to the CBC (expressive of teachers' enactment of CBC reform). Thus, the following four research questions were formulated:

RQ1. What are science teachers' beliefs about the science curriculum?

RQ2. What are teachers' perspectives about the competency-based curriculum reform of science in Tanzania?

RQ3. What are the factors influencing teachers' classroom practices within the competency-based curriculum reform of science?

RQ4. What are the differences in responses to the competency-based curriculum between the teachers in Tanzania Mainland and in Zanzibar?

1.5 Structure of the Thesis

This thesis uses a mixed-method design, predominantly driven by qualitative data from interviews and focus group discussion. The quantitative questionnaire was used to explore findings from the qualitative strand of a large population of teachers. This thesis is compiled into ten chapters, each of which include specific information in relation to this research. Background information describing the link between curriculum reform and quality of education is presented in Chapter 1. The research problem, a brief history of curriculum reform in Tanzania, and the teaching and learning science are also presented in this chapter. Before ending with the overall structure of the study, the description of the CBC document also presented.

Chapter 2 covers literature reviews derived from several academic sources, including policies and government documents containing information relating to the curriculum and its enactment. The key concern of this thesis is the link between the intended and enacted curricula. Thus, the conceptual framework that describes the relationship between intended policy and practice, as developed by Bowe et al. (1992) also presented in this chapter.

The research questions are described in detail in Chapter 3. In addition, a fully methodological approach is presented in Chapter 4. Generally, this chapter describes how the research was carried out. The data collection and analysis details, along with the rigour and ethical issues of the research, are also described here.

Chapters 5, 6 and 7 consecutively present the findings of the qualitative strand. These chapters are organised into main three sections concerning the first three research questions, to provide an overview of the findings to the first three research questions. The quantitative findings are presented in Chapter 8, where the results are described and interpreted through different descriptive statistical measures.

Chapter 9 presents the discussion of the three topics that contribute to existing literature, organised into three sections. The twin aims in science education discussed in the first section. Teacher agency in responses to the imposed curriculum, and the role of the local community and cultural values will be presented in the second and third sections, respectively. In addition, the summary of the significant key contribution close the chapter. Lastly, Chapter 10 covers the conclusion, presenting the limitations of the study and recommendations for further studies before the concluding remarks.

Chapter 2 Literature Review

2.1 Introduction

This chapter presents a review of the existing literature in relation to the area of this study. The aim is to broaden an understanding of the curriculum in general and the responses of teachers to the externally imposed competency-based curriculum reform in particular. This chapter is organised into six sections. The various conceptions of curriculum are presented in section 2.2 following the introduction of this chapter in section 2.1. The meaning of the CBC and its aspects has been addressed in section 2.3 and the teachers' responses to teaching and learning are presented in section 2.4. The chapter then focuses on the factors influencing teachers' curriculum enactment, in section 2.5. Finally, the chapter ends by presenting the conceptual framework that helped in the development of the tools for data collection and the data analysis in section 5.6.

2.2 Conceptions of curriculum

Although the curriculum is one of the most important elements in the field of education and teaching, it has not been possible to find a single definition of the word curriculum in the existing literature. However, majority of the authors are in agreement that the word curriculum is derived from the Latin word *currere*, which means "to run" (Neary, 2002; Pratt, 1994) or "race-course" (Marsh and Willis, 2007; Pinar, 1995). In a modern educational context, the idea of the curriculum as a kind of race-course may emphasise competition as a key driving force for educational success, whereby students who pass exams are the winners and those who fail are the losers, without considering their experiences during the "race". However, this metaphor does not signify there are winners or losers on the racecourse. As noted by Sawyer (2004), a curriculum tends to develop individual students in progressive ways through a defined structure and experience. Sawyer highlighted the importance of considering individual differences when defining the curriculum because students do not "compete" at the same speed while they are learning. Students learn at different rates and are motivated differently. Slattery (1995) contends that the idea of the curriculum as a race-course aims to describe the process that individual students experience, and any sort of knowledge developed while on the course. Hence, curriculum should be described in terms of what individual students experience in school settings because of the daily engagement of several activities performed by the school.

Regarding the meaning of the curriculum, initially, a curriculum was understood as what a school or educational institution offers to the students in terms of the subject matter or planned programme (Marsh, 2009). According to Wheeler (1967), a curriculum is a planned learning experience received by students from the school. The key points in this definition are the planned programme, which is designed by the school, as well as a distinct set of experiences developed by the students. However, this view too lacks a broader view of students' learning in terms of interaction with others as well as the policy underpinning the school's functioning or other unplanned programmes. Thus, Kelly (2009) contends that defining the curriculum in terms of a list of subject content or planned programmes limits the real meaning of the curriculum, because, learning environment, student experiences and other aspects of learning beyond what is planned or taught in the classroom make big contributions to student learning.

Pratt (1994) raised similar concerns with planned experience and considered curriculum as a deliberate plan to promote formal learning. This definition totally rejects unplanned activities. Of course, planned learning experience plays a significant role in formal education; however, it is important to emphasise that a student's learning is not limited to what is planned (Marsh and Willis, 2007). The unplanned aspect of a curriculum is crucial because it encourages an awareness of social norms and values, which play prominent roles in a student's life (Lynch, 1989). When defining the curriculum, it is important to give equal attention to both the planned and the unplanned learning activities (Pinar, 1995). Thus, a curriculum includes planned activities that are controlled by the school timetable as well as extra-curricular activities and other learning experiences promoted by the school (Dufour, 1990).

It is clear then that curriculum can be defined in many ways. To help us better understand these definitions, Ellis (2004) categorising them into either prescriptive or descriptive. Those definitions that focus on proposing what learners should learn or what teachers should teach are categorised as a prescriptive curriculum. For example, Posner (1995) defines a prescriptive curriculum as one in which the school plans all of the students' learning. The prescriptive definition considers a student as a receiver of what has been planned by their teachers, that the teachers should teach according to what has been planned by the policy-makers. Hence, the prescriptive definition is supported by a linear model of curricular development, which, according to Kelly (2009), pays little attention to the teacher's interest, beliefs and experience as well as contextual reality of the individual schools.

By contrast, the descriptive definition of curriculum emphasises an individual learner's impact as they engage with the school programme. Ellis (2004) contends that a detailed definition of curriculum is concerned with any aspect of behavioural changes in the individual which have resulted from the intended curriculum. As Ellis (2004, p. 5) clarifies, "*the key term in this descriptive definition is experience*". In this case, experience refers to the ideas that an individual learner has developed as a result of engaging in school life. A descriptive curriculum is defined by Tanner and Tanner (1995) as planned experience and projected learning outcomes that are designed using the logical reconstruction of knowledge and experiences that prepare an individual learner to be an active member of society. Kelly (2009) defines curriculum as all of the learning outcomes students experience from the educational programme. With these examples in mind, it can be said that a descriptive definition of the curriculum focuses on the result of students' development in relation to what they experience in school.

The prescriptive curriculum is criticised by several researchers because it tends to consider teachers as instrumental in delivering solely planned activities for learners (Barrow, 2015; Briggs and Sommefeldt, 2003; Ellis, 2004). For instance, Barrow (1984) argues that to define a curriculum as prescriptive limits learning opportunities. This is similar to the idea presented by Ellis (2004) who criticises the prescribed curriculum by positioning the teacher as a kind of patient in need of medicine that has been prescribed by a doctor. In this study, however, the prescribed curriculum operates only as a guide for teachers and the way in which the curriculum is taught remains the teacher's decision. In this case, a prescribed curriculum allows the teacher to exercise authority by making independent decisions in curriculum enactment (Pratt, 1994). For this study, defining a curriculum as prescriptive is still valid, especially when a curriculum is developed and controlled by a central governing board and imposed on the teacher for implementation.

Although multiple definitions of curriculum have been suggested and, theoretically, it can include the entire educational system, both planned and unplanned, for the purpose of this study a curriculum is limited to certain elements of teaching and learning. These are the intended goal of the externally imposed curriculum, intended content, pedagogical teaching, assessment practices, required resources for facilitating teaching and learning, and supportive context toward achieving the goal and enactment.

2.2.1 Intended, enacted, and received curriculum

Authors focusing on curriculum and its enactment conceptualise and classify the curriculum into different forms (Cuban, 1993; Eakle, 2012; Kelly, 2009; Marsh, 2009), which include a curriculum that is developed by the policy-makers, delivered by the teachers and received by the students as a result of interaction with different school programmes and the reality of the school context. This framework, which categorises the curriculum into smaller constituent parts, began long ago and its application for illustrating and conceptualising curricula has attracted the attention of many authors. For instance, in his research book focusing on how teachers teach, Cuban (1993) describes the curriculum as divided into four categories: the official, taught, learned and assessed curricula. Furthermore, he emphasises that the enactment of the curriculum is largely defined by how these aspects are elaborated, integrated and connected in the classroom. This framework has been adapted by other authors who divide the list into three – the intended, enacted and received curricula by putting assessed aspect a part of the enacted and received curriculum (Kelly, 2004; Marsh and Willis, 2007) – while others consider the importance of assessment and regard it as a separate aspect within curriculum (Eakle, 2012). As a result, Eakle identifies curriculum in terms of intended, enacted and assessed curricula. The Eakle categorisation of the curriculum lacks an emphasis on what students receive from the intended curriculum and other unplanned programmes within the broader context of the school.

The categories of curriculum are named differently by different scholars. For example, Cuban (1993) defines the official curriculum as a formal document developed by policy-makers, while other researchers term this as the planned curriculum (Kelly, 2009; Marsh and Willis, 2007). For the sake of consistency, I will use the term intended curriculum throughout. In this case, an intended curriculum is constructed by a curriculum planner and compiled as a formal document such as a syllabus or prospectus (Joseph, 2011; Kelly, 2009). The intended curriculum systematically describes the intended goal to be achieved in a specified learning duration and the content covered over a particular time period. This category of the curriculum also suggests a methodology to deliver prescribed content as well as explaining the details of the assessment procedures during the course of study. Kridel (2010, p. 5) refers to the intended curriculum as a planned learning experience derived from the policy environment as well as emphasising what students should learn in a particular educational setting. According to Kridel, such a curriculum considers students a standardised group and that it is planned to achieve a particular prescribed educational goals.

In the field of education, students are increasingly considered a heterogeneous group in terms of cognitive, behavioural and other aspects of human development. It is the role of the teacher to embrace this heterogeneity by ensuring that teaching is beneficial to all learners. The learning experience that is practiced by the teacher in their learning environment is what is called the enacted curriculum, though other scholars refer to this as the taught curriculum (Cuban, 1993; Kelly, 2009). This study will use the term enacted curriculum. Marsh (2009) asserts that the enacted curriculum is based on the professional judgment of the teacher in terms of efficiency and the appropriate use of both content and pedagogical knowledge. This is the curriculum the individual teacher delivers to the students by interpreting the intended curriculum. Joseph (2011) defines the enacted curriculum as that which the teacher practices in the day-to-day teaching within a given educational setting. Essentially, the enacted curriculum involves the application of different teaching techniques to achieve the planned curriculum goals (Ellis, 2004). The enacted curriculum always gives an overall view of the effectiveness of the delivery of the curriculum. Snyder et al. (in Marsh (2009, p. 93) asserts that:

Enacted curriculum always is the curriculum that describes how the process of implementation of the intended curriculum is made because it emphasises the educational experiences that learner and teacher interact as they determine what the planned curriculum should be stipulated each classroom to attain the goals.

This category is perhaps the most complex of the three as it involves the interpretation of policy documents and considering the reaction to it by teachers and students. Its impact depends largely on the teacher within the interaction of social forces that support the teachers' reaction and interpretation. The experiences that learners undergo in a school context as a result of the enacted curriculum are known variously as the received, experienced or learned curriculum, depending on which author informs your understanding (Cuban, 1993; Kelly, 2009; Marsh and Willis, 2007). For the purpose of consistency, this study will use received curriculum throughout. Kelly (2009, p. 6) defines the received curriculum as "*the reality of the student's experience*". A received curriculum depends on the content the teacher delivers as well as how this content is taught. There is no doubt that all three aspects of the curriculum – intended, enacted and received – are of paramount importance in measuring curriculum implementation. However, the important consideration in this study is how the enacted curriculum corresponds with the objectives of the intended curriculum. Therefore, the received curriculum will not be explained any further as part of this review. This relationship will be studied through a competency-based curriculum in the Tanzanian educational context.

2.3 Conceptions of competency-based curriculum

Despite the popularity of the competency-based curriculum (henceforth, CBC) in current educational systems in several countries, there is no common definition of a CBC (Gervais, 2016; Jones and Voorhees, 2002). The CBC is known through different phrases. The study conducted by Gervais (2016) in the US based on conceptions of competency-based education revealed that multiple phrases (problem-based, mastery-based, outcome-based, and performance-based) used in CBCs results in the creation of barriers to knowledge of the competency-based education among key informants. Thus, despite the fact that CBC provides opportunity for developing good quality teaching and learning, its impact might not be seen if the teachers do not have a clear understanding of the whole concept of that curriculum (Goh and Wong, 2014). In an effort to illustrate the importance of teachers' understanding of the meaning of the CBC, Gauthier (2013) argues that many African countries have moved from content-based curriculum to a CBC but many aspects of the CBC have failed to be demonstrated by teachers because of their poor understanding of what the CBC entails. In his study, Gervais (2016) shows the importance of a clear understanding of the CBC, because it serves as a road map for teachers and other key educational authorities to develop clear models that can define and lead the implementation.

Although the CBC is defined differently in different contexts (Jones and Voorhees, 2002), there is a common conception across the literature that a CBC is interactive and activities-based (Fisher, 2007; Kouwenhoven, 2009; Patrick and Bristow, 2014). Drawing on health education, Albanese et al. (2010) characterise the CBC and split it into vertical and horizontal learning. The former reflects the conceptual understanding of the subject content while the latter is the ability of the students to demonstrate the true applications of the subject learnt. Thus, teachers of the CBC need to concentrate on both vertical and horizontal learning (Gervais, 2016). As recognised by Glaesser (2019), it is not the intention that the CBC only develops content knowledge but that it also focuses on students' ability to apply the same in their real-life settings.

Throughout the existing literature CBC, it is agreed that a CBC is defined under student-centred learning and formative assessment (Botha, 2002; Byrne et al., 2013; Kouwenhoven, 2009; Mtitu, 2014). Discussing operationalising CBC, Gervais (2016) asserts that "it is an open system of education" which means that teaching and learning is defined through open dialogue between the teacher and students and among the students themselves. Gervais adds that the assessment in CBC focuses

on understanding the abilities the individual students have developed and their achievements rather than comparing the grades of the students.

The general understanding about the CBC across the literature, as compared with other curricula such as content-based curriculum, is its emphasis on the performance objectives (competencies) which learners are expected to achieve based on learning information (Gervais, 2016). Deibinger and Hellwig (2005) contend that teachers' conceptions about CBCs can be challenged through two aspects of teaching, pedagogy and assessment, and how they are internalised within the teacher's practice. Thus, the key benchmark to be considered for teaching to the CBC is the competencies that should be developed by the students (Byrne et al., 2013). When talking about designing a CBC in Mozambique, Kouwenhoven (2009) describes it as the curriculum that is intended to develop and promote learning competencies among the learners in order that they might participate fully in multiple social contexts. The combination of knowledge, skills and attitudes is referred to as competencies (Alake-Tuenter et al., 2012; Crujeiras and Jiménez-Aleixandre, 2013; Dubois, 1998). In the field of science, Byrne et al. (2013) assert that a CBC endeavours to develop an individual's transferable skills, rather than the mastery of subject content. As such, the success of the learning process is not measured by the extent to which the learner is able to retrieve academic content but rather by the level at which the learner can apply learning concepts in a real-life environment. The teacher is responsible not only for helping the learner to pass the examination but also for guiding the learner through the development of given competencies (Jones and Voorhees, 2002). When describing the theory of the competencies, Glaesser (2019) cautions that it is not similar to learning objectives nor is it measured by how individual students attain those knowledge, skills and attitudes. Rather, it focuses on how students can translate those aspects into application in their daily life. Thus, this suggests that exploring teachers' conceptions about the CBC is to understand how teachers' responses align with the real meaning of the competencies.

In the context of the CBC, Jones and Voorhees (2002) contends that teachers must have clear understanding of its three key components: competencies needing to be developed by the student; ways of assessing such competencies; and the standard value by which students could be judged for. For instance, the Programme for International Students Assessment (PISA) is an international educational organisation that influences educational policy in the field of science in most countries. In the case of science education, PISA assesses students' scientific literacy using three standard values of competencies: "explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence

scientifically” (see, OECD, 2015, pp. 7–8). This illustrates that teaching the CBC needs special emphasis on developing transferable skills (Sudsonmboon, 2010), but also scientific skills through scientific inquiry and argumentation. However, this becomes unfeasible under the multiple tensions within an uncondusive learning context (Joyce-Gibbons et al., 2018; Vavrus, 2009), wherein teachers often appear to focus on mastering scientific content knowledge (Moshia, 2012). The link between local context and teachers’ conceptions about the current CBC is important to obtain understanding of how the CBC is enacted. Now I am shifting to the CBC in the context of science with a specific focus on teachers’ perspectives.

2.3.1 Teachers’ perspectives on the science CBC

The CBC is thought to promote an understanding of scientific and technological concepts, critical thinking and problem-solving that can be applied to real life (Crujeiras and Jiménez-Aleixandre, 2013; DeBoer, 2000). This is about the development of scientific literacy which endeavours to synthesise scientific information through scientific inquiry strategies, which result in scientific argumentation (Alake-Tuenter et al., 2012). All of the terms used in this paragraph fit within the Tanzanian CBC. Thus, we can understand the CBC through emphasising such aspects.

Teachers’ perspectives on scientific literacy

The common perspective among science educational authors on scientific literacy is that scientific literacy should be the fundamental goal of the science curriculum (Bybee et al., 2009; Dragoş and Mih, 2015; Laugksch, 2000; Smith et al., 2012). This is similar to attitudes surrounding the science CBC; although the CBC is presented with different catchphrases (Gervais, 2016; Morcke et al., 2013), the main aim is for the students to develop scientific literacy (Bybee et al., 2009). Scientific literacy is found to have a significant role in the contemporary world because every aspect of the world relies on it. In his paper focusing on explaining the concept of scientific literacy, before explaining the meaning of the term itself, Bybee (2009) starts by stressing his views on the importance of scientific literacy. Bybee asserts that scientific literacy has well-known implications for society, not only for individual wellbeing but also across the entire spectrum of human endeavours in terms of politics, economics, health and national policy. That said, all of these aspects would not be possible without preparing scientifically literate citizens (Choi et al., 2011). However, the impact of scientific literacy is highly dependent on how teachers respond to and perceive it within their practices.

It is often believed that teachers' perspectives and understanding of a particular concept give impetus to their decision-making as well as their practices (Abd-El-Khalick and Lederman, 2000; Mansour, 2009; Roehrig and Kruse, 2005). However, some studies indicate that this is not always the case, because teacher's practices are driven by multiple factors which might override their intended practices and fail to align with their perspectives (Martinez-Hernandez et al., 2015; Sarkar and Corrigan, 2014). For instance, Sadler and Zeidler (2009) recognise the alarming use of assessment in teaching scientific literacy and argue that teaching is considered to be guided by theories and principles; however, assessment has become the biggest driver. Sarkar and Corrigan (2014) conducted a study in Bangladesh with secondary science teachers which revealed that teachers had positive views about scientific literacy; however, their practices were much influenced by assessment practices which did not support the development of scientific literacy. Moreover, in their on-line comparative study of scientific literacy among teachers in Kenya and the US, Martinez-Hernandez et al. (2015) argue that despite the difference in challenges faced by developed and developing countries, scientific literacy was a concern among teachers in both countries.

Some studies consider scientific literacy in terms of a hierarchical structure, either as part of four levels or three levels (Bybee, 2007; Laugksch, 2000). Bybee (2007) describes the following four scientific literacy levels: nominal, functional, conceptual and multidimensional. Bybee describes the nominal and functional categories as the lower levels of scientific literacy, wherein learners are expected to understand relevant scientific terminologies and essential scientific vocabularies. The conceptual category is an intermediate level of scientific literacy which consists of scientific concepts and processes. The highest category is multidimensional scientific literacy, which involves understanding scientific and philosophical issues, the nature of science and the complex relationship between science and technology. By contrast, Laugksch (2000) describes three categories of literacy: the ability of learners to acquire knowledge and skills about scientific content; an understanding of the nature of science; and the ability to apply scientific and technological concepts in society according to informed decisions. Categorising scientific literacy in these ways, however, does not mean that scientific literacy is best taught in a linear fashion. On the contrary, knowledge is developed more effectively using a spiral process (Kelly, 2009).

Considering different views about scientific literacy, teaching science CBC, the teacher must focus on preparing learners to make informed decisions when applying scientific knowledge and skills outside of the classroom. This will depend on the

activities the teacher uses to involve students in analysing scientific information and making inferences using scientific evidence (Dragoş and Mih, 2015). It is important to note that the application of science outside of the classroom is very broad and continues to change from day to day due to technological development. As such, preparing students to be fully scientifically literate on the basis of what is taught in school is very difficult. Most importantly, it is crucial to enable students to develop the necessary intellectual ability to make sound decisions about scientific issues in society (DeBoer, 2000).

In an effort to analyse the concept of scientific literacy as found in multiple literature sources since the 1950s, Roberts and Bybee (2007) reviewed the meaning of scientific literacy and divided into two broader aspects; Vision I and Vision II. Each vision includes a distinctive nature and aspect of scientific literacy. In Vision I, scientific literacy is science that focuses on developing future science specialists. It is about teaching science as a “*blueprint*” (Roberts and Bybee, 2007, p. 546), science itself or teaching science and not teaching about science (Hodson, 2014). This is assessed according to the ability of teachers to prepare student with the right knowledge and skills for post-secondary education. For scientific literacy to be achieved, students must go beyond knowledge acquisition by developing a clear understanding of solid scientific concepts and theories (Norris and Phillips, 2003). On the other hand, Vision II scientific literacy is focuses on science knowledge for living, science that equips individual to interact and make informed decisions about science-related issues (Roberts and Bybee, 2007). Thus, Vision II scientific literacy was found to have equal importance as that of Vision I. Vision II scientific literacy is the science that links the individual’s life with the social and political nature around it. This enables individual students to be involved in decision-making about science-related issues as well as about their bodies and health. This is represented by the common phrase “science for all” (Roberts and Bybee, 2007, p. 546). According to the Singer et al. (2006), scientific understanding is the ability to use ideas and predict scientific phenomena based on scientific theories. In this sense, scientific literacy is far from preparing students simply to be consumers of science, but rather to have the knowledge and skills to articulate scientific issues both inside and outside the classroom (DeBoer, 2000). In practice, regardless of how we define scientific literacy, its delivery rests on how science teachers perceive it within their professional boundaries.

As recognised by Bybee (2007), teachers’ teaching about science depends on their perspectives regarding the two aspects of scientific literacy. He calls it as “the fundamentals and internals of science itself or the external perspectives that focus

on preparing science for citizenship” (p. 10). This view is shared by Ryder and Banner (2013) in their study based on teaching socio-scientific issues. In their study, some teachers who identify themselves as scientists, or what Bybee (2009) calls fundamentalists, had negative response of teaching socio-scientific issues. But those who were less fundamentalist or who have external motives complied with the notion of science for all. Bybee argues that policymakers and educational authorities expect to achieve the goal of scientific literacy on the assumption that many teachers hold scientist perspectives of scientific literacy. Unfortunately, Bybee ignores multiple factors that condition teachers’ practices. Enacting curriculum is not only influenced by the teacher’s personal decision or identity; teaching and learning context, external examination, accountability in response to how teacher is assessed and others such factors also matter. It is very important to understand what happens behind the scenes of the teachers’ practices.

Teachers’ perspectives on scientific argumentation

Scientific argumentation is a primary concern for science education today because it promotes critical thinking skills and scientific reasoning ability (Driver et al., 2000; McNeill, 2011). According to McNeill (2011), understanding science is not only about memorising facts, laws, principles and scientific theories. Rather, it is the ability to articulate scientific concepts in relation to wider society. Nowadays, we are living in a society where many scientific issues are at the forefront of our minds. Some of the more pressing issues include the application of genetic engineering in crops, climate change and the excessive use of electromagnetic waves in various applications in the everyday human life. Therefore, scientific argumentation is necessary to prepare students to better understand how to interact with the scientific issues in society (Sampson and Blanchard, 2012; Sampson and Schleigh, 2013).

Students’ understanding is developed through participation in discussion and debate, whereby ideas are supported or opposed using scientific proof, rather than personal whims. Driver et al. (2000) define argumentation as the way in which an individual student or group support or oppose a claim posited by others, using scientific theories and principles. In this scenario, the teacher is there to mobilise discussion and to direct learners towards acceptable outcomes. Argumentation in this sense is based on both verbal and written ability. Written argumentation is necessary since students are required to present scientific ideas or findings in a clearly so as to provide a right message to the reader. However, in the classroom setting, developing students’ argumentation is mostly dependent on the teacher’s ability to translate argumentation from a given curriculum and their ability to put it into their classroom practice.

Within the CBC, teacher's practice is defined by student-centred teaching, wherein the argumentation is identified as central to the teaching and learning process (TIE, 2007). The studies related to argumentation have shown that there is positive correlation between argumentation and students' conceptual understanding (Lawson, 2009; McNeill, 2011; Osborne et al., 2013). A quasi-experimental study conducted by Tsai (2015) with eighth-grade students revealed that the experimental group which engaged in argumentation outperformed the control group in PISAs' scientific competencies. A similar effect of scientific argumentation on students' conceptual understanding and learning about socio-scientific issues was revealed by (Osborne et al., 2004). Their two-year research study into Greater London schools, analysing the quality of argumentation in classes, found that the students' understanding of socio-scientific issues increased dramatically as the level of argumentation rose. However, in their study, Osborne et al. (2004) concluded that teaching scientific argumentation depended on whether a teacher is capable of establishing and encouraging students to become involved in it. This obviously would depend how the teachers themselves perceive the argumentation within their teaching practices.

Scientific argumentation does not occur by chance; it has to be developed by science teachers. Because it is socially constructed, science should be taught in a classroom context where students are actively involved in the lesson, and where their views and opinions are valued (Alake-Tuenter et al., 2012). It is difficult for students to develop scientific argumentation skills in a classroom in which the teacher dominates the teaching process by asking students questions individually rather than overseeing a wider discussion. Scientific argumentation is not only about questions and answers (Berland and Hammer, 2012), rather it is about the individual's ability to present the ideas and defend them based on scientific evidence. Of course, explanation and questioning by the teacher are critical to a student's learning, but they should be used for the purpose of clarifying concepts and to give students the opportunity to elaborate their arguments. According to Osborne et al. (2013), a student's understanding develops when the student has the opportunity to engage in reading through a series of logical discussions about a particular concept and not simply by listening to the teacher or reading books or online resources. Students need to be empowered by explaining the concept through the construction of critical arguments based on academic and scientific evidence. They suggest that

Students' conceptual understanding is developed when students get opportunities not only to hear the explanation from the teacher, books or computer but also, they need to practice their ideas through interactive

dialogue where they can be challenged by others. (Osborne et al., 2013, p. 298)

Thus, the teacher's role is to establish the social classroom environment which fosters and mobilises students to effectively engage in a discursive learning opportunity.

Despite the emphasis on scientific argumentation by policymakers within science education, and teaching and learning in particular, many studies in the existing literature indicate that scientific argumentation is rarely observed in teachers' classroom practices (Heng et al., 2015; Osborne et al., 2013; Sampson and Schleigh, 2013). For instance, a two-year project conducted by Osborne et al. (2013) involving four schools in England revealed that teachers found practising scientific argumentation challenging because of varied factors including external examination as well as the pedagogical knowledge required of teachers to organise scientific argumentation. This is also in line with the study conducted by McNeill (2011) who contend that developing students' argumentation ability needs good teacher knowledge of both content and pedagogy. However, it is clear that teachers' knowledge about the nature of science and pedagogical knowledge are insufficient for them to exercise scientific argumentation (Sampson and Blanchard, 2012), because teachers' classroom teaching depends on the goals of the curriculum. This is further limited by teaching and learning challenges encountered by the teachers within their contextual school reality. As is demonstrated by this dialogue within the literature review, there is no simple answer to the question of teachers not involving scientific argumentation within their classroom practices. Thus, it is very important to hear from the teachers' perspective about it and consider the way they enact their curriculum.

The focus on this research is on the teachers' perspective of the science curriculum and their responses to it. However, in considering teachers' responses to any curriculum reform including the CBC, it is very important to consider the broader perspectives of teaching and learning as a whole. Therefore, in the next section I will explore broader teachers' perspectives on teaching and learning across two main themes of teaching and learning; pedagogy and assessment in collaboration with the aims of the curriculum.

2.4 Teachers' responses on teaching and learning

In the previous section, I used the existing literature to describe the two important aspects of CBC that teachers need to incorporate in their classroom practices as a way of translating the CBC in science: scientific literacy and scientific argumentation.

The teachers' decisions to enact the CBC by focusing on developing students' competencies in scientific literacy and argumentation, cannot be fully achieved without good integration it within their practices. In this section, I present the responses of teachers about a CBC by focusing on two important elements of teaching in relation to the goals of the intended curriculum: teaching pedagogy and assessment

2.4.1 Responses of teachers to pedagogy of teaching

The relationship between curriculum and pedagogy is a recurring subject of studies in many areas, and science in particular (Baker, 2013; Bell, 2005; Hyun, 2006; Jones and Baker, 2005). Focusing on questions to be considered during curriculum development proposed by many scholars (e.g. Tyler's questions), it is clear that pedagogy is defined within a curriculum. However, when it comes to the teachers' classroom practices, the curriculum goals and teachers' pedagogical practices are treated as separate entities. Two reasons may exist here for such consideration. Firstly, the curriculum as a policy document is developed by government agencies and implemented by teachers (Ball et al., 2012; Bowe et al., 1992), and these groups, in most cases, wear different sizes of lenses. Secondly, a curriculum, in most cases, prescribes what to teach and indicates the teaching methods in its general terms, the decision of which approach to be applied in the classroom to attain the intended goal remains to the teacher. Therefore, looking at these two practices as separate aspects is another way of practitioners separating theory and practice (Gilbert and Hoyt, 2007). The intended goal of a curriculum is interpreted within teachers' pedagogical practices. Thus, this apparent separation of the intended goal of the curriculum from pedagogy could result in a huge impact on curriculum enactment because of what Kelly (2009, p. 14) calls the "make or break role" that teachers have.

The pedagogy is among the most interesting variables for understanding the curriculum enactment and its impact to the student (Baker, 2013; Bell, 2005; Leander and Osborne, 2008). In curriculum enactment, teacher's pedagogical practice becomes the mediator between the intended curriculum goals and students' learning or the received curriculum. Bell (2005) conducted a study using five science projects in New Zealand from 1979 to 1998. His study focuses on the effect of pedagogy in connection to the national curriculum learning goals and students' learning. He revealed that pedagogy plays a crucial role in improving the learning of science and achieving the outcomes of the New Zealand national curriculum. Another study, conducted in the US by Baker (2013), argues that in order to increase the number of girls in science, the teacher must apply the appropriate pedagogies during curriculum

enactment. All these studies pay less attention to the distortion of pedagogy of the curriculum goal and describe pedagogy as a practice which bridges the gap between what is taught and the educational goals of the curriculum. However, this is only possible when pedagogy aligns with the intended goals of a curriculum; if it fails to attain what the curriculum expects, the gap might widen. Daniels (2001) shows how pedagogy can distort the aims of a curriculum. He argues that scientific concepts of the curriculum subject may be hidden within instructions aimed at producing a particular performance (p. 112). Therefore, how the intended goal of the curriculum can be attained depends on how teachers interpret it within their pedagogical practices.

The learning outcomes following the relationship between curriculum and pedagogy do not occur in nature but rather occur in a nurtured context. However, some studies (e.g. Bell, 2005) describe the intended goal of the curriculum and pedagogy as if they work in the absence of the teacher. To discuss the relationship between the intended goal of the curriculum and pedagogy without associating it with a teacher is not adequate. Teachers' pedagogical practices cannot be generic even within a single set of a curriculum (Hyun, 2006; Leander and Osborne, 2008). Leander and Osborne (2008) use two narratives of teacher-facilitator to analyse how reform is enacted within a school setting. Their analysis reveals that teachers' pedagogical interpretations of the object-based science curriculum contrasted dramatically with each other. The study reveals that curriculum and pedagogical practices are affected by teacher's professional identity and their audiences. In another study, Hyun (2006) found similar results showing that the relationship between intended curriculum and pedagogy is influenced by teacher's beliefs and the internal school demands. The argument here is that the teacher's pedagogical practices plays a crucial role to attain any intended goal of the curriculum.

The findings above also reveal a tension between curriculum and pedagogy. This is the result of teachers' autonomy and external influential factors such as the demands by school authorities and the examination (Crujeiras and Jiménez-Aleixandre, 2013; Goodson, 2014). A teacher's pedagogical practice is based on a negotiation with the teachers' professional knowledge and other external factors including the goals of the curriculum. That negotiation is driven by individual teachers' beliefs, desires and subjective interpretations of the agenda (Hyun, 2006). According to Bowe et al. (1992), the teacher's negotiation with the curriculum could result in either adaptation, resistance, accommodation, subterfuge or conformity. For example, in the context of a CBC which focuses on the development of knowledge application, if a teacher's agenda is on the examination results, then their pedagogical practice will focus on

that aspect regardless of the aims of the curriculum. On the other hand, as a result of external pressure, a teacher might adapt the curriculum and accommodate it into their practice. This shows how a teacher can make the curriculum and pedagogy swing in either way (Kelly, 2009): in the direction that delivers the teaching as intended by the policymakers; or the opposite direction, thereby distorting the goals of the curriculum.

Another facet of teachers' response to the intended goal of the curriculum is the teacher knowledge. Three types of knowledge – namely content knowledge, pedagogical content knowledge and curriculum knowledge – have a big impact on teaching and learning practices (Bayram-Jacobs et al., 2019; Gess-Newsome et al., 2019; Jones and Moreland, 2013). For many studies, these three pieces of knowledge have a big impact on curriculum enactment and students' achievements (Houseal et al., 2014; Roehrig and Kruse, 2005). However, teacher knowledge is not a sufficient condition for the implementation of curriculum as intended. For instance, a study conducted by Bayram-Jacobs et al. (2019) with 30 teachers from four countries (Cyprus, Israel, Norway and Spain) contended that teachers' pedagogical content knowledge of teaching socio-scientific issues is impacted by the design of the curriculum materials. Moreover, a study conducted by Leander and Osborne (2008) reveals that teachers' professional identities result from their drastically contrasting pedagogical practices despite teachers simultaneously sharing content knowledge. Here, I argue that these three types of knowledge has big impact on teacher to respond to the goal of the intended curriculum.

2.4.2 Responses of teachers through assessment practices

In teaching and learning practice, curriculum and assessment are interwoven. Even though assessment measures only a small portion of the curriculum and might not be the measure of the attainment of all the goals of a curriculum (NAHT, 2014). However, if applied effectively during teaching and learning, a significant goal of the curriculum will be realised. Black and Wiliam (2010) call for the need of assessment for learning, which is described as an appropriate form of assessment for CBC implementation (TIE, 2007). Talking about assessment in health education in New Zealand, Delany et al. (2018) argue that assessment should not only focus on what students know through a paper-and-pencil test, but rather should focus on various aspects of the curriculum. Describing the impact of assessment on the curriculum, Kelly (2009) asserts that what is important is to ensure that the assessment applied in our classroom context serves the purpose of the intended curriculum. However, this depends on teachers' commitment to their curriculum implementation.

Despite the importance of assessment for the curriculum enactment, as listed by many pieces of literature (Black and Wiliam, 2010; Kelly, 2009; NAHT, 2014), assessment can also have a negative impact on it. For example, when talking about assessment in relation to the curriculum, Kelly (2009) expresses concern about the effect of the assessment of curriculum enactment. He cautions the teachers and other educational practitioners to be keen in regulating and administering the assessment, failing which it will lead rather than support curriculum implementation. He uses the phrase “the assessment tail always wags the curriculum dog” (p.148). This phrase has the implication that assessment might alter the curriculum goals. External pressures such as assessment policy, examination results, school competition over students’ pass rates are likely to interfere with a teacher’s curriculum enactment. When teaching is driven by assessment, it is likely to twist the aims and goals of the curriculum (Wyse, 2013). The case study conducted by Posner (1994) on the high school mathematics curriculum in New York found that a the curriculum goal was controlled by a high-stake assessment . In this case study, Posner (1994, p. 93) argues that

Because of the attention focused on the exam, the curriculum was largely controlled, not by the state syllabus, nor by the teacher's own sense of what constitutes good mathematics teaching, but, instead, by the exam itself. The exam has undermined the goals of the curriculum.

Another example from Australia demonstrates how teachers experience difficulty in responding to the curriculum goals as results of assessment demand (Hardy, 2013). This research uses a case study of two teachers from a larger sample of 18 teachers in Australia and reveals that teachers had difficulty in concentrating on student-centred teaching because the teachers’ practices were driven by the standardised testing policy. National testing policy in Australia exerts pressure on the teachers, which results in the intended goal of the curriculum being narrowed. What these findings tell us is that assessment has a compelling power of making teachers lose sight of the goals of a curriculum. A teacher decides to focus on the assessment which they think counts in their teaching practices (Havnes and McDowell, 2008). However, it seems these findings distance themselves from other factors such as the contextual reality of schools, including resources, leadership practices and external authorities, which might also impact teacher’s response to the assessment practices. Teachers’ practices encompass the combination of curriculum goals, and pedagogical and assessment practices (Black et al., 2004). These three curriculum aspects always exert pressure on teachers in their professional lives including how knowledge is defined in the curriculum (Kelley, 2004). In their editorial on curriculum

journals, Hayward et al. (2016) argue that if the policy-makers fail to conceptualise clearly the inter-link between curriculum, pedagogy and assessment, the teachers' response to the curriculum becomes more complex. This is in line with the literature review done by Jones and Baker (2005) based on effective pedagogy in science education in New Zealand. Their review revealed that it is very challenging to discuss the impact of effective pedagogy without associating it with other variables such as curriculum and assessment. With this observation in mind, understanding teachers' responses to curriculum reform can also be measured by allowing teachers to describe their practices in relation to these three aspects of curriculum: goals, pedagogy, and assessment. If teachers are able to make adjustments to these three aspects of the curriculum within their classroom practices, it is likely they might achieve the intended educational destination (Black et al., 2004).

The report of the ministry of education in New Zealand by Carr et al. (2005) on the effect of curriculum and assessment on pedagogy and learning outcomes associates a curriculum with four variables: curriculum and pedagogy; curriculum and assessment; curriculum and learning outcomes; and curriculum and social outcomes. In this framework, however, I only focus on the first two associations, but, as a teacher is a mediator between the intended and enacted curricula, the rest of the association might also be revealed. My argument here is that a curriculum implementation could be well justified through teachers' pedagogical and assessment practices. Thus, the relationship between these three aspects – curriculum, pedagogy, and assessment – can serve as a fundamental basis for the researcher to answer the questions based on teachers' responses to a CBC and teaching and learning science.

2.5 Factors influencing teachers on curriculum enactment

The CBC is like many other curricula implemented in the school context. In understanding factors influencing teacher's CBC enactment, it is better to give a broader picture of factors influencing curriculum enactment. Curriculum enactment entails translating and interpreting the prescribed curriculum into practice. Understanding the factors that influence teachers' curriculum implementation is complex (Ball et al., 2012; Hargreaves, 1989; Marshall, 2006). The factors that influence it emerge from three sources, in the following ways (Ball et al., 2012; Goodson, 2001; Ryder and Banner, 2013):

- From the individual teacher, through the teacher's beliefs, identity, and biography

- From internal school factors, such as school ethos and cultures, leadership and availability of physical resources
- From external factors, such as parental pressure, the high stakes of external examination and similar, which in most cases appear to pull the focus in a different direction

Thus, the capacity of the teachers to act (teacher agency) in most cases depends on how those factors are internalised and handled by the teachers in their professional practices in relation to the imposed curriculum reform. Thus, in this section, the personal, internal and external factors and their impact on teachers' practices are presented first, followed by a discussion on teachers' agency.

2.5.1 The personal, internal and external factors

There are numerous factors that influence teachers' responses to curriculum and its enactment in particular. However, many studies about curriculum reform argue that teachers' practices form a fundamental factor for reform implementation (Goodson, 2003; Ryder and Banner, 2013; Sampson and Blanchard, 2012). For example, talking about the curriculum and assessment reform, Hargreaves (1989) shows how teachers can impact curriculum reform. He argues that at the classroom level, curriculum implementation is driven by teachers' thinking, beliefs, assumptions and the way they translate curriculum policy into practice. This is in line with the argument provided by Ball et al. (2012) when they highlight the position of a teacher regarding policy implementation. Such arguments lead a common warrant that curriculum reform is influenced by teachers' practices, which are driven by their professional beliefs and their teaching experience (Hyun, 2006; Ryder and Banner, 2013).

Teachers' responses to external curriculum reform vary from teacher to teacher even for the same reform. In their conference paper presented in the Educational Research Conference in Istanbul, Banner et al. (2009) reported that while teachers in school A prioritised preparing students for science specialisation at the higher level, the teachers in school B prioritised teaching science for social practicality. These teachers' priorities dramatically impacted the enactment of the 2006 curriculum reform about teaching socio-scientific issues. In the joint paper written by Ryder and Banner (2013), these teachers' priorities were said to have been influenced by teachers' identities and beliefs. Those teachers who identified themselves as scientists were scepticism about teaching socio-scientific issues, while others who believed in science for all responded positively to the reform. Therefore, the external curriculum must be internally negotiated within the teachers' personal knowledge before being exercised in the real classroom setting (Goodson, 2014). The teachers'

knowledge both content and pedagogical knowledge said to have a significant impact of curriculum implementation. For instance, the study conducted by Childs and McNicholl (2007) based on teacher teaching science out of their specialisation revealed that teachers' limited knowledge impacted their confidence of deeply explain and elaborated some scientific concepts. In their another study conducted in Bhutan, Childs et al. (2012) reported that teachers' knowledge was one of the factors that limit teachers to effectively taught science through inquiry approaches. As a results teachers taught theory and laboratory experimentation separately where the role of experimentation was to confirm theory rather than discovering.

Teachers' personal theories; knowledge, beliefs and experience not alone impact the enactment of the imposed reform. But also the gap between the intended and enacted curriculum can also associated within the school context and also the curriculum itself. For instance, the limited resources, time constraints and overloaded content impacted the enactment of science curriculum in Bhutan (Childs et al., 2012). In talking about curriculum reform in the context of Africa, Chisholm and Leyendecker (2008) show that the internal school context including infrastructure and resource availability has a big impact on curriculum implementation. The teaching and learning resources in less developed countries have a big impact on teachers' responses to curriculum implementation (Bantwini, 2010; Kitta and Tilya, 2010; Olufunke, 2012; Voogt et al., 2009). However, the study conducted by Hattingh et al. (2007) in Mpumalanga, South Africa, revealed that even when the resources are available, teachers' perceptions and attitudes toward the external reform have a big impact on their teaching. Reporting from their six-year project of improving science education through teaching laboratory experimentation, Hattingh et al. (2007) reveal that despite the schools having good laboratory resources, some had no practical work done there. Those teachers who consider practical work as motivation for their students teach laboratory experimentation, and those who consider it destructive to school property did not. This is similar to the study conducted in England by Abrahams and Saglam (2010), an investigation into teachers' views on practical work. In their study, they reveal that the policymakers cite the importance of science investigation in improving science teaching and learning, but its implementation depended on the goals and perceptions of those who implement it.

Other studies show that the imposed external curriculum also had the power to shape teachers' classroom practices (Fisher, 2007; Hyun, 2006). For instance, when reporting the finding of a small-scale study on curriculum reform in post-16 education in England, Fisher (2007) shows how external curriculum reform influences teachers' practices, revealing that teacher's practices changed because of the new reform.

Thus, a curriculum reform has the power to influence teacher's practice but also the teacher's practice has the power to change the goal of the reform. However, there is no straightforward answer as to the nature of this influence and whether one is more influential than the other. Rather than associating curriculum with teachers' personal knowledge, Osborne et al. (2004) link teachers' personal knowledge with internal context. In analysing the outcomes of the project involving four schools in London in relation to the development of students' argumentation, Osborne and colleagues reveal that the internal school context, which included school policy, leadership practices, school's culture and teachers' beliefs and personal goals in teaching, caused different results among the four schools.

Several studies have attempted to understand the impact of factors influencing teachers after implementing the imposed external curriculum (Goodson, 2001; Su, 2012; Vavrus, 2009). In relation to the impact of internal school context, including overcrowded classrooms, on employing student-centred teaching in the Tanzania context, Vavrus (2009) described how she experienced difficulties in awarding marks to two teacher trainees during teaching practices. She was finally able to do so after she reflected on the context in which they were teaching. Her study reveals that the internal school context (nature of the students and class size) resulted in different teaching approaches despite the fact that they all were required to teach through student-centred teaching. The work of Goodson (2001) helped us to better understand the factors influencing teachers' responses to the external curriculum reform. Goodson categorises these factors into three groups – internal, external and personal – and investigates their interplay within teachers' professional lives. In illustrating how these factors impact on curriculum reform, Goodson asserts that the momentum of implementation of reform increases as these factors align together but it becomes complicated when there is a disjuncture between them.

2.5.2 Teacher agency regarding the imposed curriculum

In the previous section, I looked at the literature on factors affecting teachers' responses to the external imposed curriculum. The review resulted in the identification of three factors that are at play within a teacher's professional life: internal, external and personal. The interplay of these factors confronts a teacher with varying levels of decisions in response to the imposed external curriculum, such as the CBC, based on their acceptance, resistance or negotiation of the same (Ball et al., 2012; Cotton, 2006; Ryder and Banner, 2013). To understand the dynamic nature of teachers' decisions and choices to act in response to reform, it is worth reflecting on teacher agency (Biesta et al., 2015; Buchanan, 2015; Ryder et al., 2018) because

teacher agency describes how teachers act towards the fulfilment of their assigned roles and responsibilities (Oliveira, 2012). Teacher agency is not about something that teacher can do or poses in terms of knowledge, skills and values but rather it is what the teacher can do within a current situation (Biesta et al., 2015; Lasky, 2005; Vähäsantanen, 2015). In the context of professional learning, Vähäsantanen (2015) describes teacher agency as an exercise in which a teacher is encouraged to make choices and take decisions that impact on their assigned roles. That capacity to act may propel teachers into different angles, not necessary to comply with the new intended reform but also to persist with their existing practices or to struggle because of the negotiation between their personal drives and reform (p.61). In the existing literature, teacher agency appeared to be highly influenced by the teacher's personal drive as explained by those who adopt an individualistic view¹ (Biesta et al., 2015; Campbell, 2012). However, it cannot be denied that even if the teacher's personal motives have the power to influence a teacher to act, achieving the intended goal of curriculum reform is largely dependent on the individual teacher in interaction with both school practices and social factors where the teacher is working (Priestley et al., 2012; Ryder et al., 2018). This is a common understanding to those who adopt the ecological view ² of teacher agency. In fact, teachers are not implementing any curriculum reform in a factor-free environment; therefore, other factors that surround the teachers, whether internal or external, cannot be overlooked as influencing their decisions to act.

Teacher agency is an essential aspect of reform implementation (Campbell, 2012; Lasky, 2005; Ryder et al., 2018). A study carried out by Lasky (2005) revealed that teachers felt that their professional morale (including their identity, agency and beliefs) was threaten by externally imposed policy reform. Accordingly, they mobilised their agential capacity to modify the reform to meet their professional beliefs. The teachers' professional beliefs and identities served as the driver to change practice, but in a way contrary to the mandated reform. Based on their experiences or personal histories and on their future goals in terms of their teaching, teachers make decisions about their practices in relation to the imposed reform (Robinson, 2012). As explained in the previous paragraph, teacher agency is not limited to personal influences. The broader school ethos, the culture and social

¹ A teacher's capacity to act as a result of teacher's personal drives such as experience, teacher biography and personal goal, personal beliefs and efficacy.

² A teacher capacity to act as a result of the teacher's ability in combination with the contextual environment in which the teacher works.

aspects of the local environment also have an impact upon it. In her review of five journal articles on teacher agency, Campbell (2012) tried to answer the question raised by Priestley et al. (2012) “*agency for what?*” and came to the conclusion that there are three aspects of teacher agency: social, political and teacher morale. This implies that teacher agency is situated within internal school policy, culture and a broader area of school leadership and administration. It is not limited to the external forces that teachers encounter during curriculum implementation together with the interaction of teacher’s personal influences (Milne et al., 2006; Ryder et al., 2018).

Teacher agency in relation to the curriculum is expressed in various ways, including complying with the reform, uncertainty and resistance (Vähäsantanen, 2015) or adaptation to their physical learning environment, subversion or creating tension with teacher’s practices (Campbell, 2012; Ryder et al., 2018). In short, as Lasky (2005; p. 900) asserts, “teachers are not simply pawns in the reform process, they are active agents whether they act passively or actively”. The power of the teacher to act actively or passively depends on the degree to which individual teachers interact with the school leadership and school culture. For example, Jenkins (2019) studies the effects of active and passive responses to externally imposed reform and revealed that teacher agency in relation to the external curriculum is established along three lines: proactively, reactively and passively. In that study, Jenkins indicates that the teacher expresses their proactive agency when they respond to the curriculum reform based on the individual teacher’s self-directed out of their external will or orders. At some point, teachers lose autonomy (Ryder et al., 2018), and tend to be reactive to the externally imposed reform in order to meet the official standard. According to Jenkins (2019), a reactive agency, teacher acts in a controlling environment to meet broader department or school interests and demands. Lastly, Jenkins indicates that when passive agency is manifested it always constrains the intended reform. In passive agency, a teacher resists the reform and maintains their prior practices or modify them to fit with their will.

In response to the mandated curriculum reform, teacher agency is not limited to action; it includes both action and perspectives. In their study of two science teachers beginning their careers, Wei and Chen (2019) reveal that teacher agency is manifested in six spaces: personal characteristics, personal beliefs, interaction with students, interaction with colleagues, curriculum material and high-stakes examination. The first two are identified as perspectives agency and the rest are in the action agency. Wei and Chen (2019) argue that “the perspective aspects of agency influenced the action aspects” (p. 1299). The study reveals that the teacher that had a positive view was an active agent of the curriculum implementation while

the one that had a negative opinion was passive and less confident. This implies that teacher agency can foster action to comply with the externally imposed reform but also the action that restrains it (Campbell, 2012; Ryder et al., 2018). However, sometimes teachers are not totally consistent, nor do they clash with the reform, they tend to re-shape their practices and exercises in part because teacher agency is also exercised through negotiation with their professional beliefs to adopt and adapt to reform (Robinson, 2012).

Ryder et al. (2018) explore teachers' experiences of a national curriculum and assessment reform in Sweden using the lens of individual sociocultural perspectives of a professional agency. Their findings reveal different expressions of teacher agency in responses to the imposed policy reform. While some teachers comply with the reform and act actively because the reform supports their professional beliefs, others felt that the imposed reform works against their professional will and therefore this results in subversion of the reform. Furthermore, teacher agency was revealed as not being static but rather moving from passive to active over time. However, it was not clear whether the passiveness could also develop over time, i.e. teacher agency could move backward from active to passive. This is arguably possible when teachers find the reform does not meet their expectations or when other factors both internal and external change. In talking about active and passive responses to curriculum change, Jenkins (2019) argues that the teacher moves across all the teacher agencies—proactive, reactive and passive – and their responses to act depend on the contextual factors impacting the teacher, the school culture (including leadership) and their own personal history. Most policy-makers clearly label the teacher as the agent of change, thinking that they can be proactive and reactive and respond positively with the reform. The idea is that the internal and external influences must be observed to see how it complies with or restrains the agentic force of the individual teacher.

2.6 Conceptual framework for exploring teachers' responses to a curriculum

The framework presented in this section is the policy cycle framework developed by Bowe et al. (1992). Here, I draw upon key broader conceptual perspectives on curriculum reform enactment in order to help imagine the possible teachers' responses to the imposed CBC as policy text; this informs my construction of the research question as well as analysis of my data. The framework by Bowe et al. (1992), provided in Figure 2-1, demonstrates a policy cycle that connects three elements of policy contexts: the context of influence, the context of policy text and

the context of policy practice. Basically, in this framework I focus on policy text and policy practices and the interplay of social forces within teachers' response. Within my thinking of policy text, I draw upon the goals of the CBC in the science context as illustrated by many authors in the existing literature (Black et al., 2004; Fensham, 2009; Hodson, 2014; Laugksch, 2000; Longbottom and Butler, 1999), and how they are conceptualised within teachers' personal and professional boundaries. On the policy practices, I draw upon broader factors that may impact on teachers' enactment of science curriculum as illustrated by many researchers, teachers' identities and biography, school ethos and department organisation.

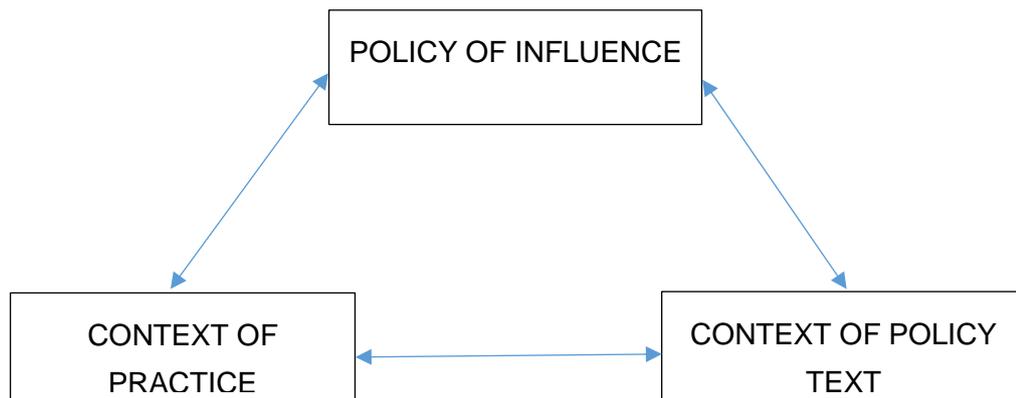


Figure 2-1: Conceptual framework for exploring curriculum reform (Bowe et al., 1992)

Focusing on the relationship between three elements of curriculum – curriculum goal, pedagogy and assessment – Black et al. (2004, p.5) describe the goal of the intended curriculum and break it down into two separate competing demands: “training for future scientists and the needs of the majority for broader scientific knowledge”. These two broader demands are also fully articulated by Fensham (2009, p.1080), who calls them as “the scientifically-based workforce and the scientifically literate citizens”, respectively. The former consists of political, economic and subject maintenance demands while the later has individual, social, cultural and environmental demands. These goals are found to be the key responses from the teachers during the enactment of the imposed curriculum. For instance, referring to the responses of teachers to the imposed science curriculum in England, Ryder and Banner (2013) identify teacher identity, personal goal and personal history as the major factors of influence for teachers to respond to such aims. In that study, teachers who identify themselves as scientists were negative about teaching socio-scientific issues as their major concern was to prepare individual students for science specialisation which in turn led them to become scientists. This is really important because Carlone and Johnson (2007) really push for the development of such an identity and view it as positive without considering how this may come into conflict with the practiced teaching of science. In their study, they show that identity serves

as an agentic force for women who want to learn science. However, within teaching practices identity may result in resistance from the teacher. Moreover, responding to large-scale educational reform in Scotland's curriculum for excellence, Biesta et al. (2015) shows that the teachers' decision on how to act largely depends on the teacher's beliefs and professional traits at work. This agrees with the findings of other studies in that teachers' responses to the imposed curriculum reform feature teacher's past experiences, their personal goals for teaching – whether immediate or long-term – and the present external and internal demands (Buchanan, 2015; Goodson, 2003; Robinson, 2012; Ryder et al., 2018; Smith and Southerland, 2007). However, social forces such as the contextual school reality, leadership practices, and external inspectorates and so on have mutual impact on teachers' responses to the curriculum. For example, in talking about the positionality of the teacher in the context of reform, Luttenberg et al. (2013) argued that teachers' classroom doors are permeable. This implies that teachers' interpretation of the policy text and their enactment of the same is potentially influenced by external demands which might force them to perform in a certain way. This argument is in line with Bowe et al. (1992), who remark that teachers' professional judgment towards policy implementation is always under pressure by the number of demands imposed on them from outside. Thus, the space between policy text (intended curriculum) and policy practice (enacted curriculum) may generate either tension and conflict or desire for the teacher. In curriculum enactment, the teachers take different directions: a direction of acceptance or direction of avoidance (Ball et al., 2012). In describing the responses of teachers to the imposed curriculum, Bowe et al. (1992) express a variety including resistance, accommodation, subterfuge and conformity to the teachers' practices in responses to the policy text.

This policy process framework recognises the struggles of teachers in making meaning from the imposed curriculum. Here, it views teachers' responses to the external curriculum as critique as well as an act of criticising the language of power; policy text (Goodson and Hargreaves, 1996). Bowe et al. (1992) argue that the responses of teachers to imposed curriculum reform often results in "clashes and mismatches between professional vs conformity, autonomy vs constraint, specification vs latitude and the managerial vs educational" (p. 13). To better understand the responses of teachers to curriculum reform and enactment, it is better not only to look at diversity or uniformity between the intended curriculum and the enacted curriculum but also to understand the "dynamic shaping forces in a large-scale of an educational reform process" (Datnow and Park, 2010, p. 209). This is also the focus of my research wherein my interest is not only in investigating the clashes

or mismatches between policy text and the policy of practice resulting from the teachers' responses, but more importantly, to understand what factors influence teachers to respond the way they do (Bantwini, 2010; Goodson, 2003; Ryder et al., 2018; Ryder and Banner, 2013; Wei and Chen, 2019). Through this framework, I also recognise that the curriculum enactment and responses of teachers to it is a process in a particular context, drawing upon social interaction in relation to the local cultural context (Bowe et al., 1992; Priestley et al., 2012; Ryder et al., 2018; Vähäsantanen, 2015). Ryder and Banner (2011) use this framework to analyse the 2006 national science curriculum in England. They used document analysis and largely focus on the examination of the "context of policy text production" (p.711), reflected on the outcomes of the intended curriculum. Their analysis revealed multiple aims of the intended curriculum, largely instrumental, and then summarised it into immediate and long-term aims. Immediate aims are those applicable within teaching and learning as well as in the compulsory level of education such as increasing students' interest in learning or improving students' examination attainment (Ryder and Banner, 2011). This kind of aim has been the response of many teachers to the curriculum enactment at school level (Harris, 2007; Hofstein and Mamlok-Naaman, 2007; Husbands and Pearce, 2012) as the discourses of who is a good and bad teacher are often framed with such aims. In addition to this, Ryder and Banner (2011) identify the long-term aims in which the focus is on post-secondary education and beyond science career specialisation. Such aims and similar intentions for preparing students for real life being the fundamental goal of the science curriculum has been a major concern for many researchers (Black et al., 2004; Fensham, 2009; Hodson, 2014; Laugksch, 2000).

The policy process framework has been considered suitable not only for analysing the policy development process (Ryder and Banner, 2011), but also for analysing the responses of teachers to the imposed curriculum in three key ways. Firstly, the teachers' responses to the imposed curriculum reflect the outcome of the struggle between a teacher's personal and professional traits with respect to the intended goals of the curriculum. Teachers receive the mandated curriculum with their own pre-existing knowledge, past experiences, future goals, interests, and desires (Bowe et al., 1992, p. 22), as well as their own framing discourses of what a curriculum should be about. Their responses to the imposed curriculum are largely driven by such personal traits. Thus, this framework puts the teacher at the centre of curriculum enactment. The concern is how teachers struggle to negotiate their own personal traits in relation to all aspects of the intended curriculum including its goals, content and the intended pedagogical practices in order to attain the desired outcome.

Secondly, enactment of the curriculum is not done based on individual teacher's wishes and interests. Rather, the interpretation and translation from text to practice is influenced by different groups of people, both recipients and authorities, and even the physical environment in which the teacher is working. Thus, in response to this framework, the teacher's response to the curriculum is reflective of an interaction of multiple factors. These include the school's contextual reality – through school culture, leadership and material resources – as well as external influences such as external inspectorates, high-stakes examinations, socioeconomic aspects, and the culture of the local community, which in turn influence the teacher's views, decisions and actions (Lasky, 2005). The curriculum enactment involves meaning-making, interpretation and actions to achieve certain purposes (Bowe et al., 1992). Thus, the major consideration for exploring teacher's responses to the intended curriculum is to understand those purposes, constraints or enablement that drive a teacher's decisions and actions. Finally, as I have pointed out above in this section, curriculum enactment is a process over time. This means that teachers' responses to the imposed curriculum are not always static nor constantly moving. As mentioned in section 2.5.2, teachers' decisions and actions regarding imposed reform move across all three responses – proactive, reactive and passive – depending on the personal capabilities and their interaction with sociocultural influences.

As a result of this description, I have divided the teacher's responses to the CBC into three influences: internal, external, and personal (Goodson, 2001). Indeed, these three influences can be condensed and divided into two dimensions: personal and contextual. I have used the personal dimension to explore teachers' personal traits and their impact on responses to imposed reform. Moreover, I have used the contextual dimension to explore the social dynamic forces that are exercised within teachers' personal and professional responses to the imposed CBC reform.

Chapter 3 Research Questions

3.1 Introduction

This research focuses on understanding the enactment of competency-based curriculum (CBC) reform in the Tanzanian science educational context by looking at policy text in relation to practice through the lenses of teachers. The previous chapter reviewed the literature derived from different research paradigms to illustrate the key broader conceptions of the CBC, its aspects, and the various factors that impact on curriculum enactment. Furthermore, the chapter used a conceptual framework to consider broader conceptions and link policy text and practices, and the interaction of sociological forces that impact the enactment. For this research, I have used the CBC aspects and perspectives on their enactment in relation to the teachers' personal and professional traits to illustrate the four research questions (see section 1.3).

3.2 Research Question One

RQ1. What are science teachers' beliefs about the science curriculum?

This question focuses on exploring teachers' different views and opinions about the science curriculum and how is phrased on the basis of the literature review (see Section 2.2). Through the conceptual framework (see Section 2.6), I have recognised that teachers' personal and professional traits include beliefs inform their views and judgement. Therefore, teachers' beliefs about how science curricula should be about are considered to help inform their values and judgements about the current CBC within their educational contexts. Teachers' beliefs about the curriculum will be measured in terms of the underlying aims of science education, as described in the existing literature (see section 2.6). I draw attention to the fact that this question does not focus on teachers' practices on a daily basis, but rather on the teachers' beliefs about curriculum and how the CBC is framed within them. From the existing literature presented in Chapter2, Bakar et al. (2006), Hermans et al. (2008), and Mansour (2009) argued that to change teachers' practices, it is very important to understand their existing beliefs about teaching and learning. However, the aim of this study is not to change teachers' practice, but to provide information on how consistent teachers' beliefs about the science curriculum are with the underlying goals of the science CBC in the Tanzanian educational context. More importantly it explores what influences their beliefs about the curriculum, whether from their personal lives and

working experiences, identity or social influences, as indicated from the conceptual framework.

3.3 Research Question Two

RQ2. What are teachers' perspectives on the competency-based curriculum reform of science in Tanzania?

The focus of this question is to understand the teachers' points of view, how the goals and other aspects of the CBC, such as content and intended pedagogy, fit within their contexts. The literature review and framework show different conceptions of the CBC and the policy text in general. The framework and the majority of the literature review are carried out in a different context within this study. Teachers' perspectives have been explored to understand how their personal traits are similar or differ with the intended of the curriculum. This question is based on obtaining the teachers' judgement values about the CBC, based on their understanding and experience. Again, this question is not about the process of CBC reform, that is, whether or not teachers were involved during its development, but rather to gain the teachers' views about the CBC as a policy document based on their understanding and professional experiences. Moreover, this question concentrates on how teachers conceptualise the current CBC compared with the former content-based curriculum, in terms of facilitating and impact on their classroom practices. Teachers can draw their broader perspectives by weighing up not only how good or bad CBC is as a policy for students' learning, but also how the CBC equips and provides room for teachers to facilitate science teaching and learning in the way they wish to.

3.4 Research Question Three

RQ3. What factors influence teachers' classroom practices within the competency-based curriculum reform in science?

This research does not explicitly look at teachers' practices through observation, but rather explores teachers' practices on CBC enactment through teachers' conversation. How a CBC is enacted was understood by how teachers describe their classroom practice in terms of how and why they do the way they do in their daily classroom and school routine. Thus, when probing teachers about their classroom practices, particular focus was on aspects of their teaching practices – planning practices, applied pedagogical approaches and assessment practices – and how teachers exercised these aspects in relation to the CBC. In this question, teachers' practices are not limited to the delivery of intended content, but rather to all aspects

of teaching and learning, including the factors that condition teachers in CBC enactment. As mentioned in section 2.5, there are various factors – personal, internal, and external – that affect teachers' enactment of reform. Therefore, this question formulated to clarify why teachers teach the way they do, and what motivates behind their practices.

3.5 Research Question Four

RQ4. What are the differences in responses to the competency-based curricula between teachers in mainland Tanzania and in Zanzibar?

As mentioned in Chapter 1, this study was carried out in two areas of the United Republic of Tanzania: Tanzania Mainland and Zanzibar, which have very close economically and culturally status. The O-level and A-level secondary curricula are shared but under different educational authorities. Therefore, this question is designed to investigate whether teachers in both parts of Tanzania share similar responses to the CBC. This question is based on their responses to the three research questions. Their responses regarding these different issues helps us to understand the differences in their responses concerning the CBC.

Chapter 4 **Research Methodology**

4.1 Introduction

This research is designed with a mixed-methods approach under the exploratory sequential mixed design. The data were collected through interviews and focus group discussions for the qualitative strand, and followed by a questionnaire for the quantitative. The qualitative data were then analysed through a thematic analysis approach, under a combination of inductive and codebook methods, while a statistical technique through descriptive analysis and chi-square were applied to the quantitative data. This chapter is organised into seven sections. The research paradigm is presented in section 4.2, after this introduction. Section 4.3 follows, presenting the research setting, sampling strategy, and samples. The qualitative strand and its full procedure of it including data collection and analysis are then presented in sections 4.4. The quantitative approach together with quantitative data preparation and analysis appear in section 4.5 and 4.6 respectively. Lastly, the ethical consideration of the study wrap up in sections 4.7.

4.2 Research Paradigm

The philosophical paradigm receives considerable attention in social and educational research. A research paradigm is the “researchers’ worldviews” (Creswell, 2014, p.537), a set of ideas that help the researcher to inform their research decisions in terms of methodological application, and ways of interpreting data. The research paradigm emphasises a shared understanding of conducting research. Every paradigm is informed by four philosophical elements: epistemology, ontology, methodology, and axiology. Epistemology (describing how we come to know the truth or knowledge), ontology (describing the nature of the reality), methodology (the entire procedure undertaken to conduct the research), and axiology (reflection on ethical issues or research quality (Creswell, 2014, p.54). Thus, there are sets of shared understanding to be considered in investigating any sort of knowledge. Thus, common shared views about how research should be carried out are important in investigating Competency-based curriculum (CBC) reform through teacher responses.

Rather than relying on the incompatibility thesis ideas that, research can only be conducted qualitatively or quantitatively, a pragmatic mixed research paradigm was chosen. The division of quantitative and qualitative paradigms within the research community is not a serious matter. In describing pragmatism, Johnson and

Christensen (2017, p.432) draw on John Dewey, asserting that pragmatism is the development of “*warranted assertability*” the researcher’s ability to find strong evidence for the effectiveness of their design in relation to the investigated topics. Thus, based on pragmatic philosophy, mixing quantitative and qualitative methods is effective. Denzin (2012, p.83) rejects the notion of the incompatibility of quantitative with qualitative research, asserting that “pragmatism is the research paradigm that supports mixed or multiple methods of social research”. Thus, in this study, qualitative and quantitative approaches were used sequentially to explore deeper and broader responses of teachers to a CBC in the Tanzanian educational context. The qualitative part of the study fostering deeper insights into teachers’ responses, while the quantitative aspect not only helps to provide a broader range of teacher responses, but also provides the opportunity to test the differences between their responses statistically. Thus, the pragmatism paradigm was chosen because the combination of qualitative and quantitative approaches divulges information that could not be captured in a single study alone. Moreover, mixed research involving teachers’ responses to CBC across Tanzania Mainland and Zanzibar is rarely carried out, so pragmatism was chosen rather than positivism and constructivism due to its flexibility of mixing two strands together.

4.2.1 Mixed Method

A mixed method research design was applied in this study to investigate the responses of teachers to a CBC reform in depth and across a broad population of science teachers in Tanzania. It is very important to understand that a mixed research is not limited to mixing the methods of data collection, rather it is the use of “multiple perspectives, theories, methods of data collection on understanding a particular phenomenon” (Johnson and Christensen, 2017, p.470). Thus, in this study, the combination of the interview and focus group discussion results were followed up with survey questionnaires in the quantitative strand to expand on the results. The core argument for employing mixed methods research is that the qualitative yields in-depth information, but from fewer teachers (see figure 4-1), about the CBC reform enactment, and the quantitative strand used to validate qualitative results across a larger population of teachers. This approach has also helped to improve the quality of the findings; the findings from the qualitative strand helps to supplement the findings from the quantitative, which in turn generates more reliable information (Creswell, 2014). As posited by Bryman (2012, p.256) that;

The research methods associated with both quantitative and qualitative research have their strength and weakness so that

combining them in a single study allows the researcher to offset the weakness and to draw the strengths of both.

Furthermore, using the mixed approach helped to corroborate the findings and improved the accuracy of the study.

4.2.2 Justification of the Design

There is no single typology used in classifying mixed-method research. This means that there are several mixed-research designs with diverse terms in the existing literature (Creswell, 2014; Johnson and Christensen, 2017). I do not intend here to characterise each design; but it is important to note that the three common designs used in educational research are convergent parallel, explanatory, and exploratory sequential designs. Of these, the last has proven to be the most relevant approach for this research. Figure 4-1 summarises the research design.

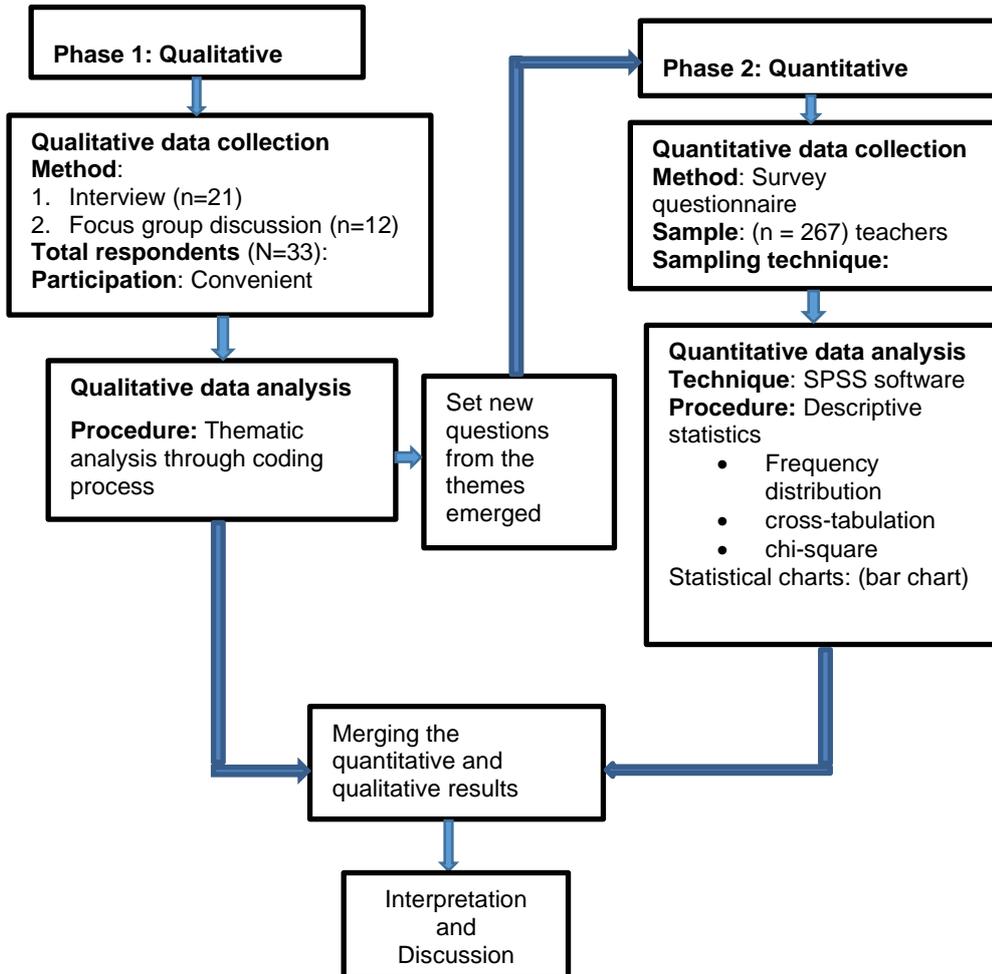


Figure 4-1: Research design

In this study, an exploratory sequential mixed design was chosen to achieve a more comprehensive, expanded, and detailed data collection on CBC reform in Tanzania. It starts with the qualitative, followed by the quantitative approach with the latter used

to create and establish an initial understanding of CBC reform and its enactment, focussing primarily on the responses of teachers from the interviews and focus group discussions. The following quantitative strand was used to uncover the trend of teachers' responses to CBC reform. The use of qualitative data with quantitative is in line with the exploratory sequential mixed research design, whereby the quantitative data helps to describe the qualitative findings against a large population of respondents (Ary et al., 2010; Bryman, 2012; Creswell, 2014). Johnson and Christensen (2017) indicated that exploratory sequential design can be either in equal or in dominant status. There are three categories of exploratory sequential mixed research design, depending on which strand drives the research. My study is a qualitative-driven exploratory sequential design, symbolised as QUAL→ quan.

The qualitative exploratory sequential design allows the use of a small number of science teachers to gain a deeper insight into their responses on CBC. The results obtained are then used to explore a larger group of teachers. I wanted the questionnaire to be developed from the responses of teachers themselves, rather than from the theoretical aspects, or literature that might not be relevant to the context of this study. Thus, the qualitative-driven exploratory sequential mixed design was favoured over the explanatory. Creswell (2014) asserted that exploratory sequential design is suitable for exploring a certain phenomenon in-depth with a broader population.

4.3 Research Setting, Sampling Strategy and Sample

4.3.1 Research settings

This study was carried out at secondary schools where science subjects (physics, chemistry and biology) were taught. The schools were chosen by considering factors such as accessibility, data collection timeline, and running costs. As it was impractical for a small piece of research like this to involve all science teachers across the country. Thus, this study was carried out in four (13 percent) of the 31 regions of the United Republic of Tanzania (URT); Dar es Salaam from Tanzania Mainland, and Urban West, North and South from Zanzibar. By choosing these sites, I had the opportunity to cover a few schools and teachers, but their responses were representative of a broader picture from science teachers across the URT.

The decision was made to select one region from Tanzania Mainland and three from Zanzibar because of their geographical dimensions and locality. One mainland region is much bigger than in Zanzibar; therefore, instead of three regions in Tanzania

Mainland, three districts of Dar-es Salaam were involved: Kinondoni, Ilala and Temeke. These two sides of the Union share a similar curriculum, but had two independent educational authorities, which allowed me to usefully compare their responses.

4.3.2 Sample and sampling procedure

The research population were all science teachers at ordinary secondary level (Years 7 to 11). The sampling used a multistage design, involving four stages– selection of the region where the study was carried out, selection of the district, selection of the secondary schools, and finally selection of teachers. The selections of the region, district and schools were carried out purposefully. This was conveniently effective in both cost and time, as well as offering flexibility for the researcher (Creswell, 2014). A total of 71 secondary schools were selected to participate in the study; 60 of which involved on quantitative strand while 11 on the qualitative. For the quantitative strand, 20 schools from each selected district and region in Tanzania Mainland and Zanzibar were purposefully selected. The main condition for selection was that the schools offered science subjects from one to Form-Four.

In Phase 1 (see Table 4-1), 33 science teachers from 11 secondary schools – five schools from Dar es Salaam, six from Zanzibar – were involved. Then, 21 teachers were selected for one-to-one interviews and 12 different teachers from schools of those involved in the interview were selected to participate in the focus group discussion. Purposive sampling was carried out to ensure that the selected teachers taught at least one of the three science subjects from Form-One to Form-Four (Years 11 to 15). According to McBurney and White (2009), recognising useful information for research is an important consideration, before starting in the science field. The selection process was carried out to ensure Phase 1 included teachers of equal distribution from all three science subjects (Physics, Chemistry, and Biology).

Table 4-1: Distribution of participants in the qualitative strand

Research Setting	School	Participant	Methods	
ZANZIBAR URBAN WEST	S1	3	Interview 1	Interview 2
	S2	3	Interview 1	Interview 2
	S3	3	Interview 1	Interview 2
	S4	3	Interview 1	Interview 2
	S4	3	Focus group	
	S6	3	Focus group	
DAR ES SALAAM	S1	3	Interview 1	Interview 2
	S2	3	Interview 1	Interview 2
	S3	3	Interview 1	Interview 2
	S4	3	Focus group	
	S5	3	Focus group	
Total	11	33		

On the other hand, in Phase 2 (see Table 4-2), 60 secondary schools were visited in Tanzania Mainland and Zanzibar. In each school, six science teachers were selected, totalling 360 teachers for the quantitative strand. To ensure equal distribution of teachers for all three science subjects, two teachers would be selected from each subject per school. However, this was not possible because some schools did not have equal numbers of teachers for each subject; therefore, convenience sampling was applied to fulfil demand. Convenience sampling was carried out by virtue of its accessibility (Bryman, 2012). In addition, teaching experience was the primary criterion for the selected teachers, because it was preferable to involve teachers who had taught science subjects for over five years. More appropriately, those teachers who had taught during the previous content-based curriculum were involved. It was expected that these teachers had enough experience of interacting with the CBC in order to be able to reflect on their practice for both kinds of curriculum. However, in some schools, this condition was violated because it was impossible to get six teachers with such experience in one school. Therefore, to avoid visiting many schools and to save time, some teachers with less than five years' experience were involved.

Teachers were selected using a stratified sampling technique, wherein teaching subject was utilised as the strata. Stratified sampling is suitable when the researcher intends to select participants with different characteristics (Creswell, 2014). However, this was only applied to those schools that had more than two teachers per science subject. Thus, teachers were categorised into the following three groups, according to subjects taught: Group 1 – Physics; Group 2 – Chemistry; and Group 3 - Biology. Thereafter, two teachers were randomly selected from each group. The random selection was used to provide equal opportunity for all respondents, as well as to avoid the possibility of researcher bias (Creswell, 2014; Walliman, 2006). Table 4-2 shows sampled results from this quantitative phase.

Table 4-2: Distribution of participants in the quantitative strand

Research Setting		School	Teachers	Data collection method
Zanzibar	Zanzibar Urban West	10	60	Questionnaire
	Zanzibar North	10	60	
	Zanzibar South	10	60	
Dar es Salaam	Temeke district	10	60	
	Kinondoni district	10	60	
	Ilala district	10	60	
Total		60	360	

4.3.3 Participant distribution

As shown above, 33 teachers were involved in the qualitative strand, with 360 in the quantitative. Of 360, 267 questionnaires were returned – about 74.2%. The research, therefore, involved 300 teachers: 33 in the in qualitative, 267 in the quantitative. Table 4-3 summarises the distribution of the total respondents for the whole research in terms of gender. Gender differences can be seen between teachers in Zanzibar and Dar es Salaam. The male teachers in Zanzibar outnumber female teachers by nearly half. However, this does not mean that the number of female science teachers in Zanzibar is much lower compared with male teachers. Teachers were recruited according to their availability and willingness to participate, with no concern for gender difference.

Table 4-3: Summary of the research participants

Research setting		Gender		Total
		Male	Female	
Zanzibar	Count	107	49	156
	% of Total	35.7%	16.3%	52.0%
Dar es Salaam	Count	68	76	144
	% of Total	22.7%	25.3%	48.0%
Total	Count	175	125	300
	% of Total	58.3%	41.7%	100.0%

In terms of educational level, Table 4-4 shows that a high number of teachers were qualified for teach science at secondary level, as per the Tanzanian CBC. According to the Tanzanian secondary curriculum, the minimum level of education for secondary teachers is diploma (TIE, 2007). Table 4-4 indicates that about 2.2 % of teachers were teaching in secondary schools without meeting the standard level of teaching qualifications. This situation of underqualified teachers at secondary level was only found in Zanzibar, and nothing in Dar es Salaam.

Table 4-4: Educational level of the participants

Research Setting		Level of Education				Total
		Certificate in Education	Diploma in Education	Bachelor Degree	Master Degree	
Zanzibar	Count	3	36	96	3	138
	% within Region	2.2%	26.1%	69.6%	2.2%	100%
Dar es Salaam	Count	0	41	77	11	129
	% within Region	0.0%	31.8%	59.7%	8.5%	100%
Total	Count	3	77	173	14	267
	% within Region	1.1%	28.8%	64.8%	5.2%	100%

According to the curriculum, teachers who hold a Certificate of Education are required to teach pre-primary to primary level (i.e. Years 4 to 11). The constraints of science teachers is the major reason for teachers teaching science despite not specialising in science subjects during their teacher training.

Table 4-5: Teacher Subject Specialisations

Subject of Specialisation	Frequency	Percent (%)
Arabic and Islamic Study	5	1.7
Swahili Language	3	1.0
English Language	2	0.7
Geography and English	2	0.7
Geography and Swahili	2	0.7
Social Science and Education	1	0.3
Mathematics and ICT	2	0.7
Geography and Mathematics	1	0.3
Science specialisation	282	94.0
Total	300	100

Table 4-5 indicates the majority of teachers teaching science have specialised, but about 6.1 percent of teachers have not. The reason for this is the shortage of science teachers. In the Tanzanian context, those teachers who teach science should specialise in science subjects on their teaching training courses at college or university. For a diploma, a teacher is required to study two teaching subjects and other educational subjects like psychology and others, and the situation is similar on undergraduate educational courses.

4.4 Phase 1: Qualitative Strand

A qualitative approach was employed for the first phase to attain a deeper exploration of teachers' responses about the science CBC. It allowed the exploration of teacher responses to a CBC within the natural school environment, without predetermined hypotheses. It was clearly understood that a qualitative approach was effective in understanding how participants operated in their real environment (Bryman, 2012; Creswell, 2014). Thus, qualitative research considers that reality or knowledge is "fluid, dynamic, and changing over time and place, and is not appropriate to generalise beyond the people being investigated" (Johnson and Christensen, 2017, p. 418). Thus, rather than using standardised inquiry methods, social interactive approaches to data collection that allow interaction between the researcher and science teachers were employed. In the context of this study, the qualitative strand was a good starting point for exploring, in-depth, teachers' views, perspectives, and reflections on the CBC, and how they practice it in their real school settings. It provided opportunities to understand the multiple realities of teachers in terms of how they think and practice this phenomenon (Ary et al., 2010; Lodico et al., 2010).

In this study, a qualitative approach provides more informative data about CBC reform, allowing better constructed sets of questions in the quantitative part. Ary et al. (2010) show that qualitative study is good for divulging a complex picture of teachers' experiences in their natural environment. As it allows social interaction

between researcher and respondents (Cohen et al., 2018), the qualitative strand helped me develop an understanding of teachers' responses in a friendly and open environment. As recognised by Bryman (2012), the qualitative approach is suitable when the researcher intends to understand how individuals interpret their experiences, and how they construct realities in their natural world.

4.4.1 Qualitative data collection methods

In this phase, two methods of data collection were used; interview and focus group discussion. As summarised in Figure 4-1, the qualitative strand involved 33 science teachers: 21 in the interview, and 12 in the focus group. Firstly, interviews were conducted with the same 21 teachers in two visits with a one-month interval. Two weeks later, four focus groups of three teachers were organised to gain a deeper insight and further elaboration of the teachers' responses. This section is organised into two parts based on the data collection methods.

4.4.1.1 Interview

Face-to-face semi-structured interviews were conducted with 21 teachers across all seven schools, as summarised in Table 4-1. Through semi-structured interviews, I was able to probe teachers further about CBC reform and enactment. The interview construction was informed largely by the literature review and conceptual framework. For instance, in the literature review, I show that enactment is about the process over time, informed by their professional beliefs in relation to the context. Thus, the first question from Visit 1 asked the teacher to describe their teaching. This question gave teachers freedom to describe every aspect of their teaching, from planning practice to lesson's end. The aim was to understand what informs their decisions and how their agency is manifested when enacting CBC. The interview provided the opportunity to delve into teachers' individual experiences based on how and why they interpret the science CBC the way they have.

To explore teachers' responses to a CBC, interviews during both visits reflected on two separate but interrelated CBC issues: intended and enacted curricula (see Section 2.2.1), and the consequences of teachers' responses to the intended curriculum (see section 2.6). Thus, the interviews were constructed in relation to the categories of curriculum. The Visit 1 interview was structured to investigate teachers' general descriptions of their teaching and learning, while Visit 2 delved much deeper into the issue of curriculum and teachers' perspectives on it (see appendices A and B). The first interview helped to identify those multiple consequences of teachers' responses identified in the literature, such as resistance, negotiation, and compliment, and could identify what influenced those consequences. During Visit 2,

the interview questions were developed upon the idea that “teachers receive the mandated curriculum with their own pre-existing knowledge, past experience, future goal, interest, desires” (Bowe et al., 1992, p.22), as well as their own framing discourses of what curriculum should be about. Thus, the interview was structured to investigate how CBC is framed within their personal and professional discourses. Two separate interview visits facilitated follow-ups on participant information that could help the researcher to gain a better understanding of the topic being investigated (King et al., 2019). Also, Berg and Lune (2014) added that the time between interviews is very important as researchers gain time to reflect on follow-up questions to develop in-depth knowledge.

To facilitate the flow of conversation, during the interview, an interview guide (appendices A and B) was used to help the researcher focus on the important questions and to avoid asking ones irrelevant to the research objectives. Researchers should avoid repeating questions as this might discourage respondents from providing interesting information (Walliman, 2006). The interview guide was designed with open-ended questions, encouraging teachers to talk in detail and expansively about their understanding and experiences regarding CBC and their enactment in classroom settings. Moreover, I was aware of the importance of audio recording for data collection, as recognised by Lodico et al. (2010) that the audio recorder helped to capture accurate information during data collection and helped reduce mistakes during data analysis.

4.4.1.2 Focus group discussion

Focus group discussion (FGD) was employed to discover more information and corroborate teachers’ responses about CBC from the interviews. Hennink (2014) advocated the use of FGD to uncover the range of participants’ viewpoints, and develop a clear understanding in a limited time. During FGDs, my role as researcher was to facilitate conversation and mobilise social interaction among the teachers and myself as researcher.

There are different views on the recommended size of a group for a FGD. Litosseliti (2003) recommended six to ten respondents, or mini focus groups with four to six members. In contrast, Flick (2014) argued that there is no ideal group size or composition. It is important for the focus group to include respondents with knowledge and information about the topic concerned (Hennink, 2014). Thus, in my study, each FGD consisted of three teachers, one from each of the three science subjects (physics, chemistry and biology). Four FGDs were conducted at four secondary schools, two each from Dar-es Salaam and Zanzibar (see Table 4-1).

Indeed, the FGD was suitable for the research design as it enabled follow-ups to responses received from the interview to be more discursive. Moreover, having the FGD conducted before the quantitative strand was useful to generate more accurate data than face-to-face interviews, as it reduces the researcher's influence and provides explicit initial insight for developing follow-up questions. In fact, the content of FGDs were similar to the interviews, and constructed in a similar fashion. The construction was informed by the literature review and conceptual framework, illustrated in Chapter 2; however, all aspects of both interviews were brought up in the same FGDs. In the literature review, I recognised that curriculum enactment is about individual teachers interacting with the sociological milieu, including material resources, authorities, and even the physical environment in which the teacher is working (see section 2.6). Thus, in the focus group discussion, questions were constructed in two broader areas – the individual teacher's personal traits, and the impact of contextual reality on teacher enactment. Also, as mentioned in the literature review, enactment is the process over time. Thus, within FGD, teachers discussed how the reform changed their practices.

One weakness of FGD is that some respondents may influence and dominate the responses of the whole group, diminishing the voices of others (Flick, 2014). With this in mind, I facilitated mutual interaction by encouraging passive members to talk, making them feel comfortable so that every respondent had an equal opportunity to talk. I shifted my dominance away and tried to motivate and facilitate discussion among the respondents themselves. I tried to generate a group dynamic, bringing issues related to CBC reform and implementation into the discussion and allowing respondents to speak among themselves.

To maintain focus on my research goal, a question guide (see Appendix C) was employed. This was a very important tool, not only for remembering the questions, but more importantly for ensuring consistency during discussion. I was aware that the guide should not be used for simply reading the questions line by line, but to modify the pre-planned questions to ensure that broader teacher responses relating to CBC and the implementation are captured. Focus group discussions averaged 90 minutes.

4.4.1.3 Piloting qualitative in the qualitative strand

Interviews and focus group discussions were first piloted in order to test the suitability of the research instruments, in terms of clarity of questions, wording, and content, for capturing information in relation to my research. The piloting exercise was carried out to familiarise myself with the interview, and to gain technical skills, including time

management, probing, and motivating individuals to speak for those passive respondents. One important aspect of piloting was that recruiting teachers was an opportunity to gain experience of the research participants within the school context, whereas Tanzania Mainland and Zanzibar have different access procedures, even at school level.

For piloting practice, I interviewed three science teachers: two female and one male. These teachers were from different schools in Zanzibar than those involved in the research, each teaching different science subjects. In addition, one focus group discussion with three science teachers was carried out in Dar es Salaam. One of the observations from the piloting stage was that teachers were more interested in talking about their enactment challenges, especially in terms of resources and overcrowded classrooms, than describing the curriculum. For instance, one of my interview questions asked teachers to describe how they implement curriculum. I then decided to change this question, and I asked teachers to describe their teaching practices. This was much straight forward question to the teachers where they able to provide a full length of information of how teachers enact the CBC in their daily basis. Moreover, during the interview, I used terms like *socio-scientific issues*, but realised that this was not a familiar term, and that they used the term *cross-cutting issues* instead. Thus, the piloting stage helped me to learn and apply common terms that teachers were familiar with, thus fostering good communication.

4.4.2 Credibility of the qualitative strand

Unlike quantitative research, which employs statistical approaches to describe internal validity, the qualitative study must be conducted through research methods and procedures that warrant credible results. Credibility is the “trustfulness” of the findings, based on methodological approaches applied, and how respondents handled during data collection (Ary et al., 2010). Thus, in this study, in order to ensure the credibility of the findings, four principles of credibility were considered – namely, corroboration, interpretive adequacy, theoretical adequacy and reflexivity.

The application of various data collection methods for a similar study have been known to increase credibility (Ary et al., 2010; Cohen et al., 2018). In my study, triangulation of the content of the research was achieved by considering different aspects of CBC: teachers teaching across all three science subjects, two different methods of data collection, and context. As mentioned in Section 4.4.1, interviews and focus group discussion were employed with the different groups of teachers across two contexts of the URT. This helped me gain an understanding of wider perspectives of CBC reform through the teachers’ responses across the two parts.

Conducting two interview visits, followed by FGDs with different teachers than those involved in interviews enhanced the corroboration, and provided strong evidence for the findings presented in the study. Based on the nature of this research, it was not possible to use investigator triangulation, as suggested by Ary et al. (2010), although several consultations with experienced researchers (my supervisors) were made. Their comments and advice helped to increase the study's credibility. Moreover, the interviews and focus group discussions were carried out in Swahili, the native language of the participants and the researcher. The use of Swahili in the process of data collection provided an open conversation environment, enabling participants to apply all of their vocabulary to explain concepts which, in turn, enriched the data.

The most important practice in research is to disseminate the information correctly as portrayed by the respondents (Cohen et al., 2018; Lodico et al., 2010). This is based on the principle of "interpretive adequacy" (Ary et al., 2010, p.499). In my case two methods were applied – member checks and inference description. After my data collection, the member check was undertaken by playing back the recording, and allowing reflection for any changes they might wish to make or supplement. According to Lodico et al. (2010), performing member checks not only reduces risk of bias, but also strengthens quality. In addition, direct quotes were applied in the report findings to help familiarise the reader with the respondents' original words. This has significant implication for research credibility, as it provides an opportunity for the reader to explicitly understand the real context of the study, and shows originality.

Lastly, to ensure credibility, I considered controlling bias. This refers to what many qualitative researchers call "reflexivity" (Ary et al., 2010; Flick, 2014; Lodico et al., 2010). I was the insider and an outsider. Being an experienced science and mathematics teacher in secondary education in a similar context for more than 10 years made me an insider, and whilst in the role of researcher, I considered myself an outsider. Thus, being a teacher in a similar field (science) facilitated the recruitment of participants. When asking teachers to describe their teaching practices, they were highly responsive. They expressed confidence, and as a science teacher, I could clearly understand their practices, tensions and difficulties, and therefore, be a representative for their responses. This developed confidence in providing information, and helped to build a good rapport. In addition, having similar experiences as the participants, I understood teachers' perceptions of the curriculum. I was familiar with their experiences and knew which areas to ask about without making them feel uncomfortable. Lastly, from an insider position, I was regularly aware of, and carefully reflected on, my position as an outsider (researcher), and how

it influenced conversation and discussion. I constantly made respondents aware that even though we had similar professions (science teaching), we may experience differently on the CBC reform; therefore, I intended to understand the curriculum from another's point of view.

4.4.3 Qualitative Data Analysis

In this study, all of the interview and focus group data were analysed using the same thematic analysis method. Analysing qualitative data involves several procedures. However, before the actual practice of data analysis, data preparation carried out helped to produce clear data analysis. Thus, this section is organised into two parts: the first about data preparation and the second presents the data analysis procedure in detail.

4.4.3.1 Qualitative data preparation

Qualitative data analysis begins with data organisation or preparation. It is well known that qualitative methods tend to collect dense data in bulk (Cohen et al., 2018; Gay et al., 2009; Hoy, 2010); that systematic data preparation is important for creating effective analysis. According to McLellan et al. (2003), qualitative data preparation is the systematic organisation of qualitative data into textual information (transcripts) ready for analysis. In practice, there is no common theoretical framework for qualitative data preparation (McLellan et al., 2003). In this study, qualitative data preparation was conducted by adopting two approaches, as depicted by Merriam (2014, p.194) involving transcribing the data and entering it into Nvivo software.

The first step of data preparation for analysis was to transcribe the data in the original language (Swahili) as it was recorded; transferring all interview and FGDs into text (Gay et al., 2009; Lodico et al., 2010). The written data was presented alternatively, depending on the actual conversation during the interview, as well as focus group discussions. For instance, I1 signifies the first turn of the interviewer, and T1 as the first turn of the teacher (respondent), I2 as the second turn of the interviewer, and T2 as the second turn of the teacher, and so on. In the interview, V1 and V2 were used to represent visit 1 and visit 2, while FGD1 signified the first focus group discussion. Such abbreviations helped to track information within the transcript, when I wanted to provide evidence during the writing process. Moreover, every respondent was assigned a pseudonym to avoid revealing their identity, which was written at the top of every transcript.

Before translating from Swahili to English, all transcripts were counter checked to ensure that what had been written was correct. Temple and Young (2004, p. 75) asserted that "the translation always has the power to reinforce or to subvert the

information, but the power rests in how the translation is executed and integrated into the research design". Thus, during the translation process I tried to be accurate and remain neutral, in order to avoid any distortion of information presented by participants. I refrained from subjectivity and considered the translation practice to be another way of knowledge development for my data sets. However, translating from Swahili into English word by word is challenging, and I wanted to ensure the information translated was the same as provided by the participant. As explained in section 4.3, the qualitative data were collected in three different visits. The interview data were collected from the first and second visits, while focus group discussion data were collected on the third visit. Therefore, all data from interviews and focus group discussions were treated in the same manner for analysis. All of the soft copy transcripts from the interview and focus group discussions were saved in my assigned drive on my university computer, and my in Dropbox account, for safety. Thus, all the transcribed data, 42 interviews and four focus group transcripts were imported into Nvivo, ready for analysis. As mentioned previously, there were 21 transcripts from each of the two interview visits, and four transcripts from the third.

NVivo was applied as the software for the qualitative data analysis. However, I was aware that NVivo is not an analysis tool (Bryman, 2012; Woolf and Silver, 2017), but a software programme to help the researcher to organise, display, and categorise data (Woolf and Silver, 2017). NVivo was used to reduce the tasks of data analysis, such as collection and coding processes. Therefore, this software was used with an open mind, in that the role of data analysis was my responsibility. The most important function of the software was to foster the coding process, and make comparisons between codes.

4.4.3.2 Analysis method

There are several methods of qualitative data analysis, depending on the type of data, but for this research, a thematic analysis method was employed. Thematic analysis concentrates on developing categories by illustrating the *implicit and explicit* concepts presented by respondents in datasets (Guest et al., 2012). Unlike content analysis, thematic analysis goes beyond identifying words, phrases or code frequencies within the data. It links ideas from a single code to a larger themes. In this study, six steps of thematic analysis were adapted, as suggested by Braun and Clarke (2013), as shown in Figure 4-2. Braun and Clarke define thematic analysis as the method of qualitative analysis which involves code identification, collating, and formulating categories/themes in response to research objectives.

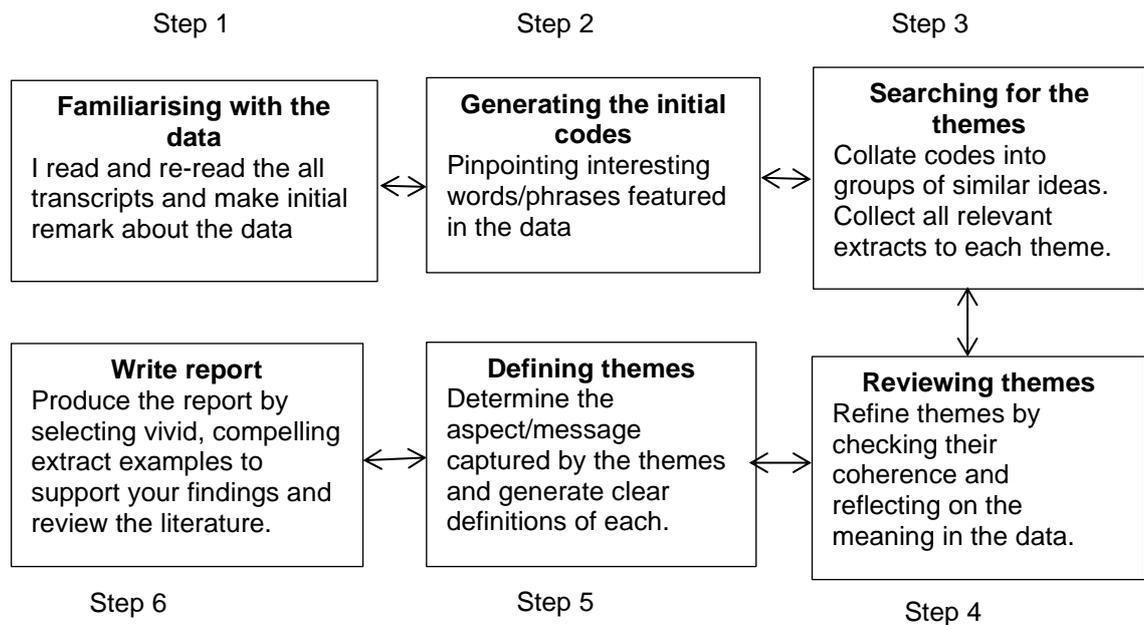


Figure 4-2: Thematic analysis process (Braun and Clarke, 2013)

Thematic analysis is the development of the theme initially identified from the collection of codes (Bazeley, 2013; Miles et al., 2014). Coding is the method for discovering important pieces of information in the dataset. Braun and Clarke (2013) categorise three approaches to coding: coding reliability, reflexive/organic or inductive, and codebook. In this study, both inductive and codebook (or a priori) codes were employed, as suggested by Johnson and Christensen (2017) that mixing inductive and a priori codes helps to display the data from different angles. As a researcher, I had my own existing knowledge about the responses of teachers to a CBC as a results of the interaction with the literature review and personal experience. Therefore, I had already developed a list of codes, based on my analytical framework and literature review, for curriculum reform and implementation. I also combined the inductive or reflexive coding approaches; all the codes that emerged from the data were not initially on the list. This combination of pre-existing and inductive codes allowed me to actively engage in interpreting the data through my own understanding and experience, and the detailed information gleaned from the datasets. The coding process in the thematic analysis is not about accuracy or reliability but emerging themes within the data (Braun and Clarke, 2013). I did not force the codes onto the data, but rather allowed the new codes to emerge when the pre-existing codes did not fit. Therefore, I did not follow a certain theory in developing the themes but let them emerge from the data itself, and applied the pre-existing codes whenever appropriate.

4.4.3.3 Analysis procedure

The analysis formally started with familiarised myself with the data again, after initially familiarising step during data collection. Thus, as suggested by Braun and Clarke (2013), analysis started by engaging in reading and re-reading transcripts, while reflecting on the research questions. I went through all the datasets, pinpointing information in teachers' responses about their beliefs about the goals of the curriculum, their perspectives on all aspects and elements of the CBC reform, their implementation, and the factors that influenced their practices. This process provided preamble information about the data and what was commonly mentioned by participants during both interviews and focus group discussions. An important role of deep reading was to glean overall ideas from the data, and starting to form a sensitive reflection on its general meaning. Using NVivo software, the memo was created for the first ideas that came from the dataset. This important step helped with labelling the data with categories in the researcher's language (Creswell, 2014).

The second step was to code the data, noting any repeated codes and codes that linked directly to the research questions, which facilitated the next step of formulating themes. The following example shows the codes that were extracted from the interview dataset. In the sample, the extraction was taken from one of the participants - Ms Aliye (pseudonym); V2 means the second interview visit, and T22 shows the turn from which the quotation was taken. Reflecting Miles et al. (2014), this was the first cycle of coding, where the goal was to assign data into small chunks.

Table 4-6: Sample of Code Development

<p>¹My interest is to see that the curriculum focuses on preparing students for self-employment because ²government cannot accommodate all students in employment. We have almost 33 years of independence, but we do not have industries, why do our industries collapse while we have raw material? Because we ³do not have experts, we depend on foreign experts to run our industries. ⁴We learn chemistry which lasts in the books. If you ask the student for example, to describe how polymerisation if formed, they can describe all process ⁵but take them to the real practice, they cannot. ⁶This is how our curriculum is made, just mastering content curriculum. (Ms. Aliye, V2, T22)</p> <p>⁷What I understand, when we talk about the curriculum, we are talking about ⁸how we should run our education in the country and what the outcomes will be. Therefore, ⁹the curriculum should focus on students' lives outside of the classroom even if they do not do A-level, ..., the science curriculum also should ¹⁰focus to prepare future scientists and therefore ¹¹the teaching and learning</p>	<ol style="list-style-type: none"> 1- Personal motives - Self-employment 2- Shortage of employment 3- Shortage of experts/scientists 4- Focus on canonical knowledge 5- Lack of application skills/practical skills 6- Curriculum focusses on content 7- Personal understanding 8- Curriculum meaning 9- Students' wellbeing 10- Future scientist 11- Learning by doing 12- Technical skills 13- Application skills
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<p><i>process should be done under activities (...) ¹²I think we need to have science curriculum like we have in technical schools. The curriculum that really ¹³prepares students for particular skills. (Ms. Sayda, V2, T4)</i></p>	
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Then, the third step was to search for the emerging themes. Codes with similar ideas or information were searched, meaning the codes that represented similar concepts were collated together into a bunch of codes. This initial process of clustering the data into different single groups/categories/themes/constructs depended on the information presented. Collated data into smaller groups helped the researcher to condense them into smaller units, simplify the analysis process, and help construct a data map, which gave the overall analysis (Miles et al., 2014). This was the start of the second cycle of coding where the coding was made from the results of the first-cycle codes. Reflecting the above example, codes were collected into the pre-existing categories, as shown in Table 4-7.

The fourth step was to check if the themes worked in response to the identified codes and research questions. I reviewed all themes and made changes again where other themes merged. This was a difficult experience as some of the codes appeared not to fit into the themes, and, therefore, it took time to balance conflicting ideas based on the themes formulated from the datasets. This was a slow process, requiring a few attempts. I was aware that the coding process in thematic analysis is not fixed and could be changed during the process. Codes could be renamed, or merged, or be split into two or more (Braun and Clarke, 2013).

Table 4-7: Example of Codes Obtained from Qualitative Data

Curriculum goal	Influence factor	Aspect of curriculum	Pedagogy
Focus on: <ul style="list-style-type: none"> • Self-employment • Application skills • Future scientists • Technical skills • Students' wellbeing 	<ul style="list-style-type: none"> • Shortage of employment • Shortage of experts/scientist • Shortage of resources 	<ul style="list-style-type: none"> • Focus on canonical knowledge • Focus on content • Lack of application skills/practical skills 	<ul style="list-style-type: none"> • Learning by doing

In my analysis, themes were formulated from the datasets by reflecting on my understanding and the literature I have reviewed for this study. Therefore, checking the coherence of a theme meant reflecting and conceptualising it in terms of the data. Any themes that did not match with the datasets was refined; those which were less represented were omitted. For instance, there were some codes based on teachers' salaries and promotions, issues relating to distance from the work station, transportation, and other issues relating to personal income that were not included.

They were omitted because they were mentioned by fewer participants and they were not among the objectives of this study. I then returned to the categories, making possible refinements in response to the objectives of the study. To ensure the formulated themes reflected the findings of all datasets, each theme was comprised many participants' codes. Previously, a high number of themes were derived from the dataset, so another close check was conducted, and some themes were reduced to sub-themes under other headings. For instance, going back and forth, the curriculum goal, influencing factors and aspects of the curriculum were collected together into one theme of the curriculum.

The fifth step was to define and name themes that appear in the thesis document. I was aware that this approach of developing themes is not a precise science but relies mostly on researchers' interpretations (Miles et al., 2014). Therefore, my interpretation was generated by reflecting on the research questions and objectives in relation to the literature review. Thus, through the qualitative data analysis process, three analytical themes were developed:

1. Conceptions of the science curriculum
2. Conceptions of the competency-based curriculum
3. Enactment of the competency-based curriculum

Every theme has several sub-themes, as presented in the findings sections (Chapters 5, 6 and 7). Figure 4-3 indicates the extract taken from the Nvivo before being collected into final themes (see also Appendix P). Lastly, I wrote the findings report after reflecting on the literature review about teachers' responses to CBC reform and their implementation in the area of secondary science education. NVivo helped retrieve the information required much more quickly and easily. For instance, it literally took a few seconds to discover what was said concerning the assessment practice and the number of sources. The findings were presented by selecting the quotes representative of the teachers' responses to the theme discussed in a particular section.

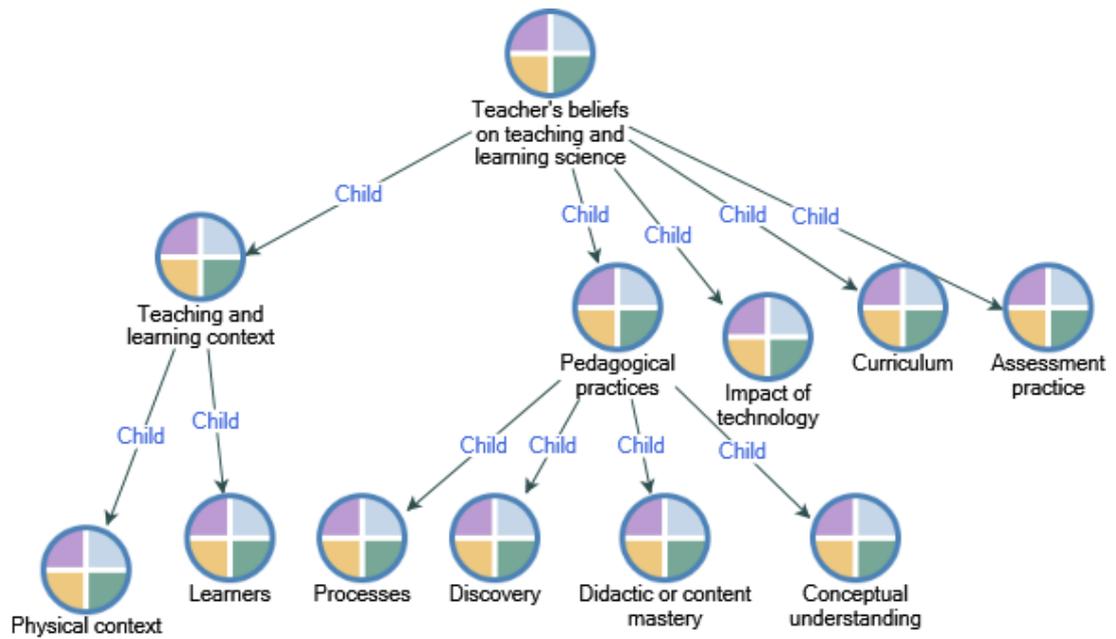


Figure 4-3 : Example of extracted themes from NVivo

4.5 Phase 2: Quantitative Approach

As previously mentioned, this research aims to investigate CBC reform and enactment through the responses of science teachers in the Tanzanian educational context. Teachers' responses about educational curriculum reform have also been collated internationally. For instance, Bantwini (2010) investigated teachers' perceptions on curriculum reform in South Africa, using qualitative interviews. In the UK, Byrne et al. (2013) employed the qualitative strand to investigate CBC reform in four UK schools. However, all these studies employed a qualitative approach, whereas in my research, I decided to couple the qualitative strand with quantitative research. The focus of employing the quantitative strand in this research was not for generalisation purposes, but rather, to inform the qualitative data for a larger population of teachers, which might not easily be covered in the qualitative study alone.

A non-experimental research design was used for the quantitative strand. According to Lodico et al. (2010), non-experimental quantitative research employs numerical or statistical information to describe *pre-existing* educational issues without treating the variables. Unlike experimental research, which can be categorised into truly experimental and quasi-experimental designs, there is no clear common agreement in the literature on how to categorise non-experimental quantitative research designs (Bell, 2009). However, some authors categorise non-experimental quantitative research into nine categories (see Johnson and Christensen, 2017, p.353). It is

beyond the scope of this study to explain in detail all nine categories, but more relevant to select one that fits with my study.

Among nine categories of non-experimental quantitative research design, Johnson (2001) recognised that the descriptive and explanatory cross-sectional survey designs are common approaches in educational research. In describing the approach, Johnson (2001, p 9) asserts that the former tends to explore information in which data are collected from respondents “at a single point in time, and then the comparisons are made across the variables of interest”, while the latter tends to explain pre-existing theories or hypotheses from data collected across a group of individuals at a single point in time. However, one goal of my study was to compare responses about CBC reform between the teachers from Tanzania Mainland and Zanzibar. The basic idea behind the quantitative strand was neither to verify nor disprove the existing theory nor to find correlations between variables, but rather to describe or explore teachers’ responses in the qualitative findings with a larger population of teachers. Therefore, with this research goal, descriptive cross-sectional quantitative research was used. A set of questionnaires were developed from the findings revealed in the qualitative strand.

4.5.1 Questionnaire

To broaden the scope of teachers’ responses of a CBC reform and their enactment in the Tanzanian educational context, questionnaires were used as data collection methods for the quantitative strand. In theory, it would have been possible to send the questionnaire electronically or by post, but due to the poor infrastructure of the study area, they were delivered in person.

As mentioned in section 4.2.2, this study was designed with an exploratory sequential mixed research approach. The quantitative research goal was to explore qualitative findings with a broader population of teachers. Thus, the questionnaires were modified in relation to four analytical themes with constituent sub-themes derived from the qualitative strand findings:

1. Conceptions of the science curriculum by reflecting on three curriculum elements: goals, pedagogy, and assessment.
2. Teachers’ reflections on the competency-based curriculum, including value judgements on reform and enactment.
3. Factors influencing teachers in their teaching and learning of science, including personal goals and beliefs, goal of the curriculum, resources, leadership, and school policy.

4. Teachers' tensions during CBC enactment, including external examination, inspectorates, syllabus completion, and students' behaviour.

Concerning mixed research design, Johnson and Christensen (2017) categorised questionnaires based on three research designs: qualitative, quantitative, and mixed. The qualitative questionnaire is fully structured using open-ended questions. On the other hand, the quantitative questionnaire was fully structured using closed-ended questions. The closed-ended questions are structured into limited responses wherein respondents select responses from pre-determined answers set by the researcher. These questions are useful for quantitative research, as open-ended questionnaires might contain a lot of information outside the researcher's interests and, therefore, difficult to categorise (Groves, 2009). Thus, the majority of questions in the questionnaire for this study were closed-ended, with only two in the open-ended format. Because this study was of a mixed methods nature, teachers' responses from the two open-ended-questions were easily transferred into the qualitative data.

The majority of questions used were in the form of a Likert scale. Likert scale questions were used to measure teachers' attitudes, values, opinions and perspectives on CBC reform and their enactment. Moreover, the Likert scale questions were used because they were found to be easier and quicker to answer than open-ended questions. Teachers' responses to CBC reform were measured using five scales from *1-strongly agree* to *5-strongly disagree*. Furthermore, in order to capture teachers' demographics and background information, checklist items were also used. Here, teachers were asked to tick one answer that applied to their situation. Table 4.8 represents the summary of the main sections and themes captured in the questionnaire.

Table 4-8: General Structure of the Questionnaire

Section	Theme	No. of item	Types of questions
A	Background information	11	Check list and Fill-in item
B	Goals of science curriculum	1	Likert scale
	Perspectives on CBC reform	3	Likert scale
C	Enactment of the CBC	3	Likert scale and Yes/No
D	Tension on implementation	3	Likert scale and open-ended
Total		21	

Therefore, to collect information based on teachers' responses to a CBC reform in the Tanzanian educational context, a mixed questionnaire (see Appendix 5) was administered across all 360 science teachers. As mentioned in Table 4.2 that, 360 teachers were drawn from 60 secondary schools, with six science teachers from each being recruited to complete the questionnaire. This was a self-administered

questionnaire and teachers were allowed to complete it at their leisure without the researcher present. The researcher organised collection of the questionnaires within two to three days of distribution, at the participants' convenience. The researcher continued to remind participants, through their preferred personal contact method, before the day of collection. However, despite the researcher's efforts to remind participants, the response rate was 74.17 percent; 267 of the 360 questionnaires distributed to participants.

4.5.1.1 Quality of the questionnaire

The quality of the research instrument or data collection tool especially in quantitative research, is underpinned by two important concepts – reliability and validity. The former refers to the measure of consistency, while the latter is about the instrument's ability to measure. These two terms form the basis of judging the quality of the research instrument. It has been argued that reliability is one condition for validity, but it is not sufficient to decide whether the instrument is valid. An instrument cannot be valid without being reliable (Salkind, 2011). To show how validity and reliability were applied in this research, the concepts are presented separately.

4.5.1.2 Validity

To ensure that the questionnaire was valid, large aspects of the competency-based curriculum were covered, including goals of the curriculum, teaching pedagogy, assessment practices, and factors that condition teachers in their classrooms. The validity of a questionnaire can also be judged by the extent to which the content domain is covered (Cohen et al., 2018; Salkind, 2011). Therefore, several consultations were undertaken with supervisors who were experts in the field of curriculum and curriculum implementation. Their reviews and comments were used to increase the validity of the questionnaire. Moreover, before administering the questionnaire to the entire sample of respondents, I conducted a face-to-face validity check. This was a process whereby I sought opinions from teachers who also taught science at secondary schools in Zanzibar. Respondents commented on whether the content was good enough to capture teachers' responses about the CBC. Lastly, the questionnaire was piloted with 100 science teachers in Zanzibar, equivalent to 30 percent of the planned number of respondents. The sample involved in the piloting stage was selected by considering similar characteristics to those involved in the study. Thereafter, a single focus group of six teachers was arranged to seek their views, ideas, and comments in order to use them to improve the questionnaire. One common major comment was that the questionnaire was too long. This comment was received positively and adjustments were made, based on teachers' suggestions,

while still reflecting the goal of the research. Moreover, the questionnaire was further developed using the results of the qualitative findings, as mentioned in section 4.5.1.

4.5.1.3 Reliability

To ensure the questionnaires' consistency, internal consistency reliability testing must be undertaken. Internal consistency reliability is the extent to which items in the questionnaire are consistent in measurement. The popular measure of internal consistency reliability is the coefficient alpha, which ranges from 0 (no reliability at all) to +1 (perfect reliability). A value close to +1 indicates that the item is highly reliable, and close to zero indicates lower reliability (Ary et al., 2010). Using SPSS software, I ran the reliability test and found that a 0.72 coefficient of reliability was obtained. Reliability coefficient indicators common in the relevant literature showed that 0.7 and above is a good indicator for a reliable instrument (Bryman, 2012; Pallant, 2013).

4.6 Quantitative Data Preparation and Analysis

4.6.1 Quantitative data preparation

The quantitative data were analysed using SPSS. This software was used in this study not only because it is the most widely used in educational research (Cohen et al., 2018), but also because it was a more familiar to the researcher than other statistical packages, such as SAS or R. A total of 267 returned questionnaires were entered into the software. I identified the questionnaire's respondents using code number of 001 to 267 sequentially to each questionnaire. In order to facilitate a good comparison, the questionnaires were arranged by region. Questionnaires collected from Zanzibar were arranged first (from 001 to 138), followed by the questionnaires collected from Dar es Salaam (from 139 to 267). The responses were entered into SPSS based on the codes identified. For instance, for gender, 1 was used for males, and 2 for females, but in the case of the five-point Likert scale for responses to questions on the goals of the science curriculum, numbers ranged from *1- very important* to *5- completely not important*.

Before analysing, it was very important to screen and clear the data. This helped to remove possible errors and make necessary corrections before embarking on data analysis. Errors, or missing information, in the dataset can cause problems with data analysis, or misleading interpretations (Cohen et al., 2018). To screen and clear data, I ran a frequency distribution table for all variables using SPSS. I went through each table, observing areas where mistakes were made during data entry. For example, I

found that I had inserted '22', when intending to enter '2', or '6' while the variable was only rated up to 5. There was a grammar error: when writing 'Chemistry', I used a small 'c' instead of capital 'C', and those entries starting with capital letters reported as different variables. Therefore, I took such mistakes into account, ensuring that the data was free from error.

4.6.2 Quantitative data analysis procedure

I collected all the questionnaires from the respondents and started the process of analysis. A descriptive statistic was used, wherein several analysis techniques, such as frequency distribution table, and bar charts were employed. In addition, inferential statistics were also applied, whereby the cross-tabulation and chi-square tests were employed to compare responses regarding CBC of teachers from Tanzania Mainland and those from Zanzibar.

Descriptive statistics were used to describe and summarise the responses of teachers in a more meaningful and visual way, making the interpretation of data simpler and more easily understood. I found the descriptive statistics appropriate because my goal was to describe teachers' responses rather than making a prediction. This is in line with Greasley's (2007) argument, that rather than making predictions from current data, descriptive statistics are applied to illustrate and describe what the data shows. In contrast, inferential statistics were employed to examine the difference in teachers' responses, making inferences about the large population of teachers teaching science in Tanzanian secondary schools. Table 4-9, summarises the analysis and corresponding techniques used:

Table 4-9: Summary of Quantitative Analysis

Section	Research question	Analysis technique	Rationale
A	Conceptions about goals of curriculum	<ul style="list-style-type: none"> • Frequency distribution • Bar chart • Chi-squared 	Describe teachers' beliefs on the 9 identified goals of the science curriculum. Compare responses on the goal of the science curriculum between two groups of teachers from Tanzania Mainland and Zanzibar.
B	Teachers' value judgement of CBC reform and enactment	<ul style="list-style-type: none"> • Frequency distribution • Bar chart • Chi-squared and Effect size 	Describe teachers' perspectives on CBC reform in terms of impact on teachers' teaching and students' learning. Compare the perspectives on CBC of two groups of teachers from Tanzania mainland and Zanzibar.

			Determine sizes of differences and association of responses of teachers on CBC between teachers of Dar es Salaam and Zanzibar.
C	Teachers' reflection on classroom practices: <ul style="list-style-type: none"> • Teaching pedagogy • Assessment practices 	<ul style="list-style-type: none"> • Bar chart • Chi-squared test • Effect size 	Describe how teachers enact a CBC at classroom level. Compare two groups of teachers between Tanzania mainland and Zanzibar on the enactment. Determine the size of the difference in response between groups of teachers.
D	Factors influencing teachers in their practices Examination attainment Teaching and learning resources	<ul style="list-style-type: none"> • Bar chart • Chi-squared test • Effect size 	Describe how national examination impacts teachers on CBC enactment between the two groups of teachers. Describe the impact of resources availability on teachers' CBC enactment across all schools in all regions. To compare the resource availability between schools in Dar es Salaam and Zanzibar.

The statistical difference between two group variables can also be tested through a t-test or chi-squared test. However, the major difference between the t-test and chi-squared test is the t-test is more suitable for continuous data, while the chi-squared test is said to be more convenient for categorical and ordinal scale data (Greasley, 2007; Howitt and Cramer, 2017). Therefore, as the data will be tested come from the Likert scale and some categorical scales, the chi-squared test was found to be more useful than t-test. For differences in responses about CBC between the teachers from Tanzania Mainland, and of Zanzibar, a chi-squared statistical test was employed and coupled with cross-tabulation and effect size to achieve more easily interpretable results. The conventionally accepted statistical significance of 0.05 was used as the level of significance to support or oppose the formulated hypothesis. Thus, SPSS was used to facilitate all the above-mentioned analysis, and the interpretation was based on statistical rules and standards. For instance, after running the chi-squared, the p-value obtained determined the acceptance or rejection of the formulated null hypothesis. Any p-value greater than 0.05 lead to the rejection of the null.

4.7 Ethical considerations

Ethical considerations in research are very important and seriously considered across all research fields, not only for the purpose of accessing consent for data collection, but also for ensuring a participant's rights and autonomy were recognised, based on the underlying standard (Bryman, 2012; Cohen et al., 2018). I reviewed all ethical standards adhered to by the University of Leeds, completed the application form and sent it to the University of Leeds ethical review board (see Appendix G). I

planned my research by considering the participants' rights, ensuring they would not be harmed in any way during the study as a result of their participation.

After receiving ethical clearance from the University of Leeds, the second step was to seek ethical clearance and research permission in Tanzania, where the study would be undertaken. It is widely recognised that the procedures for ethical issue and research permission are not internationally consistent (Cohen et al., 2018; Johnson and Christensen, 2017). Rules and principles of application vary from country to country. As previously mentioned in Chapter 1, this research was carried out in the United Republic of Tanzania (URT), with each region under a different educational autonomy, but both sharing a similar secondary-educational level curriculum. Thus, both Tanzania Mainland and Zanzibar had different paths for seeking research permission. However, all parts involved consultation with gatekeepers at multiple levels.

In Zanzibar, the ethical clearance application started with the Zanzibar Chief Secretary's Office, then went to the Office of the Chief Government Statistician Zanzibar, where I received the permit (see Appendix H and Appendix I). These two offices ensured that the research was risk-free in relation to the country's political and cultural wellbeing, as well as that of the participants. A permission letter and list of schools in the three regions in Zanzibar was then obtained from the Ministry of Education. The application clearly explained the purpose of my study by submitting the research proposal to the Zanzibar Chief Secretary's Office, and the research information sheet (Appendix E) to the head teachers in each school, before recruiting any teachers. This gave the authorities the chance to evaluate my study against their policies and regulations. Lastly, individual teachers were recruited based on their willingness to participate in the study.

In Tanzania Mainland, I request a research permit from the Tanzania Commission for Science and Technology (COSTECH). This institution is responsible for the quality assurance of research conducted in the country by ensuring it is risk-free to the country, the participants, and that the research could make a valuable contribution to the nation (COSTECH, 2018). I received the ethical permit from COSTECH (Appendix J), then took further steps to access permission from the Regional Educational Officer (REO) in Dar es Salaam. Permission was granted (see Appendix L L) for all three districts - Kinondoni, Temeke and Ilala. I then consulted each District Educational Officer (DEO) in the three named districts. Permission granted by the DEO meant permission to access individual schools located in each district (see Appendices M to O). Lastly, I visited individual schools where I had to give them the

DEO research permit to the heads of the individual schools involved in the study as evidence that I received permission to carry out my study at their schools.

Informed consent

Permission was first sought from the head teacher. I clearly explained the aim of the research before giving them the research information sheet. Science teachers were recruited through appointment in the absence of their head teacher. I was aware that talking with the teachers in the head teacher's presence might put pressure on them into participating in the study as external forces such as fear or reward from a figure of authority should not interfere with research (Johnson and Christensen, 2017). I explained the goal of my study to the teachers, giving them the research information sheet to read and sign when they were happy to participate. Signed consent forms (Appendix F) was a proof of participant's willingness to take part in the study.

To minimise any fear concerning their participation, I assured them of their privacy and autonomy throughout the study. Teachers' identities and any information provided would be handled confidentially. However, participants were fully informed that information could be presented in the final report of the research, perhaps in academic journals or at conferences, but their names would not be disclosed at any time, and all information would be used for academic purposes only. In addition, participants were given the freedom to withdraw from the study at any point without penalty (Johnson and Christensen, 2017). Participants were asked to inform the researcher if they no longer wished to participate in the study no later than one month before the end of data collection. It was my expectation that if teachers informed me one month before the end of data collection, I would have a chance to select other participants before the end of the data collection period, and avoid any inconvenience. Fortunately, there were no requests to withdraw from the study.

Another important aspect of ethical consideration is reciprocity (Ary et al., 2010). For this study, I highlighted that participation could be a good opportunity for the teachers to reflect on their practices and expand their ideas about the CBC. By participating in this study, they contributed to research that could help inform policy-makers and other educational stakeholders of teachers' views and opinions about the CBC in science.

To ensure confidentiality, all collected data were carefully managed and protected; no-one other than the researcher had access. Recorded audio was saved in a special folder and password-protected. Paperwork, including the questionnaires and field notes, was kept locked in my personal drawer. All collected data were reserved in the University archive for a fixed period after completing the study report.

Chapter 5 Conceptions of the Science Curriculum

5.1 Introduction

This chapter presents the findings drawn from analysis of the first research question (RQ1) focus to understand the science teachers' beliefs about the science curriculum and how the science curriculum is manifested within those beliefs (see Section 3.2). As mentioned in section 4.4.3, thematic analysis was conducted using codebook and inductive methods. Pre-determined conceptual themes were informed by the conceptual framework (see Section 2.6) and literature review, but space was also left for other themes to emerge from the data. Through the data from interviews during two visits and the focus group discussion, the teachers' responses were organised and collected in response to RQ1 They were categorised across four aspects drawn from the broader elements of the curriculum: goals, content, pedagogy and assessment. From each of these four elements, my analysis draws out a number of analytical themes (see Table 5-1). Thus, this chapter is organised to mirror these four elements.

Table 5-1: Teachers' conceptions of the science curriculum

Analytical themes	No. of Respondent
Educational aims in the science curriculum	
• Fostering post-secondary science specialisation	12
• Fostering future science career	11
• Fostering environmental knowledge	05
The content in science curriculum	
• Fostering scientific career specialisation	16
• Promoting students' wellbeing	08
• Fostering solving social problems	06
• Fostering environmental knowledge and awareness	06
Pedagogical teaching in science curriculum	
• Promoting learning by doing	09
• Promoting science specialisation	07
Assessment in the science curriculum	
• Assessment goals in science curriculum	18
• Methods of assessment in science curriculum	12
Total	21

5.2 Educational Aims in the Science Curriculum

Science education has fundamental aspects which relate to the entire world around us, but it must also develop the professional capabilities and other applications in the community. In this section, the nature of this multiplicity of applications is explored, looking at how it lends itself to teachers talking about science with different aims.

Referring back to the literature in section 2.6 and the seven types of science educational aims (Fensham, 2009), in my analysis I identify six aims that represent teachers' responses to the science curriculum; however, one of the aims presented by Fensham were not represented widely in my research: namely, political demands. Among the aims presented by Fensham, though, individual students are considered in terms of citizenship and broader aims towards opportunities for a science career. In the present research, the teachers seemed to have two common couplet aims; they brought two different aims together. The teachers looked at the science curriculum in terms of broader common goals, as identified in the existing literature, and in terms of individual economic gain rather than citizenship. In this research, teachers reflected on science education as related to becoming a science professional. At the same time, the teachers indicated their concern with (a lack of) recognition of aims leading to individual wellbeing in response to their local context.

This section is structured along with different levels of engagement with the knowledge of science curriculum. It starts with a goal that foster students' engagement with science (post-secondary), then moves to a small number of students who requires a high amount of engagement with science (career). Finally, I have talk about everyday science, which involves the maximum proportion of students required to develop a basic level of science knowledge (individual, social and environmental).

5.2.1 Fostering post-secondary science specialisation

The system of education in most cases is structured in stages, i.e. from pre-primary, primary, secondary, to post-secondary level. This leads teachers to view the school curriculum as an engine to propel students through that stage of education. As mentioned in section 4.2.1, this study was conducted with O-level secondary science teachers. At the end of this level, students sit for the national examination, which is the gateway to an A-level education. However, because of the examination results, not all students manage to proceed with further learning. This is a major factor that teachers consider about the twofold aims of the school science curriculum. The necessary goal of preparing students for learning science at higher levels of education and the goal of preparing students with general application of science in their everyday lives. Twelve teachers across all four focus group discussions raised this point. The responses of two teachers and one focus group discussion were highlighted as evidence. The excerpts were taken because of the depth of information they contain cuts across the responses of all the teachers. For example, during the interview, a biology teacher said:

A curriculum should prepare a student (...), for further education also with knowledge which will make the student become independent. I mean, a curriculum should not only focus on the next level of education but also should focus on the student's life after completion, even if they did not get the opportunity to continue with the A-level. (Interview, Mad. Nashda, V2, T1)

The teacher referred to the curriculum, but was not explicit about which curriculum she was referring to; it could be the national or the school-based curriculum. However, because in the Tanzanian educational context they only use centralised forms of curriculum, it is likely that they meant the official curriculum. Here, the teacher was thinking about coupled aims of the school science curriculum, which focuses on the internal audience (*the student*) of the school across two different paths. At first, the teacher was referring to the subject maintenance demand – preparing students for *A-Level studies*. Next, the teacher was referring to individual demands - *preparing the students for independent life*. However, the teacher was not explicit about this aim of preparing the student for independent life. This independence could be in terms of economic income but also in terms of knowledge to deal with socio-scientific issues as articulated by various existing studies (see section 2.4). This level of education is a potential stage for developing students' scientific knowledge in terms of scientific literacy as the basic goal of the science curriculum. However, in this study, teachers were not explicit about such aims.

Like the previous teacher, the following teachers also brought out the couplet aims of the school science curriculum. The teacher focuses on two groups of students: the minority that will specialise in science at A-level; and those who will not continue with their educational journey. During the interview, when expressing their views about the goals of the science curriculum, Mr Ole said this:

(...) For example, let us look at the curriculum for technical colleges or agriculture; their curricula are good because when students finish the college, they can become independent (...), and self-employed and generate their own income (...), so, the students could not only think about going to A-level. So, even when we talk about the science curriculum, it should help a student not only to pass their exams but also to support them to live in their environment. (Interview, Mr. Ole, V1, T22)

Again, this teacher mentioned couplet aims of science curriculum. Although the aim of preparing students for further education was considered as important, the knowledge and skills necessary for students to become self-employed have been given equal importance by the teacher. The goal of preparing students to become independent might fall under what Roberts and Bybee (2007) call Vision II scientific literacy (see section 2.3.1), but in practice the teacher was talking about independence in terms of engaging with employment opportunities rather than

making decisions about science-related issues and about their bodies and health. The society where this study was conducted is one that suffer with the trauma of shortage of employment opportunities. This might be the major influential factor leading the teachers to talk about self-employment rather than other goals related to socio-scientific issues, which are common to other parts of the worlds (see Ryder and Banner, 2013). Thus, the teacher's response to personal educational aims reflects both social and economic demands.

During the focus group discussion, mixed responses were revealed. While some teachers think preparing students for A-level is very important, others put more emphasis on social issues and students' wellbeing. For instance, in the following focus group discussion, the following teachers made this discussion:

You know, here we are talking about O-level curriculum, where I think the main goal is to prepare a student to A-level and later to become experts, but the first step is to prepare students for A-level because without A-levels students will not go to university and we will fail to get competent experts (FGD3, Mr Kalima, T12)

Yeah! I do agree with my colleague that the A-level is important, but the curriculum should also focus on other skills. I went through technical school and I have my own workshop; I repair fridges and other electrical items. I have technical skills, so even if I was not employed, I could have application skills that could help me in life. (FGD3, Mr Kibua, T8)

You know, I am a teacher but at the same time I'm a mother, so I get very sad when I see our children dropout from school because of early pregnancy, getting sexual transmitted disease. So, to me, a science curriculum should focus on such issues to help students to have the right knowledge to deal with those problems. (FGD3, Mad. Kalorine, T9)

Here, the first teacher, Mr Kalima, referred only to demand for subject maintenance as the basic aim of the science curriculum, considering the main aim of science curriculum is to foster continuation of learning from lower- to upper-level education. Contrary to him, the second teacher, Mr Kibua, gave equal consideration to those students who will proceed and those who will not proceed to A-level. Like previous teachers in the interviews, Mr Kibua also thought about the twin aims of the curriculum: the aim for the next level of education, and the aim for individual income. The teacher's professional biography had a considerable influence on his views of the curriculum.

The third teacher, Mad. Kalorine, made a different remark than the first two. She was a biology teacher and her major concern was the scientific knowledge that will help students with their lives. She referred to scientific literacy, which is socially important for the younger generations, and was concerned about social problems like early pregnancy and disease. Being a female teacher, Mad. Kalorine identified herself as

a “mother”; it might be this identity influences her views about the school science curriculum. However, Mad. Kalorine was not opposing the aim of preparing students for A-level studies, but she was keener on knowledge that would help students stay clear of trouble. Thus, the teacher’s personal context appeared to have significant influence on her beliefs about the aims of the school science curriculum. This study was carried out in one of the sub-Saharan African countries where the problems of schoolgirl pregnancy and sexually transmitted diseases are common (see Lloyd and Mensch, 2008). The teacher identity went beyond to her professional career to the parenthood and care role.

5.2.2 Fostering future science career

There is a clear concern in the existing literature that the school science curriculum is the fundamental instrument for preparing students who will pursue careers in a science-related field (Fensham, 2009; Osborne and Dillon, 2008; Ryder and Banner, 2011). This aim was also evident from the responses of teachers in this study. The issues of preparing students to become future career scientists were very common among the responses. The teachers’ thoughts about the aim for future scientists were rooted in the scarcity of science-related experts within their society – a society where the shortage of science-related personnel and even science teachers is severe. This has an impact, not just on the economy, but also on everyday life. Therefore, the teachers believed that one of the basic goals of the school science curriculum was to increase the pool of experts in science-related fields.

Out of 21 teachers involved in the interviews, 11 teachers considered the development of future scientists as an aim for the science curriculum. Their responses were very closely related. The responses of three teachers, which cut across what all eleven teachers said, will be presented in this section. The national policies as well as such personnel being in short supply in the nation were the key influences of the teachers’ responses. For instance, during the interview one teacher pointed out that:

(...), the curriculum at first should focus on the national goal (...), for example, now we have an industrial policy and the government want to improve industrial sectors. Therefore, a curriculum should focus on preparing experts who will facilitate to achieve such policy... (Interview, Mr John, V2, T1)

The teacher here wanted education to respond to the economic demands of the country. These are the long-term aims of the science curriculum, and this response was rooted in the current policy. During the period of this study, the government launched an industrial policy in order to boost the economy. The teachers believe the

science curriculum could potentially make a great contribution in response to the national policy by generating future scientific experts. Here, the teacher's focus was on a small group of students that will become scientists, and he said nothing to the students who will not become scientists. Like the following teacher, Mr Jecha, aired a similar concern over the shortage of professionals in different science-related fields in the country:

Here in our country, we have a shortage of doctors, we have a shortage of engineers, and we even have a shortage of science teachers. (...), now, due to the shortage of science teachers, the government have hired science teachers from Nigeria. So, this is the demand that our curriculum should focus on ... (Interview, Mr Jecha, V2, T4)

Again, a teacher considers the long-term aim of the curriculum. The economic demand of the nation was his biggest concern. This was a teacher from Zanzibar, where the government imports science teachers from Nigeria to fill the gaps of shortage of science teachers. The limited number of science-related experts in the URT, such as science teachers, doctors, and engineers, influences the responses of teachers about the educational aims of the science curriculum. Another teacher, Mad. Aliye, made a similar remark concerning the aims of the science curriculum. This teacher specialised in Swahili language and during that time of data collection for this study she was doing a Master's degree in Swahili Language at the Open University. Due to the shortage of science teachers, Mad. Aliye was teaching Biology to Form two (Year 8) students since 2009, despite the fact that she never specialised in science. Based on the Tanzanian curriculum, she had no qualification to teach science (see section 4.3.3). She also indicated her concern for those students who will specialise science in their further studies. Thus, in the interview she said this:

My interest is to see that curriculum focuses on preparing students for self-employment because a government cannot accommodate all students (...) we have almost 33 years of independence, but we still depend on foreign experts; we need engineers, doctors and even teachers; these also are important for the curriculum. (Interview, Mad. Aliye, V2, T18)

Here, the teacher brought together the couplet aims of the science curriculum. At first, she reflected on the aims relating to the individual demands in terms of self-employment. Again, this is not about dealing with the socio-scientific issues such as vaccination and the like (see Ryder and Banner, 2013), but rather independence in terms of individual economic gain. Similar to many aforementioned teachers, she was influenced by the consequences of the shortage of employment opportunities. Furthermore, this quote highlights the context of the country's socio-political history of colonialism and subsequent independence. Her desire to empower young people to become employed was linked to a desire to truly move forward despite the violence

and trauma left by colonialism, towards self-reliance. This trauma is absent in Western Europe, and using models developed elsewhere does not acknowledge the social history of Tanzania and Zanzibar.

5.2.3 Fostering environmental knowledge and awareness

Science does not work in an isolated jungle, far from the students' living environment. Nowadays, the relationship between the science curriculum and environmental issues or environmental education, in general, has become much closer. This becomes a major concern to most of the teachers and other educationalists in science when they talk about the goals of the science curriculum (for example, Gough, 2002). However, in the context of this study, few teachers, five out of 21 interviewees, displayed a sense of the importance of science curriculum for environmental education. Unfortunately, the environmental aim was not revealed in the focus group discussion data at all.

During the interviews, five teachers expressed their beliefs about the relevance of environmental education within the science curriculum. Rather than thinking about big environmental issues, such as acid rain or climate change, like Western countries do, the teachers in this study were referring to environmental issues within their living contexts. The responses of three teachers which cover points that all five teachers made were extracted for further elaboration. For example, one teacher during his interview put this way:

(...) for example, now the government is making a lot of effort to stop people cutting down trees for making charcoal; so, if there is a special emphasis in the school curriculum this could help... (Interview, Mr John, V2, T26)

In this quote, the teacher brought up the issue of environmental demand, reflecting on the government's concern about conserving their environment. The teacher's response appeared to criticise the current CBC for not responsive to the local community practice. This study was conducted in an area where charcoal is the major sources of cooking fuel. Thus, the context in which the teacher was living appeared to have significant impact on their responses. Another teacher, Mad. Sayda, brought up similar ideas about the science curriculum in relation to the environment:

(...), we have this problem of environmental pollution (...), if we teach our students about the effect of global warming at the earliest stage maybe even this habit of burning plastic bottles and other plastic materials will be reduced. (Interview, Mad. Sayda, V2, T22)

Again, the teacher's responses indicate the weakness of the present curriculum for not responding to what is going on in the local community. The environmental

pollution that the teacher was experiencing within their local context helped her develop views about the science curriculum. Teacher's conception on the science curriculum based on the impact it could make in their living world. The teacher's response was rooted after experiencing of bad environmental practices exercised in their country. The science curriculum is defined and judged in relation to the impact it can make rather than the laid down instrumental objective it has.

The context outside the school, in which the students live, has a major impact on teachers' responses about how science curriculum content should be taught. This was shown in this study when teachers were discussing appropriate content for the science curriculum. The external influence here involves social and economic activities such as farming, business, and social problems such as diseases, environmental issues and cultural concerns. This study's findings show that the problems and activities outside the schools had a big impact on teachers' beliefs about the content in the science curriculum. For example, Mad. Nuru said:

(...), curriculum should focus on the real environment of the student (...), for example, why we are teaching environmental pollution is caused by industries, and not talking about seawater contamination caused by hotel buildings near the sea? We have no industries here, but hotels are all over our shores... (Interview, Mad. Nuru, V2, T2)

Here, the teacher also show the disproportionate of the present curriculum with the real context to which it serves. In this quote, the teacher referred to both environmental and social demands. Mad. Nuru was a chemistry teacher from Zanzibar, a country where most of their shores have been taken over by the tourism industry, including hotels. Here, the teacher tried to indicate the weakness of the curriculum in responding to the contextual environment. Her focus was on science content that will provide knowledge to citizens to help them manage their natural environment.

5.3 The content in the science curriculum

The focus of this section is on the curriculum content (i.e., what to teach) in response to the teachers' beliefs. The focus is not on reporting a list of contents to be included in the curriculum but rather how the teacher features the curriculum content within their professional beliefs. In most cases, the teachers identified the curriculum contents by reflecting on the different aims of the science curriculum similar to those indicated in Table 5-1, also connected to other aims identified in the existing literature (see section 2.6). Drawing from the literature review, teacher's decision-making is shaped by their professional beliefs with the interaction with of the social

environment to which the teacher are interacting with it. Therefore, further analysis was made, and it was revealed that teacher's beliefs about the content in the science CBC also feature within their personal biography and the socioeconomics of the local community as well as the problems facing wider society. Similar to the above results, in this section, it was also noted that the teachers looked at the curriculum content and reflected on the two similar, broader goals of the science curriculum: preparing students' for science career specialisation and preparing them for citizenship with science that helps them in everyday life. This section is organised into four parts, as indicated in Table 5-1.

5.3.1 Fostering scientific career specialisation

The contents related to career skills was the main concern of 16 teachers out of the 21 involved in the face-to-face interviews and also featured in the responses in every focus group discussion. The teachers believed that giving students a vast amount of general science content has a negative impact on their career choices. They thought that the curriculum should be structured with respect to the career specialisation right from the lower secondary education. The responses of two teachers and one focus group discussion about the aim of fostering career specialisation were taken as representative because they covered the opinions of all the teachers. However, the evidence of this study shows that the teacher's beliefs in relation to the content in the science curriculum did not featured within present CBC. There were several agentic forces that propel teachers to criticise the present curriculum. For example, during the interview, Mad. Nashda said:

..., for example, myself, I was very interested in becoming a doctor but because the curriculum was too wide, it forces students to study a lot of things, I failed to meet my target. So, I wish a student could learn science that will direct them to a specific career related to their interests. For example, science should be broken down in response to the career a student wishes to pursue... (Interview, Mad. Nashda, V 2, T28).

Mad. Nashda's response indicates how her personal history and past ambitions have influenced her present views about the content of the science curriculum. Her responses show dissatisfaction with the present CBC curriculum for being too content-bulky. Her personal biography serves as an agency in the formulation of how the curriculum should be structured. How or what the teacher learnt during their schooling or their past ambitions and experiences appear to have a big influence on her views. Her focus was on *economic demand* - preparing students to become future skilled personnel. Here, the teacher pays less attention to the science content related to socio-scientific issues which could also help those who will not become scientists.

In a similar interview, another teacher, Mad. Njake, made a similar remark about the career relevance of the science curriculum:

(...) a science curriculum should focus on a specific career from secondary school. For instance, a student who studies biology and chemistry can be prepared for health education studies, a student who studies physics and chemistry can be prepared for industrial studies and like that (...). But today you find that student is learning three science subjects: physics, chemistry and biology, how is it possible for a student to master all these contents? (Interview, Mad. Njake, V2, T31)

Again, the teacher is concerned about the direct link between curriculum content and future careers. In fact, this was a common idea to most teachers in this study. Here, the teacher was introducing the idea of teaching science in a combined approach instead of as separate subjects (physics, chemistry, and biology). The focus was to prepare individual students for career opportunities at a very early stage of their schooling. In the context of this study, science entails learning all three science subjects (physics, chemistry and biology) plus other subjects including civic education, Swahili language, English, geography and mathematics. The teacher thinks this system has a negative impact on the students' career ambitions as there was large amount of content across the various subjects.

The findings from the interviews were in line with the findings from the focus group discussion. There were several instances where teachers referred to their personal histories; specific concerns about curriculum content were identified in two focus-group discussions out of four. For instance, in one focus group, teachers said this:

Let's teach students for purpose, for example, these students to be engineers, these to be doctors (...), But with this curriculum students learn a bit in physics, a bit in chemistry, and so on; it becomes difficult to get the skills intended for all subjects. (FGD1, Mr Sula, T21)

You know, the important thing is to know which field we want to prepare student for. For example, if we want to prepare them to be a physician, then the student could study biology and other components of physics and chemistry that are related to the field. I will give you an example. While we were at university, we learnt about "radiotherapy", which is "treatment using radiation", it is physics and there is little concept of biology. So, we were taught biology but only about cell division. So, if we will structure our curriculum like that at a very early stage, it will make the student competent in the area they have specialised. (FGD1, Mr Achu, T22)

We were taught by one teacher from Europe when I was at DIT (Dar es Salaam Institute of Technology), he was teaching us "telephone and telegraph", he was very competent (...), but if you gave him simple mathematics he couldn't, he only knows the mathematics in the field of his specialisation (...), but here we are studying lots of content at a time. (FGD1, Mr Wadu, T23)

All these teachers show their doubt of the present CBC for lacking focus of the career skills. The teachers' responses were reflecting on economic and political demands.

The teachers' concerns were about how the content of the science curriculum related to careers skills. In this study, we talked about a secondary school curriculum which some students could pass to proceed onto A-level studies, while others might dropout if they failed the exams. These teachers did not say how such content will help those not pursuing science-related careers. The responses of two teachers, Mr Achu and Mr Wadu, were influenced by their personal biography. Mr Achu was a physics teacher with a Master degree in Physics. His university learning experience appeared to influence his present view about the content of the science curriculum. On the other hand, Mr Wadu was affected by the teacher he met at college. Mr Wadu also was a physics teacher who attended a technical school and then a technical college. His educational journey appeared to be the main contributing factor to his response about curriculum content. These dynamics also played out at different points in the other focus groups and other sections of the research.

5.3.2 Fostering students' wellbeing

There was an important consideration of the local context when the teachers spoke about the science curriculum content. A major concern appeared to be the effective delivery of content that could have a good impact on the students. Eight out of 21 teachers involved in the face-to-face interviews indicated their concerns about the content in the local context. Three teachers from the interviews and one focus group discussion (six teachers in all) responded with detailed information, presented here as evidence. For instance, Mad. Nuru disclosed that:

..., in form one, a student should just learn chemistry terminologies and basic principles of chemistry, I mean, just to familiarise students with chemistry principles and ideas (...) the best way is to give students content that is related to their ages that could help them in their lives. (Interview, Mad. Nuru, V2, T13)

Unlike other teachers whose their responses show the criticism of the present CBC, this teacher was bit neutral. The teacher's responses was not given out by referring to the present curriculum like many other teachers did. In this quote, the teacher's focus was on the students (*internal audiences*) within the school context; she felt it was important to reflect the age of the students. The teacher was referring to what Ryder and Banner (2013), call the immediate aim of science curriculum (see section 2.6). The teacher did not clearly articulate how science would help students in their lives; in terms of self-employment like other teachers have pointed out or in terms of scientific literacy.

Here, the teacher's belief was presented in connection to the present curriculum by indicating the positive and negative aspect of the curriculum. Again, students (*internal*

audience) appeared to be the teachers' key concern. Mr Sadiq believed that science content should equip individual students with the skills and knowledge that are useful in their lived reality. He used the following example to illustrate his idea:

Let me give you an example, we are learning about "evolution"; what is the application of "evolution" in normal life? I know it has, but how much does this topic help our students when they end up at this level? But the student is learning photosynthesis in plants, this has a direct application to the student's life, even if they fail to continue with their studies ... they can use it in agriculture to work out where they should grow plants. (Interview, Mr. Sadiq, V2, T7)

Here, the teachers' focus was on the outcome of the curriculum. The teacher used an example of the topic of evolution to indicate its impact on the student in their local context. Mr Sadiq did not reject evolution as a science education topic, but his concern was how useful it was to the students in their local context. This resembles findings by Jenkins and Nelson (2005), who argued that, "*it is important but not for me*". Mr Sadiq believed that the topics like evolution might be relevant within the science curriculum for other levels but not to the level he was teaching. He saw evolution as an irrelevant topic for the level of student. However, other parts of this study showed that religious beliefs were a core factor behind the teacher disregarding evolution in the science curriculum.

This concern about seemingly irrelevant content was echoed by others. For example, Mad. Sayda also said,

(...) Let us ask ourselves a simple question, why are most students interested learning "current electricity than static electricity"? The answer is simple; because students see the vivid application of "current electricity than static electricity". Curricula should include content a student can understand and has applications in their real environment. (Interview, Mad. Sayda, V2, T2)

Again, the teacher's response pointed out some irrelevance of the content within the present CBC. She did this by referring to the two physics topics – *current electricity* and *static electricity*. Mad. Sayda was a physics teacher at form-one and form-two (Years 7 and 8), where students start to learn these topics. Her response appeared to be rooted in her teaching experience. It was about how students react to different curriculum contents within the classroom. She tried to look at curriculum content in relation to local context, focusing on the curriculum content that could promote students' interest in learning.

A discussion also arose about the concept of an atom within the science curriculum during the FGDs, and teachers had mixed responses. For instance, from one of the FGDs the following teachers had this to say:

Long ago we were learning industrial chemistry. When the student finishes they can directly apply what he has learned, but now, the student may finish form-six, and when they go out there is nothing they can do, why? Where they will apply atomic structure or where will they use the Dalton atomic theory? Where do you go to apply that thing? (FGD3, Mr Kalima, T30)

To me, there are some concepts that are still important, for example, when we talk about atomic configuration, these are the basics for a student to understand chemistry (...) an atomic structure is the basic unit in chemistry. And we cannot talk about atoms without mentioning Dalton; he made great contribution to the atom. How will students learn chemistry at a higher level if they did not learn the atom here? (FGD3, Mr Kibua, T28)

(...) when our graduates go to the community they fail to apply the knowledge they have learnt. But where will they apply it while they learn something that is not relevant to our environment? Now, learning the ideas of other people by recognising their contribution is ok; but how will it help the students? (FGD3, Mad. Kalorine, T31)

The teachers' mixed responses are the result of their different focuses when they were reflecting on science content. Mr Kalima and Mad. Kalorine responded to the individual demands of the science curriculum about content with application for the students in their living world. The teachers were not explicit about the application of science content in science-related issues, although Mr. Kalima used the example of atoms to exemplify content that was irrelevant to the students in their living world. However, this idea was totally rejected by Mr. Kibua whose focus was on preparing individual students for further education and subject maintenance demand. He looked at the concept of an atom in relation to learning scientific canonical knowledge. Therefore, there were several views about the appropriate level of content which were influenced by teachers' background, national context and their experiences of learning similar concepts, but it was clear to the teachers that the curriculum include some irrelevant content is relation to their local context.

5.3.3 Fostering solving social problems

As claimed in the existing literature, the social reality of the local community also has a big impact on teachers' perspectives and views. As I have shown in the literature review (section 2.5), that teachers' decision-making is the result of interaction between teacher's beliefs or understanding and sociological forces encounter within their living environment. Thus, the analysis of the qualitative data revealed that teachers' personal theories about the curriculum, including what to teach, were featured within the problems existed in their local community. In one way, we can see that teachers were trying to reflect on the socio-scientific issues that were locally experienced. Unlike the studies carried out in Western communities where the socio-

scientific issues were argued on those issues decided by the scientist such as vaccination, or impact of radiation (see, Ryder and Banner, 2013), the teachers in my research were responding to issues that locally exercised by their local people.

In most cases, teachers' responses were expressed in combination with other goals of science curriculum, but here the teacher paid more attention to their social problems. The responses of two teachers from the interviews and from one focus group are presented as representative. These extracts were highlighted because their content represents broader expressions about this matter among teachers' responses. Mad. Njake made this remark:

(...) currently, we are in a period when the world is very contaminated with several diseases. Therefore, I would like the science curriculum to include topics which will develop knowledge and skills that will enable students to face such challenges. I think we should focus more on "human biology", because it helps students to understand their bodies and how they can live safe. (Interview, Mad. Njake, V1, T47)

In this extract, Mad. Njake referred to one of the existing social problems – *diseases*. Her focus was on the internal students and the community at large; developing knowledge and awareness of several social problems like diseases. Mad. Njake's interest was not about knowledge and skills to solve the problem (*diseases*) but rather content which could help the student with knowledge and skills necessary to take the right measures and decisions to avoid contracting them. This study was conducted in an African country (Tanzania) where diseases are among the most serious problems in society. Thus, the teacher's belief about content of the science curriculum was influenced by the local environment she was living in. She was trying to respond to both individual and social demands. Mr Ndama, a chemistry teacher, echoes the Mad. Njake's response. He believed that curriculum content should reflect the social problems which students are familiar with:

To me the content that teaches students basic skills such as waste disposal, fruit preservation, the proper use of animal waste for vegetables and so on. These are also very important because they are the common issues in our society. Now we see people irrigating vegetables with dirty water from the sewage. What science is talking about such matters? The curriculum should include such topics as well (Interview, Mr Ndama, V2, T25)

Multiple aims are recognised here about social, individual and environmental aims. The teacher's response was influenced by some of the problems within his living environment and reflects on social-scientific issues. Mr Ndama also highlighted socio-economic activities – "*irrigating vegetable with dirty water from the sewage*". Thus, the concern about content related to scientific literacy was realised in this

teacher's response. The use of dirty water (water from the sewer) for vegetables indicates the importance of scientific literacy in society.

Such findings also feature in the data from one focus group discussion, where teachers argued,

I would like the topic related to pollution being taught in one subject and not as a separate subject so that all students will learn because it is a topic that is so general for all students because this is a serious problem in our country. (FGD3, Ms Agnes, T21)

I didn't know the issue of "heavy metal" until I reached university, this is a very important concept to be taught at this level as well, not at higher level as we did at university (...) You know we have many farmers here in Dar es Salaam who are using water from industry for farming activities... we must educate our students at very early stages about the effect of it on human life. (FGD3, Mr Kitua, T20)

(...) imagine, last year 73 out of 200 students failed the exams. These are going to join the community. We have a serious problem of drug abuse; how does the curriculum help society reduce the problem? we have the topic of drug abuse in the syllabus, but it is not enough, the content should go deeper to help our generation... (FGD4, Mr Alison, T25)

The teachers' responses indicate the dissatisfaction of the present CBC for being content irrelevant. The teachers indicated that the CBC was weak to respond to the problems that were socially renowned. The problems that were existed outside-school context. Problems such as environmental pollution, drug abuse and the impact of heavy metals were used by the teachers to reflect on the kind of content the science curriculum should have. They were responding to multiple demands but in terms of scientific literacy and environmental demands. Here, the teachers were more concerned about those students who will not become scientists or specialise in science in their further learning. The assumption here was that those who go onto post-secondary and/or science careers would develop this knowledge because of their potential future trajectories.

5.3.4 Fostering vocational skills

In most countries the common practice is that vocational skills are taught at vocational colleges and also in technical schools. This research reveals that many teachers were talking about integrating vocational skills within the secondary science curriculum. Referring to the literature review (see sections 2.4 and 2.6), the goal of vocational skills were not identified as among the secondary school science curriculum. But, in my research, due to the challenge of employment and socio-economic status of the community, the idea of vocationalising the science curriculum has been given equal emphasis as other goals. Thus, as indicated previously, some teachers showed their concern for students that could specialise in science in a future

science-related career; other teachers focused on those students without the opportunity to study further. These teachers were thinking about content related to vocational skills rather than content for career specialisation – the use of scientific knowledge for self-employment. For instance, during the interview, Mad. Njake explained this:

(...), the curriculum should have content that relates directly to the students' real environment. For example, long time back when I was a student, agriculture and animal husbandry were among the biology topics with the goal of helping students after finishing their studies even if they failed to proceed with the next level of education, they could use the knowledge to help themselves in terms of self-employment and generate income. (Interview, Mad. Njake, V1, T46)

The personal biography reoccurs with this teacher as well. Her concern was on the individual in terms of economic gain, and she was thinking about integrating the school science curriculum with vocational science-related content (*vocationalisation of secondary science education*). The focus was on having alternative ways of helping those students who fail to continue their studies, or the future non-scientists.

Mad. Njake had been teaching for 25 years, and education for self-reliance was a basic policy during her schooling. However, during this study, Mad. Njake was working at a public secondary school in the city centre where business activities were the main economic activities. But the teacher's thinking was still on agriculture and husbandry activities, which were practiced more in rural areas. This indicates that the teacher's support for vocationalising science education was rooted in her personal biography.

Another teacher who studied at a technical college introduced a similar idea of integrating vocational content into the school science curriculum. When she described the content in the science curriculum, she said:

(...) this curriculum has a lot of content and is just confusing the student (...), I remember when we were in technical schools, we finished in four years and we came out with useful skills, I have friends who now are good electricians, good welders, good mechanicals but this curriculum, you find students have completed the four years but they cannot even do simple wiring in the house. (Interview, Mad. Sayda, V2, T5)

Again, the teacher used her personal biography to criticise the current curriculum. Her concern was with science content related to vocational skills like wiring. She did not talk about science content that might support those who would become neither technicians nor scientists. The teacher was thinking about the individual demand in terms of employability rather than in terms of scientific literacy. This is a common finding across many teachers in this study. As I have pointed out above, the scarcity

of employment in the context where this study was conducted might be a major reason for most of the teachers focusing on the coupled aims in the school science curriculum.

5.4 The pedagogy in teaching in science

Tsai (2002) categorised the approaches to teaching science into three groups – traditional, process and constructivists – claiming the majority of teachers used traditional approaches. In my present study, many teachers believed science should be taught through a student-centred approach similar to the CBC. Thus, the teachers in this research categorised science teaching into two approaches: theory (traditional) and practical (process). The two terms, which were commonly used by the teachers in this study were coined by Donnelly (1998) as the language of practice. It is the language used in the practice of teaching and learning science, which might have a different meaning in other practices. In this study, the teachers used the term theory to mean the knowledge of science that focuses on mastering the theoretical aspect of the subject (learning canonical science). It is about students understanding the intended content of the curriculum through content mastery without any sort of hands-on experience. On the other hand, the practical approach incorporates hands-on experience where the students could be involved in enquiry through interacting with teaching and learning resources. As pointed out above, the findings here are more about the teachers' beliefs and not about their actual practices.

Data analysis revealed that all teachers believed that science should be taught through student-centred approaches, where there is an integration of theory and practice. Their beliefs were in line with the idea of teaching in accordance to the CBC in the Tanzanian context. However, the reality of using such approaches differed among teachers. The data from the interviews and focus group discussions revealed that when teachers express their beliefs about pedagogy in teaching science, they reflected on two educational aims. These include promoting learning by doing and preparing students for further learning. Thus, this section is organised by these two themes found in the data.

5.4.1 Promoting learning by doing

As mentioned above, many teachers believed that science should be taught through a student-centred approach and that one of the main goals of student-centred approaches was to develop student's understanding. Out of 15 teachers who expressed their opinions about pedagogy in the teaching and learning science, nine

believed that science should be taught through hands-on experience in order to motivate students and develop understanding. However, they did not make it clear whether they meant to motivate students to learn science for the next level of education, for future science careers or for individual application in terms of scientific literacy. This was more about facilitating the teaching and learning practice at the classroom level: the immediate aim of the science curriculum rather than the long-term aim (see Ryder and Banner, 2011). For instance, in the interview one teacher said this:

Science should be taught through practical and other participatory methods (...) to make students motivated to learn science. (Interview, Mad. Aliye, V1, T18)

Here, the teacher believed that the major goal of pedagogical practice is to facilitate students' participation in order to motivate them to learn. She used the term practical, which means more than laboratory experimentation. Elsewhere in the interview, she conceptualised practical work as

“Practical” in teaching science includes all laboratory and non-laboratory activities which will make students observe the phenomenon and interact with learning materials through collaboration. These activities lead to students' understanding. (Interview, Mad. Aliye, V1, T10)

In general, the teacher was referring to learning science through inquiry, where students involved in various hands-on experiences and interactions to develop conceptual understanding. Her focus was on the students' understanding, though she was not explicit about the goal of understanding, whether it is for science specialisation or individual application. This teacher also spoke about her personal goal of science curriculum wherein she indicated her concern about preparing future scientist.

The integration of theory and practical or experimentation were the common phrases used by the teachers to elaborate how science must be taught. For instance, another teacher, Mr. Ndama, when talking about his belief how science should be taught responded this way:

Science should be taught through activities; means; students should perform experiments many times (...) at first, students should be taught theory and then taken to the laboratory to interact with materials to perform the experiment. When you tell students that “oxygen gas gives pop sound”, students should verify it. This could be easier for the students to understand and help them to keep as long-term memory. (Interview, Mr Ndama, T13)

The word activity here is used as synonymous with laboratory experimentation. Mr Ndama believed that students should first understand the theoretical aspects of the content before being involved with hands-on experience. However, his focus was on

students' understanding, but it appeared that he looked at science teaching as a rigid process of starting from theory, followed by practice where the main goal of experimentation is to verify scientific theories and laws. This is contrary to how science should be taught as per the CBC, which defines science teaching in terms of inquiry and argumentation; that idea was not heard from the teacher. He believed that teaching through activities has a positive impact on students' understanding, in line with the responses of many teachers in this study.

Let me give you example, until I finished Form-one, I was not interested in learning science, but in form-two we had a teacher who was very funny, he was engaging us in different activities, I remember even the day when we made soap and he gave it us to take home. Since, then I was very motivated for science (...) so, science must be taught through learning by doing. (Interview, Mr Nasa, V2, T25)

Contrary to the previous teacher, whose beliefs were shaped by her career context, Mr Nasa's beliefs were rooted in his personal biography during his schooling. The way he was taught at school made him construct a rationale of teaching science through practical activities. The role of activities is not only to motivate students to learn science but also to develop students' long-term memory.

The results from the interviews corroborated the findings from the focus group discussions. All teachers in the discussions indicated the same belief that science should be taught through a participatory teaching approach. One of the major goals of the interactive teaching approach was to help students' understanding. For instance, at the third focus group, the teachers made the following arguments:

Physics should be taught through activities (...), recently, students came and asked me about an "Electrical Bell; how does it work?"; it is a very simple issue, but because students learn in theory it makes it hard to understand (...) we need to involve students in activities to make them understand how physics works. (FGD3, Mr Alison, T3)

Science should be taught through activities; such as laboratory activities and classroom activities such as "group discussion, presentation, demonstration" (...) to make students more interested and develop long-term memory. However, teaching through experimentation is difficult in our situation because of the resources. (FGD3, Ms Agnes, T2)

Ahh! You know, when you talk about science subjects in a real sense we focus on application. A student should be involved in experimentation, they should touch the equipment and follow the process of investigation; making observations, collecting data until the conclusion. (Interview, Mr Kitua, T4)

All these teachers held similar beliefs about pedagogical approaches in science. They reiterated their strong belief in an activity-based approach as the best for teaching science, which is in line with the goals of the competency-based curriculum in Tanzania. Mr Alison, used an incident within his working environment as a rationale

for teaching science through practical activities. He reflected on solid-state physics, where students are involved in experimental physics. However, Ms Agnes identified several approaches to be applied in teaching science, appearing to focus more on classroom level: motivating students and developing long-term memory. Mr Kitua believed that application in science is best achieved through experimentation. This is particularly for those students who specialised in science; however, the approach for students who will not learn science was not clearly articulated.

5.4.2 Promoting science specialisation

One of the key aims of any school science curriculum is to prepare students for further education in science-subject specialisation. Teaching pedagogy that focuses on preparing students for the next level of education also appeared to be a major concern in this study. Out of 15 teachers who expressed their beliefs about pedagogy in teaching science, seven shared the view that science should be taught through participatory approaches. The teachers here felt that for effectively preparing students for further studies, science should be taught through student-centred approaches.

As the teachers gave similar responses about pedagogy, four were selected as representative. These four responses were selected because of the clear and detailed information they provided. For instance, Mr. John, who was teaching chemistry at a school with students from both O-level and A-level, posited that,

(...) I'm teaching both O-level as well as A-level. I received students from O-level; they don't know even to pipette, it become very difficult because you have to start from scratch. And I am not blaming the students, but it is about how science it taught at lower levels, it is taught more theoretically.
(Interview, Mr John, V1, T9)

This teacher believed that science should be taught through experimentation, referring to the subject maintenance demand - preparing students for science specialisation at A-level. His belief had developed from his career experiences, teaching students who were not involved in experimentation experiences. This is similar to a teacher's response in the study by Ryder and Banner (2013), that the focus of the teacher was on the external audience (science teacher) who will meet these students at the next level of education. This teacher believed that the experimentation approach has a positive impact on those students who will proceed with the science specialisation in their further studies. However, how such teaching approaches might benefit other groups of students not continuing to A-level was not mentioned. His responses were in line with the responses of other teachers about the pedagogical practice in teaching science.

(...) science is a subject that depends most on “experimentation”; it is not a subject that relies only on explanation. Teaching should be carried out through students’ involvement in performing “experimentation” (...) to develop a basic knowledge of scientific investigation, so, when they reach a higher level they will have a good foundation of scientific skills. (Interview, Mad. Njage, V1, T12)

Here, the teacher considers science as a body of knowledge that should be taught through scientific approaches such as experimentation. Her focus was on students who will continue with science at A-level. Again, in this extract, the teacher did not indicate any concern about those who will not become science specialists, though she did show concern about science in individual application. The third teacher, Ms. Tau, talked about pedagogical practice in science:

(...), we don’t want our students to end at this level, the goal is to prepare them for a higher level; so, physics should be taught through activities like “discussion, presentation, experiment” (...) to motivate for further learning. (Interview, Mad. Tau, V1, T40)

Contrary to Mr John, who focused on only one teaching approach, experimentation, the teacher here referred to multiple approaches of being student-centred. In this quote, the teacher introduced twin aims for teaching science: motivating students to learn science and preparing students for further education. However, the teacher did not indicate how such approaches related to preparing students for higher-level education. Her beliefs appeared to be rooted in her personal goal of teaching: *preparing students for a higher level*. The goal of teaching by reflecting on higher-level education was also supported by another teacher:

(...), most of the students when they reach A-level, they run away from science because they were not taught well at lower levels. So, for science to be taught better, students should be taught through participatory methods, through activities or laboratory experimentation. Students should learn by doing. (Interview, Mr Guni, V2, T9)

Again, this teacher refers to one goal of science education – subject maintenance demand. His belief was the consequences of his personal observation, correlating a small number of science students at A-level with poor approaches used in teaching science at secondary level. He believed that interactive teaching approaches including experimentation have a positive impact on students, encouraging them to continue learning science at a higher level. The teacher’s criticism is the indication of poor CBC enactment, that teachers fail to enact the CBC as intended.

Through the FGDs, teachers expressed a belief that science should be taught through a student-centred approach, particularly through the use of experimentation.

(...), I studied through the alternative to practical when I was at O-level, and when I went to A-level it was really hard to me to do laboratory

experiments (...), therefore, out of other participatory methods, science must be taught through experimentation at this level. (FGD2, Mr Vugo, T15)

Yeah! You have reminded me of something very important; you go to A-level, you don't know even how to read the micrometre screw gauge; truly it was a mistake for the curriculum. Yes, it is important for science to be taught through experimentation at very early stages. (FGD2, Mr Pandu, T17)

To me, the experiment is important in teaching science, but also the field trip has a big impact in motivating students for future careers. For example, one day we went to hospital to learn about X-rays, when we came back everyone was very ambitious to learn science. (FGD2, Mr Haji, T14)

All these teachers focus on subject maintenance demand. Mr Vugo and Mr Pandu believed that science should be taught through participatory approaches, but their main concern was laboratory experimentation. These are teachers who learnt science laboratory experiments through alternative to practical, whereby the experiment was done through relying on diagrams and given data without student involvement in data collection. Mr Vugo's and Mr Pandu's difficulties at A-level because of previously learning science through alternative to practical approaches influenced their beliefs about pedagogical approaches in teaching science. Apart from experimentation, Mr Haji believed that field trips had a big influence on student motivation for career choices. Instead of thinking about subject maintenance demand, Mr Haji reflected on economic demand – future scientists. His response was rooted in his personal biography.

5.5 Conceptions of assessment in science

This section covers the descriptions of assessment practices associated with the science curriculum and teaching. The assessment practices reported were drawn from teachers' professional goals, teaching experiences and personal reflections on how science is assessed in their educational context. During the interview and focus group discussions, the issue of how science should be assessed was an overarching issue raised by all teachers. Seventeen teachers out of 21 involved expressed their beliefs about assessment in science curriculum and teaching. Their responses rested on two predominant issues: goals of assessment, and methods of assessment.

Thus, this section is divided into two sections, in keeping with the themes that emerged from the data analysis. The goals of assessment will be presented first, followed by the methods of assessment. The two themes are closely matched in the responses of teachers making it difficult to separate the responses of teachers about their beliefs related to methods and to goals. Therefore, the findings will be presented

in response to the respective analytical themes or topics indicated. There were mixed responses.

5.5.1 Goals of assessment in science

The goals of assessment practice in teaching and learning are discussed in the existing literature (Brown, 2004; Harris, 2007). Brown (2004) identified three goals of assessment: motivating student learning, and holding students and teachers accountable. During this research, it was realised that teachers' beliefs about assessment in teaching and learning science were related to two main goals. Almost all 21 interviewees said their beliefs of assessment in teaching and learning science were about motivating students on learning and preparing students for examination attainment. As the teachers had similar ideas on this issue, four responses with detailed information will be quoted as a reference.

According to Brown (2004), the majority of teachers believed that assessment, especially written examination, is irrelevant to students' learning, because the examination results reportedly disappointed students and discouraged their learning. In this study, the teachers believed the opposite. Some believed that in teaching and learning science assessment can be used to motivate students to strive for academic achievement. They thought that assessment, including classroom-based tests, have a positive impact on the students, encouraging them to be responsible for their learning. Teachers reported that assessment provides an intrinsic motivation for students to learn. Many of the teachers in this study were in favour of frequent assessment for the purpose of encouraging students to learn. However, the teachers were silent on the negative impact of assessment, especially for lower achievers students.

(...) the teacher is required to make a regular assessment when they are teaching; before the lesson, during the lesson and at the end of the lesson
(...) the assessment should be a continuous process throughout the lesson to motivate students' learning. The goal is to measure students understanding of how they are learning... (Interview, Mr John, V1, T19)

Here, the teacher talks about the idea of formative assessment – assessment for learning. In this quote, he mentioned the intertwined goals of assessment within the classroom. At first, his belief in assessment reflects an immediate goal of teaching and learning science – motivating students to learn. However, he was not explicit about how regular assessment can motivate students to learn or support their learning. In the second part of the quote, Mr John reflected on the measurement purpose of assessment, claiming that another goal of assessment was knowing more

about how students learn. Again, the teacher did not make it clear whether the feedback of assessment is for teachers' reflection on their teaching, for the school administration, for parents so teachers are held accountable to an external agency, or for the students to understand themselves.

Other teachers thought that the role of assessment is to prepare students for examination; many reflected on the future goals of teaching and learning science. Therefore, the teachers looked at the external examination as a gateway to different science career specialisations. In responding to the beliefs about assessment in teaching and learning science, Mr Kapu pointed out that:

You know at the end we are teaching to ensure that our students pass their exams, and this is mostly achieved when students are given frequent tests. Students should be assessed frequently to develop students' attitude to learning because (...) no student likes to lag behind. Also, frequent assessment helps students avoid examination phobia. (Interview, Mr Kapu, V1, T58)

Here, the teacher reflected on the goal of certification. To him, doing frequent assessment will make students more responsible for their learning and in turn they could perform well in their exams. Frequent assessment was considered to have a positive impact through familiarising students with the examination. Here, his response seems to reflect on the subject maintenance demand of education, but his focus was only on those who will proceed to the next educational level. Moreover, the teacher believed that assessment puts students in a race where some will lead and others will lag behind, almost assuming a deterministic view of attainment. However, Mr Kapu failed to explain how frequent testing will help students who will lag behind and fail to achieve the standard.

This goal of preparing students for the examination makes another teacher thought about how assessment could be structured to enable students to proceed with their education. Rather than talking about assessment within the classroom, Mad. Nashda reflects on the structure of the national examination:

Because the curriculum is too long, as I have previously said, therefore, I think a student should not be assessed for three hours on the four years' contents. This is unfair to me; a student should be assessed in an interval format. For instance, at a certain interval, a student can be assessed, and their marks could be recorded, then a student will be assessed again at the next interval and their marks recorded as well, then, at the end of four years, their marks will be added together for evaluation purposes. (Visit 1, Interview, Mad. Nashda, T57)

In this quote, Mad. Nashda was referring to the present CBC and the style of assessment at the national level. She indicated that she was dissatisfied with the

way national assessment was conducted. The teacher considered national assessment as irrelevant because of the duration of the exam and the vast amount of content being assessed. This teacher taught the final year of O-level secondary education – Form 4. The national examination is crucial for students that want to proceed onto A-level studies, join certificate colleges, vocational colleges or end their schooling journey. Thus, the teacher expressed a preference for assessing students in the semester format. The goal is to help the students to manage the learning content. It should be remembered that this teacher wished to become a doctor during her schooling and believes that she did not achieve her target because of the broadness of the curriculum. Therefore, it might be her personal history that influences her responses about assessment of teaching and learning science. She focuses on students' examination attainments, which in turn enable them to proceed to higher-level education.

Another teacher, Mr. Sadiq, like other teachers presented previously, expressed his beliefs about assessment in science by reflecting on national assessment:

(...) I invigilated the national examination several times. You look at the student until you feel so sad the way student is trembling and worried during the practical exams. And this is because, during the teaching and learning, students were less involved in such experience. So, science should be assessed through experiments from the lower level to make students familiar with it . (Interview, Mr Sadiq, V1, T34)

In this quote, the teacher talked about the rationale of assessing students' practical skills from the lower level of their education. The teacher was referring to his previous experience of the consequential impact of national assessment on students. His perspective was that students were worried because they didn't do enough practical assessment prior to the main exam. To avoid such anxiety, science should be assessed through practical activities in the early years to give students enough experience of practical skills. Thus, his focus was on the students' experiences of examination attainment. Again, the teachers' responses indicates the disjuncture between what is postulated by the CBC reform and what is actually went on in the real classroom setting or school environment.

5.5.2 Methods of assessment in science

In teaching and learning science, there are many methods of assessment such as paper and pencil assessment, observation, portfolio, presentation, experimentation and many others. In this study, although many teachers expressed their ideas of how science should be assessed, their concern was assessing canonical scientific knowledge and experimental skills. Moreover, the evidence of this study revealed

that there was no overall consensus in the way teachers viewed the role of assessment in learning and teaching science in terms of the purpose of assessment or even the type, though some trends were identifiable. The complexity of each teacher's standpoint and experiences, their pedagogical approach and their views on the purpose of science education overall – all discussed in previous sections– also affected their perceptions of appropriate assessment.

In this study, the terms theory and practical were an overarching issue for many teachers involved in this study. Teachers repeatedly reported that science should be assessed through theory and practice. Their conceptualisation of assessing science through theory means assessing science content knowledge and principles via papers and pencil test assessments. On the other hand, assessing through practical approaches is a process of assessing students involved in hands-on experiences, such as laboratory experimentation, and other forms of enquiry. The teachers used these two terms, theory and practical, referring to the Form 4 (Year 11) national examination where students are assessed through two types of papers: theory and practical. However, in reality, due to the scarcity of laboratory resources, teachers were assessing science through paper-and-pencil tests only. This seems to be against their beliefs and understanding about how science should be assessed. The teachers' responses brought out the evidence that a CBC was not assessed and enacted as intended. In other words, there was a discrepancy in the way teachers assessed at the classroom level and the way they believe science should be assessed. All 21 teachers presented their beliefs about methods of assessment, and the distinctive responses of four teachers were presented as evidence:

I am trying to refer to how we assess science at the national level and feel that we are not doing it right. Science should be assessed in theory and practice at all levels, even for small children. (...) but now, at national level, experimentation is only assessed at the Form 4 levels but there is no practical examination at Form 2. (Interview, Mad. Aliye, V2, T28)

This teacher referred to summative assessment. One of the goals of the national assessment is certification. Her belief was about how science should be assessed at the national level. Mad. Aliye was a biology teacher teaching students in Forms 1 and 2 (Years 7 and 8). Here, she was referring to the Form 2 national examination which involves one paper examination (on theory). This is different from the Form 4 examinations which include two papers: theory and practical. Here, the teacher tried to indicate the weakness of the Form 2 national examination, which obviously reflects neither the CBC nor the teachers' beliefs on how science should be assessed. In her opinion, science should be assessed through paper-and-pencil exams, wherein

students will be assessed on science content knowledge and principles as well as through practical skills.

As the teachers above talked about the assessment for preparing students for the next level, we can contrast these teachers with two below who talked about assessment for preparing students for vocational skills.

(...) we should not always rely on paper-and-pencil testing because some students might not be good at presenting their ideas on paper, but they might be good in hands-on activities. We should not think only of those students who will proceed to a higher level of education, we must also think of the ones that will not. But if you are going to rely more on written assessment, you are automatically going to lose those students who are not good in written form and automatically kill their talents. (Visit 1, Interview, Mr Nasa, T46)

This teacher was trying to reflect on those students who might not proceed with their education, believing that assessment in science should meet the needs of every individual. He believed that paper-and-pencil assessment is not an appropriate technique in science, and his focus was on developing skills that will help students in their everyday lives. His reflection was on individual demand in terms of individual economic gain, and his idea was supported by other teachers. For example, Mad. Sayda used her past schooling experience to describe how science should be assessed:

(...) I have the background of a technician because I have studied at technical college before I went to study for a degree in education. At technical college, I studied mechanical engineering. There, you are assigned a task and required to do it practically (...), but here student is asked the question; what is; explain this; I don't think we can really prepare students on application skills. (Interview, Mad. Sayda, V1, T28)

Mad. Sayda believed that science should be assessed through hands-on experience. Here, the teacher was referring to her past experience when she was studying at technical school. Her previous biography influences her view of the present; that is, her past is in the present (Goodson, 2009). How she was assessed during her schooling seems to have had a permanent effect on her thinking about how science should be assessed. Her focus was on the internal audience (students) and the development of scientific application knowledge in their living environment. Again, this teacher criticised the paper-and-pencil test in which students would be asked to recall learned information. Here, she considered how science assessment presently seriously hinders attaining the goals of the CBC.

Other teachers' life experiences influenced their beliefs about how science should be assessed. Assessing science through presentation seemed of vital importance to

other teachers due to its impact on students' social interactions and personality development. This was revealed when teachers expressed their beliefs about assessment practice in science. Rather than thinking about assessing scientific skills preparing students for further science studies, the teachers' focus was on using presentations to develop generic skills such as communication skills and confidence - suitable skills for students to apply in later life. For example, Mr Jecha was a secondary-school chemistry teacher who believed that other than using assessment for students' learning, it could also be used to develop the personal skills of the student:

These students are going to be the teachers one day, are going to be leaders (...) When I see, someone is shaking during their presentation; I say to myself the teachers did not play their role when this person was in school. We teachers, our role does not end at teaching content only, we should also develop communication skills with the student. Science should also be assessed through presentation and group discussion to see how they (students) present their ideas to the audience and how they build their arguments. (Interview, Mr Jecha, V2, T21)

Two fascinating issues are revealed in the teacher's excerpt. Firstly, his personal interest lies in the role of assessment in developing students' personal skills. The teacher was responding to the external audience; those people who will interact with this student in outside-world; such as their later careers. He referred to the individual student after school life when they will become a teacher, a leader or someone in another career. Mr Jecha's response was influenced by his personal life experience witnessing how individuals exercising skills in their professional fields. It was about the confidence of an individual before an audience, their communication skills, and the way they build their arguments. According to Mr Jecha, school assessment practice undertaken by the teacher and teaching, and learning has a major impact on shaping students' future application skills. The second aspect the teacher referred to was the method of assessment. Mr Jecha listed presentation and discussion as his preferred methods. His belief aligns with the idea that such approaches allow mutual conversation between students and teacher, which in turn develop students' personal skills.

Contrary to previous teachers who talked about classroom presentation or focus group discussion, Mad. Pamela considered oral conversation assessment.

It could be better if I could get the opportunity to sit and talk to the student verbally to see how they have understood a certain concept. But in most cases, we are using exams to assess our students, we correct papers and you think students have understood but sometimes paperwork does not give you a good answer about what the student understands. (Visit1, Interview, Mad. Pamela, T10)

Like many teachers above, Mad. Pamela was trying to reflect on their assessment practice, which was predominantly in a written form. Paper-and-pencil assessment was considered an ineffective measurement of students' understanding. Again, the teachers' responses about how science should be taught criticised current practice of enacting the CBC. The main message here shows that the teachers' assessment practices were not aligned with how science should be assessed as per the CBC. Mad. Pamela was more interested in assessing science orally through face-to-face conversation, seeing it as an effective approach to assess student's understanding and focusing on the individual student's understanding.

The teachers' beliefs about assessment in teaching and learning science were also revealed in the FGDs. As in the interviews, the teachers believed that science should be assessed through practical activities. Teachers felt using practical activities in assessment would facilitate students' understanding and develop skills students could apply in their real lives:

To me science should be assessed through practical activities to develop scientific skills for future application in their studies. Students should be assessed on how to collect data, drawing graphs and making interpretations; these are important skills in learning science. (FGD1, Mr Sula, T14)

(...) ok, the student collects the data; they follow all the steps, but after collecting the data, so what? They have drawn the graph, found the slope, I think this is "very basic" yet it does not help a student who is in the fourth year of secondary education (...) we should assess students on experimentation to see how they use science to even design a small project that relates to real life. (FGD1, Mr Achu, T13)

(...) a student fails to enter Form 5 because he was only assessed on content knowledge. But now, follow this student after finishing school; when he is doing welding, for example, you will like his work, go to garage, he can open the whole engine (...) we had students who we believed that they were weak but now they are good technicians. Why? Because they went to vocational college and they were assessed through more practical means. But here we are assessing science more through theory; so, assessment in science should be in practical. (FGD1, Mr Wadu, T14)

All these teachers shared the belief that science should be assessed through practical activities. However, they were referring to different goals in science education. For instance, Mr Sula referred to subject maintenance demand. His focus was on the students developing scientific skills for the next level of education. Mr Achu, on the other hand, reflected on individual demand, discouraging learning canonical science, collecting data and drawing graphs. His focus was on scientific skills relevant to the outside-world. His idea about assessment was in line with Mr Wadu's, who tried to show the rationale of assessing science through practical activities. He appreciated

that some students perform better in practical assessment than in paper-and-pencil assessment, and His focus was on developing students' vocational skills.

5.6 Chapter summary

The findings from this chapter were based on data collected through interviews as well as from the FGDs and reveal that teachers' beliefs about teaching and learning science can be broken down into four aspects. These were the educational aims of science education, curriculum content, pedagogy, and the assessment practices, which formed the structure of this chapter. The findings show that teachers' beliefs about the goals of the curriculum fell under two common goals: preparing students for science specialisation, and preparing students for science for living. Moreover, the findings indicate that teachers' beliefs coincided with how science should be taught as per the CBC. From this result, it was revealed that all the teachers believed in teaching science through student-centred learning coupled with formative assessment. However, the overall teachers' beliefs about how science curriculum and teaching should be about brought out the criticism on the present CBC. This study revealed the disjuncture between not only the teachers' beliefs and their practices but also between the intended and the enacted curriculum. It was also evident that the teachers' responses were more influenced by the local contextual reality of their own community.

Chapter 6 Conceptions of the Competency-Based Curriculum

6.1 Introduction

This chapter responds to the second research question (see section 3.3). I have shown that the teachers' responses in terms of meaning-making, values and judgement are driven by personal theories from interaction within their sociological milieu. The data from both interviews and focus group discussions (FGDs) showed the teachers' responses were framed by personal theories including their professional beliefs, personal histories, and teaching experiences. Moreover, their judgment of the CBC reforms were helped by the schools' contextual realities, including availability of resources and socio-economic condition of the school together with the social problems experienced locally. The analytical themes revealed from the data were collected to fit within four conceptions of the curriculum: meaning of the CBC, aims, content, and pedagogy. I have then collected the aims, content and pedagogy together into one topic: aspects of the CBC. Thus, this section is organised into two sections, the first section presents the framing of the CBC, and the second section will present the aspects of the CBC, as summarised in Table 6-1.

Table 6-1: Teachers' conceptions of the competency-based curriculum

Conception of the Competency-Based Curriculum	No. of Respondent
Personal framing of the Competency-based curriculum	
• Competency-based curriculum as the curriculum aim	19
• Competency-Based as a teaching methodology	14
Features of the Competency-Based Curriculum	
• Aims of the Competency-based curriculum	09
• Contents of the Competency-based curriculum	12
• Teaching pedagogy as per the Competency-based curriculum	08
Total	21

6.2 Personal Framing of the Competency-Based Curriculum

In the interviews and FGDs, there was a specific area where the teachers were talking about the differences between the former content-based and the present CBC (see Appendix B, Q3), which revealed issues about how the teachers frame the meaning of the CBC and the term competencies. The findings of the study revealed that teachers framed the meaning of the CBC within two broad curriculum elements: aims and teaching methodology. In one hand, there were groups of teachers who conceptualised the CBC in terms of policy and specific aims in the field of education. On the other hand, other groups of teachers described the CBC as a teaching methodology. As I have pointed out previously, teachers' framing was informed by

their different personal theories and their interaction with social forces. The study revealed that the teachers' framing of the CBC reflecting more on activity-based learning and focusing on engaging students in solid scientific investigation. It appeared that the teachers' perspectives about the CBC reflected on only one aspect of competencies: development of scientific enquiry in the three competencies from three competencies identified by PISA (see section 2.3.1). Thus, this study indicates teachers' understanding was limited of the actual meaning of the CBC in the field of science education. This section is organised into two parts: the first part presents the CBC as the curriculum aim, and the second part presents the CBC as a teaching methodology.

6.2.1 Competency-based curriculum as curriculum aim

In the literature review in section 2.3, I have shown that the CBC aims to prepare individuals for the broader aspects of scientific literacy and argumentation. In this research, teachers framed the CBC by reflecting on the future career knowledge in terms of hands-on skills. It was framed within teachers' living environments, reflecting both the political and economic status of the nation. It revealed that the economic development and personal wellbeing of the individual were the main factor when teachers considered the school science curriculum. The responses of five of the 21 teachers interviewed were chosen to express them all. Furthermore, the responses in the interviews were corroborated with the responses from one FGD. The quotes have been selected as they cut across the responses from all 21 interviewees and four focus group discussion. The first teacher, Mr Mkanda, describing his understanding of the CBC said:

“Competency-based curriculum” is a curriculum that has the aim of preparing students to have the ability to translate the knowledge they have learned in the classroom into practice as what has been said by Nyerere in education for self-reliance. A student should be able to apply their knowledge to solve the problem in their environment and real life in general. (Interview, Mr Nkanda, V1, T34)

The historical perspectives of a country transitioning from colonial rule to independence and its resultant need for productive citizens inform the teachers' decisions. The teachers described the CBC by referring to the long-term goal of the curriculum: *preparing self-reliant citizens*. This self-reliance was the first philosophy of education established by the first president of Tanzania after independence. The goal of this philosophy was to prepare independent citizens socially and economically. It seems that the legacy of education for self-reliance influences the teachers' present thinking. It appears the teacher's framing of the CBC is manifested within the political

ideology of their nation. The teachers also reveal a similar concern for preparing individuals to become self-reliant:

My father studied at the time of the eight-year education, but that old man knows how to craft wood and, in fact, he has multiple skills for many things, he can paint, and he can exercise many things in his living environment (...) This is what the competency-based curriculum is about; to prepare the individual for useful skills in their life. (Interview, Mr Matege, V1, T27)

The teacher referred to his father's educational experience, and for him, the meaning of the CBC is framed within his father's capability. Mr Matege used his father's ability to perform multiple tasks to conceptualise the meaning of the CBC, which seems to reflect the long-term aims of the curriculum: preparing the students for a future life of manual work. Here, the teacher was talking about a similar idea of vocationalising school curriculum, to prepare individual students for learning vocational skills in response to their living world. The idea of relating the CBC with practical skills development was very common to most teachers in this study.

The following teacher also framed the meaning of CBC in terms of the long-term aims of education. Mad. Sayda, a physics teacher with technical experience, described the CBC in terms of vocational skills. It is appeared that her prior learning path influenced her responses:

(...) "a competency-based curriculum" is "learner-centred", which is "activities oriented", meaning students should be fully involved in the teaching and learning process. Therefore, it has a lot of goals but the most common in science is to enable students to use scientific knowledge and skills in their real lives, to enable students to apply scientific procedures to solve their life-related problems. (Interview, Mad. Sayda, V2, T9)

At the beginning of the quote, the teacher defined the meaning of CBC in terms of the teaching methodology: "*learner-centred*". This was also the common understanding of many teachers, as I have indicated above. In the second part of the quote, the teacher referred to the educational aim of the CBC, focusing specifically on students working toward the development of scientific skills in relation to their living world. This was a teacher who went to technical college before going to teaching college, who believed that science curricula should focus on vocational skills (see section 5.3.4). It appeared that her personal experience of the technical college had a big influence on her present perspectives.

In the literature review, I emphasised how teachers' personal biography inform their meaning-making (see section 2.4). In my study too, teachers appeared to figure the meaning of the CBC drawing on their past life history. For instance, the following teacher used his biography to distinguish the competency-based from the content-based curriculum:

I remember when I was at school; once you missed teacher's notes you were likely going to fail. The teacher's notes were like a holy book, and we used to cram all the contents. This was what going on in content-based. It was just focused on the completion of study because "it was all about the transfer of knowledge" (...) but the "competency-based curriculum focuses on transforming someone". It focuses on developing skills for the student to face different challenges in their life. (Interview, Mr John, V2, T18)

Like many teachers above, Mr John's shows an appreciation of the current CBC as better than the previous content-based curriculum. His personal biography helped him not only to frame the meaning but also serves as an agency to make a personal judgement about the CBC as opposed to the former content-based curriculum. At first, the teacher used his past schooling experience to introduce the idea of a content-based curriculum. It seems that his past learning experience influences his present views on the distinction between the content-based and competency-based curricula: two curricula with different goals. The former focuses on the transfer of knowledge, while the later focuses on skills development. Another teacher, Mr Alex, who previously taught at teacher college before transferring to a secondary school, had this to say:

From what I have learned from the college, in a content-based curriculum, a student just learns by going to the next level of education. The success of learning is determined when student manages to go to a higher level of education (...) even the examination paper during the content-based [curriculum] you can see their questions, what is this? list, identify, it was questions that measure the content; it was so easy to pass. But today if you take a chemistry paper, the question style has changed, it needs more thinking skills; the questions are not asking for direct content. (Interview, Mr Alex, V2, T8)

In this quote, there are two important points the teacher was trying to make when he was differentiating the content-based from the current CBC. Firstly, the teacher's distinction between the present CBC and the former content-based curriculum was informed by his past experience. It seems that the teacher's past learning experience at college level still influences his present career position. Secondly, the teacher's differentiation of the two curricula lies in the examination: how the exams were constructed during the content-based curriculum and in the present CBC. To him, the present CBC is much better as compared to the former content-based.

Some teachers seem to be more influenced by the intended goals of the curriculum.

When you develop a student in the "competency-based" means you are placing a student in the professional skill, we call a "competency" (...) in content [content-based curriculum], a student finishes their Bachelor's in Chemistry, but they cannot apply the chemistry they have learned in the classroom outside in their environment. (Interview, Mr Jecha, V2, T14)

Like many other teachers, Mr Jecha also had a positive perspective to the present CBC. His understanding was framed from his professional experience of interacting with both the former content-based and current CBC. He framed the meaning of competencies by reflecting on the outcomes of the former (content-based) curriculum. Here, his concern was not at classroom level but rather the environment outside because of what the students learnt in the curriculum.

Reflecting on the findings from the FGD, it became evident that the teachers' responses from all four focus group discussion were in line with those from the interviews. The teachers in both framed the meaning of the CBC using the educational aims and teaching methodology.

Take an example, a student has learned about measurement. Therefore, when this student is required to grow a vegetable at a certain interval they could use the knowledge of measurement to do so. (...) what I am trying to say is that, is a student able to transform the classroom knowledge into a real-life situation? If they do have such ability, then we can say that this student has developed a competency in measurement; this is what I understand. (FGD2, Mr Vugo, T19)

Firstly, this issue of "competency" is a new concept in our curriculum, before we were not talking about "competency". When we talk about the "competency", it is about "application of the knowledge". The application of "chemistry" that the student learns in the classroom; how a student could apply in their environment. (FGD2, Mr Pandu, T17)

(...), this curriculum is just competency by name, a large part of the curriculum is talking about leading the student to explain, to describe, to identify; now tell me what kind of "competency" do you think can be developed from such questions? I think "competency" is about practical skills. (FGD2, Mr Haji, T21)

These teachers conceptualised competency in terms of hands-on skills. In teaching and learning science, there are multiple competencies, such as explaining, distinguishing, evaluating and so on, but for all these teachers, skills were reduced to one aspect: practical competency. The teachers used different examples in their framing but they had a common understanding. Here, their professional knowledge helped by informing their meaning-making about the CBC. This was the indication that many of the teachers did not have clear understanding of what CBC in science was all about.

6.2.2 Competency-based curriculum as a teaching methodology

While some teachers conceptualised the CBC in terms of educational aims, others referred to it as a teaching method. Mr Kauka, a Physics teacher, used his teaching experience to describe his personal understanding of the CBC:

In fact, the curriculum has changed from “one-way traffic to two-way traffic” whereas that “one-way traffic” was “spoon-feeding”, I mean a teacher was feeding their students the content. But this one [competency-based], even a student can be a teacher and a teacher can be a student. (Interview, Mr Kauka, V2, T9)

Like many other teachers above, Mr Kauka had positive perspectives of the CBC over the former Content-based. However, his understanding of the CBC was limited to the teaching methodology which undermine the real meaning of the CBC. In this quotation, he distinguished the former content-based curriculum and present CBC through what the teacher called “one-way and two way traffic”. However, the teacher did not mention what he meant, though it was obvious that he referred to teacher-centred and learner-centred approaches to teaching. So, to Mr Kauka, the main difference between the CBC and the content-based curriculum lies in their methods of teaching. This was understanding of the majority of the teachers in the context of this study, however, putting it into place was the opposite story. For example, in the next quote, another teacher continued by saying:

I see the “competency-based” as a good method; I mean “it enhances students’ understanding”. Because “competency” means the “ability, it is the ability to understand” (Interview, Mr Kauka, V2, T10)

The idea of a CBC as a methodology of teaching clearly came out from this teacher. Although he responded positively about the CBC for students’ learning and understanding, it appears here that the teacher had a limited understanding of its actual meaning of the CBC. The meaning of the CBC must go beyond the methodology of teaching to the justification of the purpose of such teaching. Here, the teacher was referring to the immediate aim of teaching: students’ understanding. The teacher here appeared to left a major question of how this immediate aim of the curriculum; student’s understanding could be brought out the broader outcome of the intended competencies of the curriculum. With similar concern, Mr Ole differentiated the two curricula:

Let me tell you this, in a content-based curriculum, a teacher is going in the classroom without any preparation. But in the competency-based teachers cannot do that because a student must be involved in the teaching and learning. So, you [teacher] need to interact with the students and comments from what they [students] have brought in the lesson. Here [in the competency-based] they [students] are not listeners. But in the content-based you go in the classroom, you feed the students in wholly and receive it. (Interview, Mr. Ole, V2, T15)

Firstly, the teacher introduced the aspect of preparation before teaching and learning practices to indicate how the two curricula differ from each other. To him, the preparation prior to the teaching practice is influenced by the teaching approach planned for their lesson. Again, the teacher understands that the differences between

content-based and CBC lie in the teaching methodologies. Like the previous teacher above, this teacher also showed that non-participatory and participatory teaching approaches are the main aspects that distinguish these two curricula. It appeared that teacher's professional experience of working with these two curricula helped him to make the distinction.

As indicated previously, many teachers in this research frame the CBC by relating to the hands-on experience. Instead of reflecting on the science specifically, the teacher seems to have brought the general meaning of competencies. For instance, Mad. Reki makes a very clear statement which shows that the meaning of competencies refers to the hands-on experience:

(...) a competency means the ability to perform a real thing in practice. But if the curriculum is fully loaded with content, where you can develop competency? Competencies are obtained when students learn by doing. (Interview, Ms Reki, V1, T13)

At first, the teacher tried to describe her understanding of the term competency and how she relates it with practical experience. In the second part, she indicates how competency can be achieved in the teaching and learning process. Here, the teacher indicates the weakness of the present CBC as having a large amount of content. Again, she framed the competency using hands-on experience. In fact, this is only one of the competencies in science education, and this response seems to be influenced by her beliefs about how science should be learned: learning by doing. Referring to the literature, competency is measured in different ways, in terms of argumentation and enquiry. However, in this research teacher appeared to identify competency only in terms of enquiry skills. This is another indication that the teachers had limited understanding of the aspects of the CBC.

In reflecting on the findings from the focus group discussion, it was realised that the teachers' responses across all four FGDs were in line with the interview responses; framing the meaning of the CBC using the educational aims and teaching methodology. For example, teachers from the first focus group discussion were discussing this:

I think the curriculum itself is not bad because the CBC focuses on skills; make students go out and able to apply the knowledge. (FGD1, Mr Achu, T4)

When we talk about a CBC we are talking about students' involvement in the teaching and learning process. Meaning, a teacher should try to put a student in the real learning context of what they are teaching (...) it is a "learner-centred learning". (FGD1, Mr Sula, T15)

(...) a competency-based; the teaching and learning process should be student-centred. This gives a student an opportunity to be independent

and confident in their learning. The skills they obtained from the learning experience should enable them [students] to apply them in their living environment. (FGD1, Mr Wadu, T17)

Here, the teachers gave out mixed responses. Mr Achu frames the meaning of the CBC in terms of educational goals, while the other two looked at the teaching methodology perspective. Mr Achu conceptualises the meaning of the CBC by reflecting on the long-term goals. The teacher talked about applying knowledge, but he was not specific about the application because it could be for a career or in terms of interacting with social issues related to science. The teachers show a peripheral understanding of the CBC, but they fail to make a detailed account of the curriculum in relation to the development of various scientific competencies such as argumentation, participation with socio-scientific issues or analysing scientific information. These are key terms of the CBC but the teachers were mostly reflecting on hands-on experience or the interactive teaching approach. The teachers appeared to look at the CBC solely within their classroom settings.

6.3 Features of the Competency-Based Curriculum

Somewhere in the interview, teachers referred to the positive and negative aspects of the CBC in response to the Tanzanian educational context. The teachers' conceptualised the CBC into three main aspects: aims of the CBC reform; content of the curriculum; and the intended pedagogy as per the CBC reform. This section is about the teachers' value judgements on the CBC concerning to their personal views and opinions. The chapter is organised into four sections. The first is about the aims of the CBC, and the second is about CBC content; the third and fourth sections present the pedagogy and national assessment of the CBC, respectively.

6.3.1 Aims of a competency-based curriculum

This section presents the findings based on teachers' perspectives about the aims of the CBC within the Tanzanian educational context. As the teachers reflected on the aims of the CBC as a policy, they also tried to sort their perspectives into positive and negative, which raised contradicting views about the reform. Many teachers, 12 out of 21, were positive about the goals of the CBC as educational policy. However, nine gave negative responses and thought the CBC is not contextually relevant. The differences between these two groups were influenced by the way they conceptualised the CBC. Some looked at the CBC in terms of a policy text, but others who were negative they looked the CBC in reflection to their school contextual reality.

The perspectives of six out of 21 teachers, who gave distinctive responses that cut across all the others are presented.

Some teachers had positive perspectives concerning the goals of the CBC. However, many teachers reflected on the general statement of understanding. They were not reflected in specific skills of understanding because of the science CBC. The teachers' focuses were on understanding in terms of facilitating teaching and learning. In other words, teachers were reflecting the immediate aim of teaching; students' understanding and motivating learning. This is to say that the teachers' perspectives were confined within the classroom settings.

(...) in our area [science] we are required to focus more on understanding than calculation (...) previously, we were teaching by focusing on stating scientific laws and calculation; students were studying by memorisation. (Interview, Mr Guni, V2, T18)

This teacher looked at the CBC's goals in a positive light; his past experience helped him to view it in contrast to the former content-based curriculum. He modelled the aims of CBC by considering the way science teaching is supposed to be as per the new curriculum. Teaching science aims to develop students' understanding rather than memorise scientific facts, principles and laws. Here, Mr Guni's concern typically referred to the immediate aims of the curriculum: fostering teaching and learning. The curriculum's aims in relation to classroom teaching found to be the common perspectives among other teachers as well.

The CBC was considered good by the teachers because of its emphasis on individual students applying skills in their living environment. Instead of looking at the curriculum aims in response to classroom learning, the other teachers looked at the CBC in terms of its outcomes, focusing on the settings outside the school.

The curriculum reform happened in 2007, and the goal was to make students more confident (...). The goal of this "competency-based" [curriculum] is to prepare a student so that they can be confident and leave here [school] ready to join their community. (Interview, Mr John, V2, T20)

Here, the teacher considered the long-term goal of the curriculum - developing competent future citizens. He had a positive perspective about the aim of the CBC but presented a very general statement. He was not specific about the aims of the CBC in relation to science education. This might reflect his limited understanding of the aims of the CBC. Moreover, the teachers were silent on how those goals could be achieved or had been achieved since the inception of the CBC.

Another teacher looked at the CBC in terms of its relevance to preparing students for post-secondary education. Many teachers had past experience of interacting with

teaching or learning within the former content-based curriculum, which helped them with their responses:

This curriculum is a good introduction to a student who will go on to study science at A-level. For example, previously we had “an alternative to practical”, and now the student must carry out real practical; if students learn science through an “alternative to practical”, they will experience very big challenges at A-level; a student enters Form 5 having never even touched the apparatus. Now you can see how the A-level teacher gets an extra job to deal with such students. (Interview, Mad. Pamela, V1, T30)

Here, the teacher was referring to the subject maintenance demand of the curriculum: preparing the students for post-secondary education (A-level). This is about the long-term goals of the curriculum, and her perspective on the CBC was rooted in her personal experiences during her teaching career. Interestingly, her perspective on the CBC focuses on two audiences in the learning context. The first is the internal audience (students) when they reach A-level, and the second is the external audience: A-level teachers who will meet these students in their science classrooms at the next level. There were similar findings from Ryder and Banner (2013) in the UK. Mad. Pamela thought that the CBC has the role at this level of pulling students toward post-secondary education. She gave less attention to those students that could not secure A-level studies.

While the above teachers positively viewed the curriculum, others viewed it negatively. Three teachers have different perspectives that contradict the previous ones and are presented in this section. While previous teachers opined that the aim of preparing students for post-secondary education was an important goal, other teachers saw otherwise.

When you look at this curriculum, you can see that it focuses more on taking students from O-level to A-level and it is not about employment or becoming independent. Because if you look at the curriculum you can find that we are learning many things in a small way. We are learning small in chemistry, small in biology and small in physics. So, it does not have specific directions toward a certain application, it is just for continuation of their studies. (Interview, Mr Kapu, V2, T28)

Mr Kapu’s perspective is different from those of the previous teachers who considered that the CBC aims to prepare students for post-secondary education. The present CBC was considered by Mr Kapu as irrelevant because of its accumulation of content. To him, the aim of preparing students for the next level of education is not important, an idea supported by other teachers. Many of the teachers in this study seemed to have no doubt about the aim of preparing students for further studies. The teachers in my study did not judge the present science CBC with the ability to prepare informed citizen on socio-scientific issues, which is a common experience in Western

communities (see Fensham, 2009; Ryder and Banner, 2013). The teachers' judgement of the present CBC was made in relation to the curriculum to respond to the social challenges including shortage of employment. Thus, the present CBC said to be irrelevant for failure for it to respond to the social and individual wellbeing of the students in terms of individual economic gain. In the conversation with another teacher during the interview, she had this to say:

This curriculum has good goals in terms of statements which are not achievable in real context. For example, the curriculum aims to prepare students for appropriate use of chemistry to solve a real-life problem. This is an unrealistic goal for this curriculum; it is just a curriculum for preparing students for the basic knowledge of chemistry and to move to the next level of education. The curriculum is talking about developing students in self-employment and independence but you find that we have lots of graduates that don't know what to do while they have finished four years of secondary education. (Interview, Mad. Nuru, V2, 17)

This was a Chemistry teacher and during the interview, Mad. Nuru took out the syllabus and read one of the objectives from it; she was trying to criticise the statement goals by relating them to the outcome of the curriculum. Her perspective about the aims of the CBC was influenced by her present experience of observing students who cannot help themselves after finishing school. Preparing students for further studies is one of the important aims for the school curriculum, other teachers perceived the curriculum needs also to focus beyond school life. As with other teachers, the concern was with economic gain and not science for living in terms of students to analysing scientific news and the like. Another teacher continues to criticise the present CBC by saying this way:

The first issue, emphasised by this curriculum, is the examination. The curriculum focuses on preparing students in school life. I think a curriculum should look at students in relation to their living environment. Long time ago we had agriculture schools, fishing schools. The student was taught and when they finished they could apply the skills they have learnt in their real life. (Interview, Mr Sadiq, V2, T22)

The teacher tried to devalue the present curriculum because it only focuses on examination attainment. He referred to the educational system after independence where the school curriculum was integrated into the vocational subjects and students were required to learn at least one vocational subject. The aim was to equip students with knowledge and skills that could enable them to take part in the economic activities once they finished their studies. Thus, Mr Sadiq referred to the long-term aims in terms of students' social, economic and personal wellbeing. It seems that the teacher's present perspectives about the aims of the CBC are informed by their historical perspective of their country. The trauma of the shortage of employment

appeared to have a big impact on the teachers' conceptions about the aim of a science CBC.

In responding to the findings from the focus group discussion, the study revealed that teachers from the group had similar perspectives from those in the face-to-face interviews. Their perspectives were reflected on the intended goals of the CBC across all; the long-term and immediate timescales. They showed little doubt in the written goals of the curriculum but were more concerned about implementation to attain those intended goals. For example, in the first FGD, the teachers had this to share:

As I have said at the beginning, I appreciate this curriculum in terms of its goals. Because according to this curriculum, when the students complete secondary education, they should be able to apply what they have learnt at school (...) but this is just a statement goal, it is opposite in the reality. (FGD1, Mr Sula, T17)

The first problem of this curriculum is that it does not provide an opportunity for the teacher to achieve the competencies indicated; the curriculum gives the teacher the ability to teach only content and the student to move to the next level. (FGD1, Mr Wadu, T18)

In my opinion, there are some competencies that can be achieved, for example, to explain, to describe; but designing it is hard to achieve due to the shortage of resources and low standard of our laboratory. (FGD1, Mr Achu, T20)

Like other teachers in the interview, Mr Sula was positive about the intended goals of the CBC; his doubt rested on achieving them. His perspectives introduced the distinctive nature of the policy text (intended curriculum) from the policy of practice (what is enacted by the teacher). And he has shown that there is a gap between them and the ability to fill it need more than the teacher's acceptance of the reform. However, here the teacher failed to explain why that gap still exists but the last teacher, Mr Achu showed the reason for that gap is the shortage of resources and enacting the CBC in the underserved laboratory. Thus, While Mr Wadu considered there was no room for teachers to achieve the intended curriculum competencies, Mr Achu believed some of the competencies were possible especially if the resources were there. Mr Wadu was not satisfied that the curriculum to only focused on the next level of education. This was a teacher somewhere in the FGD indicated his interest in vocational skills. Therefore, Mr Wadu's personal interest might have led him being negative about the CBC's goals. Mr Wadu and Mr Achu reflected on teaching approaches: teaching science through practical skills. They focused on how to facilitate the implementation of the curriculum in response to the intended goals.

6.3.2 Curriculum content in science

The teachers had different perspectives on the content of the CBC. At one point in the interviews and focus group discussion the teachers show a positive perspective concerning to the content but they also felt that the curriculum were too content. As a result made the effective enactment of the CBC to be very difficult and left a big gap between what was intended and enacted. This results in contradictory perspectives among the teachers and sometimes the teachers hold opposite views about the curriculum content. In most cases, they were referred to two issues: content added because of the reform, and content in relation to enactment of the CBC. The responses of seven out of 21 interviewees are also presented. Also, to corroborate the findings of the interviews with the focus group discussion, responses from one FGD will be presented which are representative of all the teachers involved in the study.

In responding to the curriculum content, the teachers looked the content of the curriculum by reflecting on problems around their society. Their perspectives on curriculum content were informed by social problems and other local community practices.. For example, the following extract from Mr. Sadiq indicates how the curriculum content was connected to social problems:

To a large extent, the curriculum focuses on preparing the student for school life, from O-level to A-level. But there is a major national epidemic: AIDS, the curriculum tries to pay much attention to this, almost across every level. This is a very good aspect here to me because this [AIDs] kills our task forces. (Interview, Mr Sadiq, V2, T22)

In the first part of the quote, the teacher referred to the goal of preparing the student for post-secondary education; however, this does not seem to motivate him much. What impressed the teacher about this CBC reform was the addition the current issues such as HIV and AIDS as a topic in the curriculum. This is a national issue with a negative impact both economically and socially. Ideally, the teacher's perspectives seem to be informed by both the social and economic issues of the nation, as was also revealed by other teachers who teach the same subject:

(...) for example, a topic such as "Evolution" how does this topic help student? Even when I teach it, I'm not feeling comfortable (...). There are these topics that had been added such as "Good manners, Personal hygiene, Disposal", these are good because they touch the student directly. Nowadays we must have topics that develop knowledge and skills for the students to be able to face their challenging environment such as diseases. (Interview, Mad. Njage, V1, T47)

Like the previous teacher, this teacher's responses were informed by her living environment and rooted in problems like diseases that are locally experienced. Her

concern was about the individual demand in terms of health and safety rather than individual economic gain. On the other hand, she criticised the present CBC reforms and her judgement was informed by her professional opinion about the appropriateness of the curriculum content, how the curriculum content can help the individual student within their living environment.

The reaction of the physics teachers to some of the added content suggested one aspect that improved the quality of the curriculum document, as the teachers said:

When you read this syllabus, we can see the curriculum has become better now. The topic such as “renewable energy” together with geophysics, at least now you can see we are touching important issues in our living world. We used to have a topic like a cathode ray tube, which we still have, but sometimes you wonder what student can benefit from this topic, especially when they end up at this level? (Interview, Mr Kapu, V2, T)

Here, there is a sense of appreciation of the present CBC over the former Content-based. Mr Kapu seems to value the present CBC because of the content added in the curriculum. His focus was on the individual student outside school life when they interact with society. The teacher failed to give out an example of a topic he thought was less important. His response also appeared to be informed by his professional beliefs about the relevance of the curriculum content. A topic like “cathode ray tube” was considered irrelevant in response to the life of the student at the secondary-school level. There was no doubt with other teachers about the importance of the new topics added because of the reform. This was also supported by the Mad. Sayda:

I know now we are in the competency-based [curriculum] where previously we had a content-based. But what is the difference between these two curricula in terms of our practices? I don't see any difference. The big difference is on the stated goals (...), in this new syllabus, there are some topics, such as environmental issues, renewable energies that have been added. So, if you are asking me about these topics I can tell you, yeah; these topics are important at this time. But what impact does this curriculum have compared to the previous one, I can tell you that nothing has been changed. (Interview, Mad. Sayda, V2, T8)

There are two interesting issues raised by this teacher. Firstly, she reflects on the difference between the policy text and practice (see Bowl et al., 1992). There is a clear message that what has been written in the curriculum document is quite different from what happens on the ground. Mad. Sayda indicated that, although they have undergone the reform in the curriculum from content-based to CBC, their practice remains unchanged. Thus, a sign of resistance to the reform can be vividly observed. Her responses were informed by her reflection on the outcome of the present CBC reform.

Another teacher, Mr Kauka, who had 32 years of teaching experience in physics and also was a head of the physics department, provided fascinating remarks about the

reform when talking about the content in the present curriculum. He made distinctive responses and therefore I have presented his three quotes one after the other. His response was informed by his teaching experience.

For example, in the past, we had the Abbott (Ordinary Level Physics by A. F. Abbott), which goes deeper in the concept. But today you'll find physics has been just given a small area. So, you look at physics now and you find that it is very shallow. Now, there is lots of equipment in the laboratory no longer in use, but it was used in the past. It's not useful because their area has been removed from the curriculum (...); so, when you say physics is everything in life, but then you have removed some aspects, it means you have reduced its application in life... But, does it fulfil the application in life? You find no! (Interview, Mr Kauka, V2, T2)

One of the interesting points here is that the teacher was referring to his career in teaching, indicating his dissatisfaction with current content in the CBC by reflecting on how content was before the reform. The past teaching and learning resources in physics, such as Abbott's book and the laboratory, served as the criterion reference for the teacher's views about curriculum content. The interview was conducted in the laboratory, and Mr Kauka was able to pinpoint the laboratory equipment that were no longer in use. His idea was that the present curriculum becomes so weak compared to the past because before the reform they were learning many more concepts compared to what is in the CBC. Thus, the teacher's present perspectives were influenced by his past teaching experience. Later in the interview, the teacher continues to support his argument:

Previously, the way Abbott was written was how we were taught, so when you looked at the syllabus it was the same as that book. But this syllabus now has skipped a lot of things and they've just take a little bit of stuff, then you've finished Form 4. (Interview, Mr Kauka, V2, T3)

And that's why you see now there are books written as "contemporary physics". Contemporary physics! Ah! What is contemporary physics? Means a modern physics, "no! Physics is just physics." (Interview, Mr Kauka, V2, T23)

The teacher seems to be conservative and continues to show his rigidity in supporting the content of the former curriculum. This is a clear indication of how the past experience of the teacher influences his present perspectives. It seems that the teacher's interest lies in learning canonical physics, which means he favours the former curriculum's content. However, this is the same teacher somewhere in the interview showed his appreciation of the present CBC over the former Content-based curriculum when he was referring about how science should be taught; teaching pedagogy. This shows that teachers look at the curriculum and judge it in piecemeal, not as wholly. They can value one aspect of the curriculum and devalue others.

In corroborating the results of interviews with the FGDs, the study revealed that the teachers had similar perspectives concerning the content of the CBC reform. The teachers from the FGDs looked at the content of the curriculum reflecting the same issues raised by the interviewees. Some teachers had positive views of the CBC because of its content, and others indicated the opposite. The views of teachers from one were like this:

In physics we have topics such as renewable energy, environmental issues, global warming, first aids; these to me are very good (...), the addition of these topics makes the curriculum look better now because previously most of these concepts were in geography only, which was not right. (FGD3, Mr Alison, T24)

I do agree with what have been said by my fellows here, in fact, the additions of these topics are just a repetition; students learn these topics in physics, chemistry, and biology as well as in geography; it is not right. The addition of these topics makes the curriculum very bulky (...) when students learn in one subject, they find they are learning something that has been already taught, so, their attentions become very low. (FGD3, Mr Kitua, T22)

Yeah, but I don't think it is right to learn those topics in one subject, because the pollution in chemistry is different to pollution in physics and so on. So, for me, it is better to learn it in separate subjects. (FGD3, Mad. Agnes, T19)

These had contrasting views about some of the content added in response to the CBC reform. While Mr Alison saw the additional content in a positive way, as it improved the curriculum document, Mr Kitua thought it had a negative impact for both teachers and students. Mad. Agnes held the opposite view from Mr Kitua; however, she was silent about whether the insertion had improved the document. These divergent perspectives emerged because each teacher had a different focus. Mr Alison and Mad. Agnes focused on the clarity of the curriculum document, while Mr Kitua was concerned with enactment. These teachers did not reflected on the aims of the curriculum but instead looked at curriculum content in terms of the policy text and policy of practice. Later, Mr Kitua and Mr Alison extended the discussion in this way:

You know, here we are in lower secondary education (...) let's compile these topics in one area then, students can learn deeper when they fully specialised on it. To me, learning these issues in separate subjects is just redundant, we are not helping the students, we make them [students] and even the teachers become more tired; and that's why you find most of the teachers delaying teaching these topics and, once it has been taught by others, the teacher skips it. (FGD4, Mr Kitua, T25)

Yeah, I know some teachers are doing that but they are not doing it right because those topics just have the same names but are different in content. (FGD4, Mr Alison, T23)

Mr Kitua expands on his views by providing a rationale for teaching the content related to environmental issues in one subject. This was rooted in his professional experience, witnessing the reactions of students and the behaviours of some teachers, who skipped the content. He considered that teaching content in separate subjects has negative effects on both the taught and received curricula, focusing on the two groups of the internal school audience: teacher and student. On the other hand, Mr Alison was not convinced about teaching all environmental issues content in one subject, informed by his professional views around how curricula should be structured.

6.3.3 Pedagogy of teaching within CBC

All teachers argued that the CBC must be enacted using student-centred approaches. This was the major criteria for the teacher to judge the present CBC but some teachers were also referred to schools' contextual realities in terms of material resources. This introduced contradictory views about the CBC among the teachers involved in this study. Some were positive about the student-centred approach, while others thought it was contextually unrelated to the CBC aims. In general, the teachers described the student-centred approach to the CBC curriculum in terms of different aims in teaching and learning science. Some referred to the student-centred approach concerning the facilitation of the teaching and learning practices, but sometimes others described the approach through focussing on individual students outside the school setting. In this section, three responses are presented that show the distinctive features across all the teachers' perspectives concerning pedagogy with the CBC.

Teachers had different views about the pedagogical approach, depending on their intended goals. For example, Mr Ole, who was teaching biology across all classes at the secondary level with 31 years of teaching experience, commented that,

(...) there is this new information we have received, that theory must be integrated with practical. I like it very much because at previous, we had a student arrived at Form 4 who had never touched apparatus and they started learning practical at Form 4 level because they are expected to sit the exams. It was double work to teach at Form 4. It was not right, science students should start entering in the laboratory from Form 1 level.
(Interview, Mr Ole, V1, T14)

Mr Ole's positive view of the CBC reform and his responses were informed by his professional experience. His present perspective seems to be influenced by his teaching biography with the former curriculum. It seems that teaching Form-4 students who never been involved in experimentation before, shaped his present perspectives about the pedagogical approach within the CBC. He was concerned

about the school internal audiences (Form 4 teachers) who will teach these students experiments at Form-4 level and reducing the workload of teaching science at Form-4 level.

Instead of focusing on students in terms of teaching and learning science, the following teacher referred to his personal beliefs and past college experience:

I understand that this curriculum of “competency-based” should be facilitated through the “learner-centred approach” and even me, this is what I believe and how I have been taught during my teacher training course. However, in practice, I am doing the opposite due to several barriers, as I have pointed out in my previous talk. (Interview, Mr Alex, V2, T24)

There are three important issues raised in this quote. Firstly, the teacher’s perspective was informed by his own belief about how science should be taught. Secondly, the teacher’s present perspective about the pedagogical approach is informed by his biography at teacher training college. In other words, it can be said that the teacher’s past learning experiences at the college impact his present perspectives about CBC reform. Lastly, the teacher highlights a fascinating issue: the incongruence between policy text and teacher practice. The teacher’s practices were not complied with the intended CBC reform. This was not about the teacher’s resistance but, the constraints of teaching and learning resources, including laboratory equipment, had a big contribution for the teacher’s deviation to student-centred teaching.

In addition to the teacher above the following teacher also had this to add:

I have already said that science should be taught using interacting teaching approaches (...), you know, a curriculum is not just a description of statement. This description should be seen in the real context. If the curriculum said that student should learn through laboratory experimentation, the school must have a laboratory with enough equipment. So, without the resources, the curriculum is not yet complete. (Interview, Mr Nasa, V1, T19)

Mr Nasa’s negative views about the CBC in response to the intended pedagogy because of the mismatch between the curriculum goal and the school’s contextual reality. This was how some teachers judge the real meaning of the curriculum. They conceptualised a curriculum as the totality of objectives and the allocation of teaching and learning resources necessary to enact it. Mr Nasa neither reflected on immediate nor long-term aims of the curriculum; instead, he was concerned about balancing curriculum and resources.

The interview results were triangulated with the results from the FGDs and it was revealed that both groups held similar views about teaching pedagogy and the CBC. All teachers talked about the student-centred teaching methods as the CBC’s

recommended approach. In the focus group discussion some teachers looked the pedagogical approach as a theory of teaching. They said the curriculum is good because it emphasises participatory teaching, which in turn facilitated students' understanding. On the other hand, some teachers related the approach to the school context, concluding that a CBC was irrelevant because of the mismatch between curriculum objectives and school context. For example during one of the FGDs, teachers responded this way:

What has been emphasised in this curriculum is the activities (...) this is much better than that of learning by theory. Because when a student learns by doing, they become motivated to learn (...) the student's interest in learning chemistry now has increased. (FGD4, Mad. Agnes, T13)

The teaching in a CBC is supposed to be done with the integration of theory and practical. That makes this curriculum better as compared to the previous; in the past it reached a place where students were taught through alternate to practical, but now the practical activities has been given priority in science teaching. (FGD4, Mr Kitua, T15)

(...) to me it is hard to say curriculum is good because it emphasises practical or student-centred; those is what have been just written, can be achievable? probably not. (FGD4, Mr. Alison, T17)

Mixed perspectives were revealed within this group of teachers. The first two were positive about the CBC; their perspectives relied on the intended teaching methodology the curriculum required being implemented. Mad. Agnes related the pedagogical approach with the short-term aim of the curriculum: motivating students to learn. Learning science through activities was considered to have a positive impact on students' learning. On the other hand, Mr Kitua's perspective was informed by his teaching experience. Teaching science through an alternative to practical approach in the former curriculum, and teaching using actual practical in the current curriculum helped him to value the present curriculum. Both teachers looked at the curriculum as a document without considering the implementation. In contrast, the third teacher, Mr Alison looked at the curriculum in terms of implementation, concerned about achieving the intended curriculum, while the first two teachers looked at the statements on the curriculum document. These two views of the curriculum brought out different perspectives; negative and negative among teachers on CBC.

6.4 Chapter summary

This chapter has been structured to present the findings concerning the perspectives of teachers about the CBC as a policy document. The findings revealed that teachers had a limited understanding of the real meaning of the CBC. They considered two elements of the curriculum – aims and pedagogy – without taking into consideration broader perspectives on competencies within the science CBC. Moreover, the

findings revealed that teachers had different perspectives about the CBC, some positive but the majority negative. These different perspectives were informed by their personal framing of the CBC reform. The teacher's personal influences; personal biography, teaching experiences, professional goal and beliefs and the sociological settings made major contributions to their value judgements regarding the CBC reform.

Chapter 7 Enactment of the Competency-Based Curriculum

7.1 Introduction

This chapter is organised in alignment with how teachers described their enactment of the CBC within their school settings, based on the responses to the third research question RQ3 (see section 3.4). RQ3 was designed to identify the factors informing teachers' responses to the CBC enactment. The conceptual framework (see section 2.6), as well as the underlying literature review, were used as analytical lenses to identify the various teacher agencies that informed their decisions regarding CBC reform enactment. Through the conceptual framework, I have shown that the teachers' responses to the imposed curriculum are the outcome of a struggle between their personal theories and the reform. In addition, I indicated that enactment of the curriculum is not done only by individual teachers' desires and interests, but through the interaction with other social forces. During data analysis, the focus was to identify all possible influences on teachers in terms of the CBC reform enactment. The analysis identifies a sense of tension, constraints and resistance to the CBC reform because teachers tended to be more accountable to external agencies, such as the school leader and external examination boards. Moreover, teachers' practices in response to the CBC enactment were influenced by a number of factors including broader personal theories and other factors related to internal and external schools.

Table 7-1: Factors influencing CBC enactment

Analytical themes	No. of teachers
Factors Influencing Teachers in CBC Enactment	
Personal teachers' theories	
• Teacher's personal knowledge	16
• Teacher's personal goal	10
• Teacher's personal biography	10
• Teacher's religious beliefs	11
The internal school context	
• Nature of the students	11
• Student-teacher ratio per classroom	21
• Teaching and learning resources	21
• School assessment policy	19
• Language of instruction	16
The school external agencies	
• Goal of the competency-based curriculum	09
• National examination	21
• Inspectorates	21
Teachers' Tension and Accountability	
Tension and accountability at planning stage	16
Tension and accountability in teaching	21
Total	21

This chapter is organised into two sections: the first presents the factors influencing teachers in CBC enactment and the second presents the tensions and accountability of teachers in response to the CBC enactment. The factors influencing teachers has been organised following the three factors of influences illustrated by Ryder and Banner (2013) and originally developed by Goodson (2001). Table 7-1 shows the summary of the analysis for this chapter.

7.2 Factors Influencing Teachers on CBC Enactment

The analysis in this section focused on the factors influencing teachers' enactment of the CBC. It was revealed that the factors influencing teachers on CBC enactment reflected various findings in the existing literature (Childs et al., 2012; Goodson, 2014; Ryder and Banner, 2013). As I have indicated above, the analysis of this research draws upon Bowe et al.'s (1992) framework, but in this section, the findings are arranged following the three sets of factors previously outlined. Many factors identified in the existing literature (see section 2.5) were also evident in this research. However, there were some common factors in my research and other studies –Ryder and Banner in England, for example – there were many internal factors such as resources, class size, the language of instruction, and social, cultural and religious beliefs that were not the same. Such factors are often common in the context of developing countries, like the context of this research (see Bantwini, 2010; Childs et al., 2012). This shows the impact of context on the science curriculum. In terms of Bowe et al.'s framework, external pressure such as external examination and inspectorates resulted in great pressure on teachers to complete the syllabus completion. To present all these in detail, this section is organised into three sub-sections based on the three sets of factors as I have highlighted above.

7.2.1 Teachers' personal theories

In the literature review (Chapter 2), some studies found that personal factors had a major impact on their responses to the school curriculum (Goodson, 2001; Ryder and Banner, 2013). This was also evident in the context of this study when the teachers described how they enacted the CBC within their educational settings. When they described their teaching practices concerning the CBC, they referred to four personal influences: teachers' personal knowledge; teacher's personal goals for teaching; teachers' experiences; and teachers' religious beliefs. These factors will be presented in turn with quotations from teacher interviews and focus group discussion as evidence.

Teachers' personal knowledge

The teachers' personal knowledge has been given significant consideration in the teaching and learning practices and curriculum enactment. Before going into the classroom to teach, teachers ensure that they understand the appropriate content they intend to deliver to the students. This idea of focusing on content knowledge before teaching was presented by 11 of the 21 teachers involved in face-to-face interviews and across all four focus group discussion. Overall, the teachers are concerned about how content knowledge influences their decisions regarding the CBC enactment. Four responses from the teacher interview have been selected to present the findings for this section because of the rich information they include which cut across all the responses.

When teachers talked about their teaching practice, in several places they indicated that the first step was to ensure they have good knowledge of what they teach. This gave the teachers room to structure their teaching in response to the learning context. They were very open about how they link their content knowledge to other sources of information like syllabuses, textbooks and other teaching and learning resources. For example, Mr Kauka, head of a physics department during the one-in-one interview had this to say on how he put the CBC in place:

Ah! the first thing is I ensure that I know the topic in detail. Then I prepare the teaching and learning materials, I also prepare a sheet of work on which I will write down the activities that I want students to perform during the teaching (...) I also prepare a lesson plan which I will take in the classroom to help me to teach according to what I have planned (Interview, Mr Kauka, V1, T3)

The teacher's pedagogical knowledge about how the teaching and learning should be organised became the agentic force of his practice toward the CBC enactment. The teacher's response shows that the enactment of a CBC was a process that involved teachers on the series of steps of the teacher's engagement including preparation of materials. In this extract, Mr Kauka's focus during the CBC enactment was on his content knowledge as a teacher. He considered understanding the subject content is the first aspect of the planning stage.

It was also reported that other teachers that their practices were informed by content knowledge which helped them interact with the syllabus document. For example, another teacher from a different school, Mad. Nuru said:

(...) when I have good content knowledge, it make easy analyse the syllabus and know the depth of the content I should go to (...), so, usually,

I prepare notes in advance because I must provide notes for my students which help them for do revision. (Interview, Mad. Nuru, V1, T5)

In this quote, the teacher appeared to respond to varied factors; however, the teaching here appeared to be driven by content knowledge, and her professional belief that teaching involves providing notes to the students. Lastly, she raised the very important issue of her commitment to the planning stage of providing notes. In this respect, it can be said that the teacher was also influenced by the internal audience: her students. Preparing notes for students was an issue for other teachers. However, there were different views among the teachers –some considered it was their responsibility to prepare notes for students, while others thought students must develop their own.

(...) after ensuring that I know what to teach, I prepare notes for the students (...) notes are very important for the students, especially when you consider that we use English as a medium of instruction, which is not familiar to most of the students. (...) for the nature of our students, if students do not have notes, it is one reason for them to fail in exams. (Interview, Mad. Maua, V1, T10)

The teacher shows consideration of content knowledge to the teacher toward CBC enactment, but her main concern was preparing notes for students before teaching. The reason for preparing notes in planning practices was to respond to two tensions. Firstly, taking the difficulties students experience because of the language of instruction into account showed the focus was on the internal audience (students). Secondly, the teacher was trying to respond to the tension of external examination. As this is at the preparation stage, it indicates how the teacher was accountable to the external board of examination. It indicates that the teacher's responses was rooted in her professional experience that providing notes to the students is part of teaching practice. However, for other teachers, giving students notes went against the CBC guidelines.

I give all my effort to ensure that I have enough knowledge about the topic I want to teach (...) I want to see my students understand the concept in detail and if possible to translate it into their real lives (...) I do not provide notes to the students; my role is to teach and ensure students understand; we are on the competency-based [curriculum], the student is required to construct their own notes, we are not required to make student dependent. (Interview, Mr Matege, V1, T9)

This teacher is concerned about the importance of content knowledge before teaching practice. Mr Matege tried to show that teacher's content knowledge is related to students' understanding. Secondly, contrary to the previous teacher, he felt that preparing students notes harmed students' learning. This position derived from his personal framing of pedagogical practices concerning the CBC or how the CBC should be facilitated for students. These contradictory positions show that teachers

do not share similar understandings about how the CBC should be facilitated for students.

Teacher's personal goals of teaching

The teachers' practices about the CBC reform enactment were also predominantly influenced by the teachers' personal learning goals. Whether teacher-centred, student-centred or a selection of assessment practices, teachers' pedagogical approaches were driven by what they intended to achieve. Their responses bore strong similarities with findings from the literature review in that the teacher's capacity to act or decide are often featured within their personal and professional goals. For example, Mr Kasu taught biology and employed the participatory method of teaching because he intended to develop multiple skills.

My main goal in using participatory methods of teaching is to develop students' thinking skills, creativity and to develop reasoning skills. Also, to build confidence for the students, to have the ability to express their ideas to other without fears. (Interview, Mr Kasu, V2, T21)

Mr Kasu connected the participatory approach with multiple competencies, thinking skills, creativity and reasoning skills, which are common competencies across education literature. He considered the participatory teaching approach as having a positive effect on student teaching. The teacher was silent about the student-centred approach to the CBC reform. Teachers' personal goals together with their professional beliefs influence their decision whether to comply with the teaching approaches suggested by the CBC.

Aside from developing multiple skills, another major concern for teachers was students' understanding. The teacher used a question-and-answer approach as an alternative way to involve his students in the teaching and learning process. For example, one teacher described how he enacted a CBC in his real classroom setting:

My main goal is students' understanding and not just finishing the syllabus. So, because of the large number of students, I find that the best way of engaging the students and make them understand is through questions and answers one day before the lesson, (...) This is another way of engaging students with their learning. (Interview, Mr Mamba, V1, T13)

Again, the teacher's selection of teaching pedagogy was rooted in his personal goal of teaching, but at the same time his pedagogical knowledge of how teaching to respond to different learning situations. Firstly, Mr Mamba responded with the question-and-answer approach to accomplish the teaching goal: students' understanding. The number of students per classroom is also recognised and used by the teacher as a factor that influences him when selecting a teaching approach. His concern was to ensure that students are actively involved in learning. Therefore,

he decided to announce the topic to the students a day before the lesson as a way of engaging them in learning. Following this response and the responses of other teachers, it is obvious that teachers had no common goal for employing student-centred learning nor common teaching approaches for CBC enactment. However, teachers did not indicate how they achieved those goals.

Moreover, in both interviews and the group discussion teachers used different examples to describe how they were using assessment practice to help students' learning. The study revealed that teachers were predominantly driven by two personal goals in relation to assessment practices: motivating students in learning and fostering students' understanding.

In assessing students, you must look all around; you must look at content mastering and skills development; in my assessment, I involve students in different activities that motivate students' thinking. I like students to have wide knowledge for their further learning. (Interview, Mr John, V1, T20)

A personal influence emerged from this extract. The teacher's assessment practice was influenced by his personal goal. Also, how he conceptualised the role of the assessment informed his decision about CBC enactment. However, Mr John was not specific as to how those activities related to student motivation or the CBC enactment.

(...) sometimes I assign students some sort of discovery to be conducted at home. Topics like growth, seed germination or photosynthesis are the topics which students could learn through "discovery" even when they in their homes. When I assign students such a discovery, I am interested in motivating students for scientific skills such as data recording, analysing and reporting. (Interview, Mad. Aliye, V2, T11)

The teacher uses a common approach relevant to the CBC: "*teaching science through discovery*". Her selection of approach was influenced by her personal goal in teaching science: *developing students' scientific skills*. She linked the discovery approach with the development of the students' scientific skills. However, like many previous teachers, she failed to explain how her approach could help students become involved in different social scientific issues that are big concerns on the CBC too.

The teachers use several teaching approaches for different purposes within their CBC enactment. While other teachers reported using a scientific investigation approach to develop students' understanding, other teachers were using the scientific approach for the goal of verifying scientific facts and theories. For instance, Mr Ole commented on why he was using experimentation during the CBC reform enactment:

When a student learns through experimentation, it facilitates deeper understanding. For example, I was teaching a “cell structure”, I first taught theory and then gave students a “microscope” to observe for themselves, so, they could see the structure of the cell with their own eyes. (Interview, Mr Ole, V2, T16)

Here, the teacher described how he taught cell structure to his students, dividing his lesson into two parts: theory and practical. The teacher’s description of his teaching, separating it into two parts, is similar to the observation by Childs et al. (2012) at science classrooms in Bhutan. At first, the teacher was teaching theory, meaning he focused on teaching science content, ideas and scientific theories of cells to develop science content knowledge. The second part was learning by doing. The exercise of involving students in the observation of the structure of a cell was influenced by the teacher’s personal goal: verification of what he taught in the first part. His responses were also influenced by his understanding of how science should be taught: theory and practical. This was a common idea among the teachers in this research. Wanting to foster students’ understanding through their teaching practices was a major concern of the teachers. But practical activities were merely used for verification rather than developing intended competencies including inquiry. Another response of teacher was like this:

In my teaching, I make a different assessment. Out of those that I conduct within the lesson or after the lesson, I also conduct an assessment through “micro-teaching”. I ask a student to go in front of the classroom and present the topic. I want to know if the student understands but more importantly I intend to develop presentation skills and confidence in the students. (Interview, Mr Jecha, V1, T33)

There are two issues in this quote: students’ understanding, and confidence. Mr Jecha used the word “micro-teaching” to mean individual presentation. He would give students a concept to present individually to the whole class which he would interrupt with different questions. Interestingly, aside from using assessment practice to developing students’ understanding, Mr Jecha also used it to develop students’ confidence. Developing generic competencies within science teaching is very important within the CBC. During my second visit, when Mr Jecha was talking about how science should be assessed, he used his personal history to indicate the same concern. It appears his response to the CBC enactment was rooted in his personal goal of teaching but also his biography. To elaborate his personal goal of assessing students through the presentation, further in the interview, he added,

(...) when I sit and ask the student and the student is able to answer it, that student develops more understanding and what we call “argumentation”. I used to ask students many questions that focus on developing the ability to present the idea using scientific evidence. (Interview, Mr Jecha, V1, T35)

The teacher here pointed out two important competencies; argumentation and providing scientific evidence. These are among the key components of scientific literacy (see section 2.4), and involving students in individual presentations followed by extensive questions was considered as a way of helping students to develop these scientific competencies. It is also clear that the pedagogical knowledge of the teacher helped him on his decisions regarding CBC enactment.

Teachers' personal biography

On the other hand, the teacher's personal biography was reported as influencing teachers' teaching practices in terms pedagogical approach as well as assessment practices in response to the CBC implementation. Two teachers detailed responses which are presented in this section. Firstly, Mr Ole said he was exercising the student-centred approach in his teaching, influenced by his personal biography.

What impressed me about using participatory methods of teaching, after realising that in the past when we were using the non-participatory method, you could teach but when you turn around two or three students were asleep, can you see it? But the second reason is that the participatory methods facilitate understanding. (Interview, Mr Ole, V1, T18)

Here, the teacher's professional experience helped him to recognise the advantage of a student-centred approach over a teacher-centred one. His response shows that he did not use the student-centred approach because of the CBC reform, but after realising that the teacher-centred approach was uninteresting to his students. However, he did not show how long after the inception of a CBC it was before he realised that the student-centred approach worked better, but his responses confirm my argument that enactment takes time. Another teacher had a similar response:

(...) one day, long time back the principal called me and told me that there are teachers from abroad wanting to see how we are teaching (...) I went and taught; I conducted a very good lecture (...) at the end they said that you know physics very well, but the teaching approach was not appropriate, you did not involve the students; I was very disappointed. From then, I decided to change my teaching, I also received training from INSET in all three phases; I learned everything; "participatory teaching, improvisation, writing lesson plan". (Interview, Mr Kauka, V2, T27)

The teacher talked about how he adapted the CBC enactment. His experience influenced him in the present application of participatory pedagogy in his teaching. The feedback he received as well as the in-service training helped him to change his teaching practice. Unlike other teachers who said they never received training, Mr Kauka explains he received special training for the CBC three times. In the Tanzanian context, INSET means In-service Education and Training. It was a special training programme offered to teachers to facilitate curriculum implementation in response

to the local school environment. Thus, the influence of the teacher's professional experience serves as an agentic force that propels him to apply the teaching approaches as per the CBC reform.

Teachers' religious beliefs

In the interviews and FGD there were special questions that allowed teachers to express the challenges they faced implementing the CBC. For instance, during the second visit interview, question 7 (see Appendix B) asked teachers to express the challenging areas in the CBC. This was similar in the focus group discussion question 9 (see Appendix C). Aside from skipping teaching laboratory experimentation because of poor laboratory resources and length of the syllabus, the teachers also indicated their concerns about teaching about evolution and the origins of human being. In this research, they expressed scepticism about teaching evolution because the underlying theories and concepts of the topic pull away from the teachers' cultural and religious values. Teaching evolution as per the CBC was considered rejecting their cultural and religious beliefs. However, this was more an issue for teachers from Zanzibar than their fellows in Tanzania Mainland: Dar es Salaam, in particular. The interference of religious beliefs in some of the content within the CBC appeared to harm curriculum implementation. Eleven out of 21 teachers complained they experienced difficulty in teaching evolution, referring to religious beliefs. As all 11 teachers reported the same issue, in this section the detailed responses of four teachers will be presented. This will also be corroborated with the findings from the focus group discussion.

This topic [evolution] is difficult to teach in our society because of the religious beliefs, the students might feel that you are bullying and playing with their faith. (Interview, Mr Sadiq, V2, T26)

This response showed that teacher did not feel comfortable teaching evolution. He tried to show how the students' religious beliefs have a negative impact on CBC implementation. Here, he considers himself as a neutral actor, as though he was not influenced by his faith. On one hand, this response shows that the teacher lacks knowledge about border-crossing in science education (see Aikenhead and Jegede, 1999). Another of the teachers wrote,

It is difficult to teach it [evolution] because its theory is going against our faith, not only for the students but even myself as a teacher, I don't believe the theory of evolution; I don't feel comfortable teaching it. (Interview, Mad. Nashda, V2, T22)

This indicates that the teacher's strong religious beliefs potentially harm the curriculum implementation. Mad. Nashda's religious beliefs influence her

understanding of evolution, which in turn affects her classroom practice. The interviews revealed that the teachers had serious concerns about the concept of human evolution as explained in the topic, compared to religious explanations of human creation, or Creationism. This teacher indicated that evolution as a concept within the CBC is not wholly accepted by either teachers or students as it conflicts with their religious beliefs. It appeared that some teachers failed to negotiate the boundaries between scientific concepts and their faith.

Darwin and Lamarck's theories are difficult to make students understand. This theory is going against our beliefs, it is hard to teach really. (Interview, Mad. Njake, V2, T19)

Here, another teacher shows scepticism about teaching the topic because of their religious beliefs. Her religious beliefs had a negative impact on the CBC enactment as she failed to effectively negotiate the border; their religion and cultural beliefs and science as another culture.

However, I can contrast the above teachers with one who had different views about teaching evolution.

(...) when you teach the concept of evolution, the teacher should understand the origins of the human beings from the holy books. When you understand that you can give the students clear information about the origin of man from the religious perspectives and from the ideas of evolution ... I think learning it, is no problem but to believe it is something else... So, to me, saying that we should not teach evolution because it contradicts our faith, I don't agree... (Interview, Mr Kasu, V2, T35).

Only this teacher saw it this way. Although the teacher's response shows the impact of religious beliefs on teaching such concepts, he makes two important issues very clear: understanding, and belief. It appeared that his knowledge and understanding influenced his response; however, the same teacher spoke later about his personal goals in teaching and showed the impact of his beliefs on his teaching and thinking.

I am doing that because lately I want to see a patient lady being attended by a lady doctor and a man attended by a male doctor. There are other issues that cannot be avoided, and it can done by all doctors, but for issues like gynaecology including giving birth, I wish a time will come when we could have enough ladies who specialised in that field. (Interview, Mr Kasu, V2, T26)

One could say the teacher is reflecting on gender equality in teaching and learning science. He is a teacher in Zanzibar, where society is bounded by Islamic culture. Thus, it is an interaction between his personal beliefs and the Islamic cultural background of the society to which the teacher is living. There was a perception that the teachers should maintain cultural values and other teachers in different schools supported this position:

As a way of motivating them [students] to learn science, I often ask my students, you are going to the hospital, you are a woman but your doctor is a man or you are the man but you are attended by a woman doctor; or send your wife and you find that she is giving birth with a male doctor; how do you feel? And all reply that they don't feel comfortable; this is a shame; we need more doctors of all genders. (Interview, Mr Jecha, V2, T30).

This shows how religious beliefs and social-cultural values influence teachers' thinking about the science curriculum. Unfortunately, such responses were seldom voiced by the teachers from Tanzania Mainland. The teachers in Zanzibar appeared to enact the science curriculum under what Childs et al. (2012) called the tension of maintaining their cultural norms and values. These results show the impact of the context on the science curriculum enactment.

7.2.2 The internal school context

The internal school context was found to have a big influence on policy enactment, including the curriculum (Braun et al., 2011). How the teacher conducts their classroom practice depends on the internal school context. In the existing literature, Braun et al. (2011) identified various factors of internal school context, such as school culture, leadership, resources, students and their behaviour, etc. This study revealed the overlap between these factors when the teachers described their classroom practices in response to the CBC. In the context of this study, I have identified four factors: nature of students, student-teacher ratio, teaching and learning resources, and school leadership. These themes emerged across all 21 teachers involved in interviews and across all focus group discussion data. In dealing with these named factors concerning the teachers' practices and the CBC enactment, some tension and resistance revealed. Thus, all these factors are described in turn with the support of some extracts from both interviews and focus group discussion.

Nature of students

In talking about their enactment of the CBC, the teachers revealed their main agenda was to organise their lessons to accommodate the nature of their students. One teacher described her teaching as a part of the CBC enactment pointed out that:

(...) every weekend I sit and prepare my lesson plan for the whole week. You know I am teaching students who are going to sit for the exams; I'm very tight with teaching periods, I teach during the normal school's hours and then I teach extra time after school's hours, so, I go back home very tired. (Interview, Mad. Tau, V1, T10)

Two factors can be observed: the level of the students as an internal factor, and the examination as external. In response to these two factors, Mad. Tau reveals a tension in her school context during the CBC enactment. Because of this tension, the teacher tended to prepare her lessons weekly instead of daily, as required in accordance with

the CBC in the Tanzanian context. Thus, the class level Mad. Tau was teaching was considered as a major driving factor for her preparation. The teacher was teaching physics to Form 4, the level which sits for the national examination. usually, the teacher's concentration was on how to drill their students in order to achieve good examination result.

Like the teacher above, other teachers also were reflected in the internal and external influences when they were making their preparation for CBC enactment. Due to the pressure of examination, from the planning stage teachers were highly focus on the external examination.

In testing, the focus is on the students, it depends which level I am teaching; Like now I'm teaching Form 2; soon they will have exams; so, I look at what the syllabus is saying as well as how the examinations appear. So, when I make preparations, we look to many things; students, syllabus as well as national examinations. (Interview, Mad. Reki, V1, T2)

This teacher identified three factors: students, curriculum and external examination. These three factors represent two main influences: internal and external. The two external influences are clear: the syllabus and the examination; the teacher starts to focus on the national examination at the preparation stage. However, this teacher response was due to the nature of the students she was teaching. The response of this teacher pinpoints two interesting issues: accountability, and tension. On one side, it can be seen that the teacher is accountable to the external board of examination, which was a source of tension right from the preparation stage. Mad. Sayda's excerpt showed similar responses to previous teachers:

In the preparation stage, I first identify a topic (...) then the objectives of the topic according to the syllabus to be completed by the students. Now, from this point, I identify the teaching methodology in relation to the students I intend to teach and which teaching aids should be used in the teaching (Interview, Mad. Sayda, V1, T6)

Multiple factors are identified by this teacher during the planning stage, which can be arranged into two groups: the external and internal factors. Externally, the teacher's preparation was driven by the syllabus and the objectives stipulated therein, which helped teachers understand how they could go about their teaching. Internally, students were also a driving factor that helped teachers select their teaching methodology. In the same interview, Mad. Sayda added that: "(...) I develop my lesson plan and select the teaching methodology which will match with the nature of my classroom environment" (Interview, Mad. Sayda, V1, T6). Again, the internal factors appeared to influence the teacher in her teaching practice. Notably, the classroom context was considered the reflection for the CBC enactment and helped the teacher select the appropriate teaching methodology. The teacher's selection the

teaching and learning pedagogy and appropriate teaching and learning materials were informed by the nature of the students.

Similarly, Mr Kasu described how he used to select the teaching approach that he thought was more advantageous to the students' learning.

I am looking at advantages and disadvantages of each method of teaching, in response to the students' learning. It is not that a curriculum forces someone into a specific teaching method; the curriculum is free for the teacher to use any method of teaching which the teacher believes can work in response to his student. I am using participatory [approaches] to motivate students to learn. (Interview, Mr Kasu, V1, T20)

This teacher declared that he was using a participatory teaching approach during the CBC implementation, and this selection was influenced by the internal audience. In this quote, he referred to the teacher's autonomy in selecting the teaching approach for their classroom practice. According to Mr Kasu, the CBC reform does not chain the teacher to a particular method of teaching. However, many teachers indicated that the greater priority of the CBC reform was the student-centred approach. This shows that the teachers did not share a common understanding of the appropriate pedagogical approach in relation to the CBC reform.

Teaching and learning resources

The teaching and learning resources became the concern of many teachers in response to the CBC enactment. Many teachers showed resistance to the reform because of the scarcity of teaching and learning resources. Moreover, the analysis indicates that this shortage was among the factors some teachers considered when deciding not to assess their students through hands-on experience. Instead, teachers relied heavily on paper-and-pencil testing, which not only contradicted the teachers' professional beliefs about assessment in science teaching but was also against the CBC reform. At many points in the interviews, teachers clearly articulated that teaching practice should include both theory and experimentation. However, this was hardly achieved because of the constraints on the teaching and learning resources. Sixteen teachers out of 21 responded in this way, and in this section four responses were selected as representative. Selected quotes were taken because of the depth of information they contained and represented the responses concerning the impact of teaching and learning resources on the CBC enactment.

According to this curriculum we are required to use the participatory approach of teaching, but for myself it depends on the nature of the classroom, sometimes our classrooms are too big, so I use it when I have a smaller number of students, otherwise I use teacher-centred [methods]. (Interview, Mr Guni, V2, T24)

Contradicting Mr Kasu, who said that the CBC gives teachers autonomy in selecting their methodologies, Mr Guni had the opposite idea, saying the CBC forces teachers into a particular teaching approach: the participatory teaching approach. The teacher understood that the CBC requires teachers to use participatory teaching approaches, but the nature of the classroom had a big impact on the teacher's decision about which approach to use. In this quote, the teacher mention of a large number of students per classroom was the agency that pulls the teacher back of applying the teaching pedagogy as recommended by the CBC reform. This adds to evidence of how internal school context negatively impacted the enactment of the science CBC in the setting of this research.

Another teacher used the internal school context as the rationale for using a teacher-centred approach during the CBC implementation.

We have huge number of students in our classes and we are teaching science with a scarcity of teaching and learning resources; our syllabus is fully loaded with content. The teaching basically falls under teacher-centred approach where the chalk-and-talk strategy dominates. Our schools run with limited access to internet connectivity and shortage of ICT facilities to support the facilitation of curriculum implementation. (Interview, Mad. Nashda, V1, T12)

Like the previous teacher, Ms Nashda was influenced by internal factors. Here, she indicates several constraints experienced within her school context, which were the driving factors behind her selection of pedagogical approach during the CBC reform enactment. Some teachers consider the use of a teacher-centred approach as a way to respond to constraints experienced within their school context. Moreover, this reveals there is resistance through not using the teaching approach suggested by the CBC, which is associated with internal and external influences. Besides a large number of students, the amount of the content within the CBC was another internal factor that supplied a rationale to resist employing the participatory teaching approach. Mad. Nashda tends to criticise the present CBC for being too content-heavy as that hinders teachers in enacting it as intended. This was a common criticism of many of the teachers in this study that the CBC was too much content which harmed teachers' responses to a CBC. The idea of resources was an issue for many teachers where the following teacher also voiced this:

(...) teacher might be guided by the curriculum to involve students in group discussion but when you go into the real environment you realize that group discussion will not work. The curriculum recommended integrating our teaching with practical, but actually we rely on chalk and talk because of the resources. (Interview, Mad. Tau, V1, T16)

The limited teaching and learning resources was an agency to teacher's resistance to the CBC reform. Mad. Tau was well-informed about how science should be taught as per the CBC, but she and others failed to put it into practice because of their scarce resources. Many teachers in my research make that argument that scarcity of teaching and learning resources made them switch from student-centred to teacher-centred approaches.

Another teacher, who teaches physics, commented on assessment practices:

No! The way I assess is not how science is supposed to be assessed; science is supposed to be assessed through both theory and practical, especially for this curriculum [competency-based], not through paper and pencil only. However, how can we assess students through experimentation with the shortage of learning resources? We rely more on paper and pencil ... (Interview, Ms Pamela, V1, T11)

Again, internal influences drove the teacher to assess through methods contrary to the CBC reform. They shifted from assessing through experimentation to paper-and-pencil testing because of the shortage of resources and they struggled to put the CBC into practice for the same reason. The teacher was merely focusing on assessing students on content mastering rather than the practical skills that were the key concern of the CBC reform. This was a common response among other teachers as well.

Corroborating the interview data with the focus group discussion, it was evident across all four discussions that one of the major hindrances preventing the teachers from enacting the CBC as intended was the scarcity of resources.

It is difficult to teach as per the competency-based curriculum because of the environment; the teaching environment does not allow me to teach as required by the curriculum; there are challenges of overcrowded classrooms, little laboratory equipment and so on; in most cases I ended up teaching through teacher-centred [approaches] (FGD4, Mr Alison, T6)

(...) the number of students is very large. I fail to provide individual support. Sometimes, even the school leadership becomes a problem; they do not provide good co-operation. You can request the resources and it takes ages to get them. (FGD4, Mad. Agnes, T7)

(...) but also at the government schools, the students are the problem. You want to finish the syllabus earlier but even when you ask students to come on Saturday, they do not come. I can give an example of the private school because that's where I started teaching. Whenever you asked students to come for remedial lessons, the students came on time. (FGD4, Mr Kitua, T7)

Again, multiple factors are revealed here. The internal school context of overcrowded classrooms and insufficient laboratory resources influenced Mr Alison to apply the teacher-centred approach instead of student-centred. Here, he referred to the internal influences within the school context. In addition to resources, Mad. Agnes

reported internal school leadership had a negative impact on the CBC implementation. Mad. Agnes tried to show the role of the internal school leadership during the CBC implementation. In addition to the lack of resources or leadership, the students were also found to impact on the CBC curriculum implementation. Mr Kitua revealed that his professional experience helped him present justifications regarding the CBC implementation. Teaching at private schools in the past helped him to judge the readiness of students in the present.

(...) the objectives of the curriculum itself are good but I can say that it is not contextually relevant because our schools do not have the resources for effective implementation... to me the issue is not about the curriculum being good or bad, it is about implementation. The implementation is not as expected because of the resources. (FGD1, Mr Wadu, T25)

I have attended one of the workshops based on how to use ICT in teaching but when you come to real school settings, the school itself does not have ICT facilities, you train me how to fish then you take me to the sea without giving me any fishing tools, do you think I can do it? If you train me how to use ICT, make sure all schools are fully equipped with ICT facilities. (FGD1, Mr Sula, T27)

What I want to tell you is that a curriculum describes an issue, which is quite different to the real school environment. For example, the curriculum talks about the use of ICT, while in our school we do not have even a single computer, you expect where I have to get all of that. Also, the curriculum talk about every school should have well-equipped laboratory while we have just a room that we have turned into a laboratory and the equipment is bought according to the demand of the national examination which makes teacher to teacher by prediction and not according to the syllabus. (FGD1, Mr Achu, T28)

Like many previous teachers, the teachers here indicated less doubt about the goals of the CBC reform. However, their concerns were about the enactment concerning the limited teaching and learning resources. The analysis of this study shows that teachers were always struggling to put the CBC reform into practice because of the disjuncture between how the CBC is supposed to be taught and the school's contextual reality. The issues of ICT and internet connectivity were a major concern for all teachers about their interpretation of the CBC enactment.

The student-teacher ratio per classroom

The class size or the number of students per class was another factor that influenced teachers on the CBC enactment. It was reported by the teachers that their selection of teaching pedagogy as well as their assessment practices were driven by the number of students they had in the classroom. In the context of this study, many teachers indicated that they were enacted the CBC in overcrowded classroom environment. This situation resulted in negative responses from teachers about the CBC and the idea that the reform was contextually irrelevant. These consequences,

the signs of tension and resistance, were revealed in the teachers' practices. The CBC reform is an official curriculum document in the Tanzanian educational context which declared clearly that for effective implementation of the curriculum, the student-teacher ratio should not exceed 40:1. In this research, it was revealed that the student-teacher ratio exceeds the recommended standard value. Vavrus (2009) made similar findings in a similar context to my research (see section 2.4).

In practice, the student-centred approach was highly recommended for the CBC reform enactment, but teachers did not hesitate to say that they were not applying at all in their classroom instead their practices were dominated by the teacher-centred approach. For example, the extract of the interview taken from Mad. Sayda indicates how the internal school contextual reality pushed her to teach contrary to what she understood the science teaching should be about:

To be honest, my major method of teaching is the teacher-centred approach, although I understand that the curriculum put more emphases on the learner-centred approach, as I have mentioned previously. It is not because, I do not like to use learner-centred approach but because of some barriers which I have mentioned at the beginning, such as the large number of students and scarcity of teaching resources. (Interview, Mad. Sayda, V1, T13)

One important issue raised in this quote is the pushing back agency: the huge number of students, and the shortage of teaching and learning resources. Mad. Sayda was informed that the CBC reform needed to be enacted through the student-centred approach, but she failed to do so and opted to apply the teacher-centred approach because of some tension within her school context. Talking on the same issue, Mad. Nashda added that:

We have huge number of students in our classes and we are teaching science with a scarcity of teaching and learning resources and at the same time our syllabus is fully loaded with content. Therefore, our teaching basically falls under the teacher-centred approach where chalk-and-talk strategy dominates. Our schools run with limited access to internet connectivity and a shortage of ICT facilities which would support the facilitation of curriculum implementation. (Interview, Mad. Nashda, V1, T12)

Like the previous teacher, she was influenced by internal factors. Here, the teacher indicates several tensions within her school context, which were the driving factors behind the teacher's decision to apply the teacher-centred approach during the CBC reform enactment. It has been realised that teachers consider the use of the deductive approach as a way to respond to the tensions experienced within their school context. Mr Usi, who was teaching physics, pointed out that:

Student participation is very low during my teaching and learning practice, because of the number of students and amount of intended content I am required to cover per year. Therefore, in most cases, I speak a lot than students, maybe, I can teach certain learning concepts, then at the end is where I try to ask students a few questions to see if they have understood or not, that's how I'm doing it.. (Interview, Mr Usi, V1, T9)

Here, the teacher mentioned two issues – the number of students and amount of content – that influenced him not to involve students during the teaching and learning practice. These are associated with internal and external factors, respectively. The teacher seldom used questions to assess his students' understanding.

Another teacher, talking about their assessment during CBC enactment, pointed to a similar impact in terms of overcrowded classrooms and how they influenced their decisions regarding their practices. For example, when Mr Mamba was talking about his assessment practice, he explained it this way:

Assessment is difficult because of the large number of students we have. I mostly use written tests; I give students a test; I mark it and give them feedback. Students' understanding is measured on the marks they have, a higher mark means good understanding and lower mark means poor understanding. (Interview, Mr Mamba, V1, T19)

The internal influence of the school is revealed by this teacher. A large number of the students creates some difficulties for the teacher, who in turn decides to rely on a single approach of assessment: paper-and-pencil testing. The result indicates that he failed to enact the CBC reform as intended because of the overcrowded classroom. This argument also coincided with the response of Mr Matege who added:

(...) I tried "oral assessment" where I used to call an individual student then I ask questions orally to see how they are responding; it was a good way of assessing students, but I decided not to proceed with it, it was tiresome work; the number of students per class is very large; I mostly use "written exams" now. I give students a test then after correcting them, I know how much students have understood. (Interview, Mr Matege, V1, T22)

Again, the impact of internal school influence on the teacher's assessment practice revealed. The teacher shifted from assessing individually through oral questioning to written tests because of the student-teacher ratio. A large number of students was a rationale for resistance in the teacher's assessment practice in relation to the CBC. To respond to the challenge of teaching in overcrowded classrooms, the teacher accommodates the curriculum the way they saw fit within their school contextual reality.

The findings from the interview can be corroborated with the focus group discussion where the issues of internal school contextual reality in terms of class size and

resources were the main concern to teachers about the enactment of the CBC reform.

The biggest challenges that limit the implementation of this curriculum are what I have already said, the instructional time is not enough in respect to the depth of the syllabus ... there is also an issue of class size; our classes are too big for the teacher to engage students on activities-based teaching. You find you have 50 students or more in a science classroom ... that's why we [teachers] are relying on chalk and talk all the time. (FGD2, Mr Vugo, T28)

You know learner-centred approach requires students' full participation and you find our teaching environment is not friendly. We are suffering with a shortage of resources; our class size is too large ... we are trying but I do not fully employ a learner-centred approach due to these challenges. (FGD2, Mr Haji, T32)

Firstly, it is true that our class sizes are very big, so when you want to teach using hands-on activities for the whole class becomes very difficult ... I therefore was forced to teach using chalk and talk, which means using theory only. (FGD2, Mr Pandu, T41)

These teachers show a certain resistance to the imposed CBC reform driven by the nature of their classroom and school environments. The analysis of this study shows that the majority of the teachers confessed that they are not enacting the CBC reform as intended because of various factors within their school settings, largely the issues of scarce resources and large classroom sizes.

School assessment policy

Teachers also identified the internal assessment policy as one of the factors that influenced their assessment practices in response to the CBC. Every school had their assessment policy but in general, all policies had the similar goal of motivating students in learning and preparing them for the national examination. The teachers talked about their assessment policies in connection with the enactment of CBC. This brought two contradictory remarks, wherein some teachers were positive about their policy while the others were negative. During the interviews, teachers indicated how they were accountable to their school assessment policy. Teachers showed that they were assessing their students to comply with the school policy. For example, Mr Matege was teaching biology but at the same time he was the academic dean at his school, during the interview, the teacher said this:

Aside from classroom assessment that we are doing regularly, we also assess students monthly through classroom test. This is special school policy to motivate students in learning. We also use these results at department level to discuss our teaching, this policy makes us to work hard and improve our teaching ... (Interview, Mr Matege, V1, T30)

The internal influence revealed how it affects the teacher's assessment practice. Here, he was reflecting on the twinned goals of the school assessment policy:

motivating students to learn, and as a measure to assess teachers' practices. This means that the school assessment policy was considered to have a positive impact on both students' learning and CBC implementation. The assessment used as a tool that makes teachers responsible for the CBC enactment.

While the teachers above had positive responses on the school assessment policy in connection to the CBC enactment, I can contrast him against others with opposite responses. The teachers considered the school assessment policy does not add any value to the CBC implementation.

(...) this policy affects my practice because this policy has not been shown in the curriculum, so, it makes me use extra time to fix it in my scheme of work. The whole week you are busy with the test; when you go home, you must sit and mark the papers; when you come to school you should teach, "It is hectic". (Interview, Mr Kauka, V1, T32)

While other teachers consider the school assessment policy had a positive impact on their practice, this teacher indicates that the school assessment practice was negative in their practice. The school assessment policy was considered chaotic by the teacher. The teacher's reflection on the school assessment policy was made in relation to his understanding of the curriculum; resulted in some resistance to the school policy.

According to the teachers, the internal school leaders also played a significant role in the CBC implementation. The school made close supervision in leading in the teachers' assessment practice in response to the CBC. The responses of the teachers show that the internal school leadership had a significant impact on the teachers in their assessment practice. For example, Mad. Nuru said this in her interview,

The teachers get blamed if they teach out the syllabus; for example, before your test is printed, the academic must be satisfied if your test did not go out of the syllabus (...), so, I am trying to ensure that I assess as per the objectives stipulated in the syllabus... (Interview, Mad. Nuru, V1, T43)

Here, the internal influence was revealed from the teacher's response. The teacher referred to the school test where the validity was a major concern of the school administration. Therefore, the teacher's assessment practice was done to ensure that it complies with the school's standards. In other words, the teacher's practice was influenced by the school leadership, the academic dean. In addition, one interviewee said, "high percentages of the questions in my assessment are those that measure skills because this is what we are always told by the administration" (Mr John, V1, T21). Like the previous teacher, the internal influences, such as the internal school

leader, have a big influence in his assessment practice. This teacher shows the accountability to the internal school leadership.

Language of instruction

The teaching and learning using a second language have been given significant attention in the education literature (Brock-Utne, 2010; Mwinsheikhe, 2007). In this study, using English as a language of instruction had a big influence on the teachers in their CBC enactment. In the Tanzanian context, English is a medium of instruction at the secondary level that is different from the first language of the students. Moreover, the students at the primary level were also learning using Swahili and started to use English at the secondary level. In this research, the teachers saw this situation as had a negative impact on their classroom practice. The teachers were concerned about those students at lower secondary level classes, Forms 1 and 2. The teachers perceived that the students' language ineptitude influenced them to apply the questions that measure low thinking skills. The study revealed that the students' language ineptitude was a reason for the clash between teachers' practices and the curriculum directives. To avoid more repetition, five responses will be presented in this section. First, the extract of the interview taken from Mad. Njage:

My test depends on the level of the students, for example, for Form 1 and Form 2 students many questions are those that measure remembering using short answer questions, matching items, (...) The language is a problem. You know we are teaching science using the English language that is unfamiliar to many students. (Interview, Ms Njage, V1, T34)

Here, this internal factor influenced Mad. Njage in the assessment practice. This teacher talked about the students at the first and second year of secondary level (Form 1 and Form 2). As the students at these levels were considered inept in the language of instruction, the mode of assessment was switched to objective questions to respond to the language barrier. The students' language ability was considered to have a negative impact on the teacher's assessment practice. In the next turn, Mad. Njage added that "when you ask students to describe or explain, out of 40 students only five to ten students may be able to respond correctly but the majority of them they will not" (Ms Njage, V1, T35). The teacher avoided employing subjective questioning in her test because the majority of the students were considered for weaker subjective questions due to their poor command of English.

While there were different assessment practices considered more effective than paper-and-pencil testing, which teachers tended to employ because of the nature of their students.

As I said before, assessment is still a challenge. There are many assessment practices like observation, things like a checklist or a portfolio, which are good for students' learning. But for the nature of our children, it is difficult because the portfolio is a collection of materials (...), the ability of our students is very low and even the language ability is a problem, so, we end up relying on paper-and-pencil testing (Interview, Mr Matege, V1, T32)

Again, the language of instruction used for enacting CBC reform dragged the teachers into paper-and-pencil testing. The incompetence of the students including language difficulties was stated as hindering teachers using other assessment practices than paper-and-pencil testing. The teacher appeared to undermine the students and considered portfolio assessment was deemed unsuitable because of the students' ability. The students' language ability is reported as affecting teachers' assessment practices by using different claims. The excerpt from Ms Aliye's interview pointed out,

(...) high proportion of my questions fall on remembering and application. Although, now we are required to focus our questions more on high-thinking skills questions; the questions which focus on analysis and evaluation, questions which demand students use mental ability to develop argumentation, but such questions need language and our students cannot go beyond the teacher's notes. (Interview, Mad. Aliye, V1, T24)

Again, the internal audience – students – acts as the major factor influencing the teacher's assessment practice. The nature of the students in terms of their language ability creates some resistance to the teacher to assess as per the curriculum. Mad. Aliye tended to rely on remembering questions contrary to what they are required by the curriculum, because of the students' language incompetence. Also, the language barrier was reported to have a negative impact even on the students' learning. The student relied on one source of information; teacher's notes, because of the ineptitude of the English language. Another teacher, Mr. Nkanda, who was teaching chemistry at Form-1 level, added that:

(...) as I told you, because these pupils are still too young in chemistry and they have just begun to learn science in a language that is not familiar to them, so, I used to give them questions that measured the ability to remember the information but as they are going forward I keep changing the style of questions. (Interview, Mr Nkanda, V1, T20)

Again, the level of students and their language incompetence were described as the factor that made the teacher contravene the assessment. He was more concerned about the summative form of assessment which they used to construct using the questions that measure remembering skills. By concentrating on the language issue this teacher added:

In my opinion, although we are teaching science, because English is the medium of instruction, in the assessment practice, communication skills

should be given priority. Because, students could have a good idea, but they might fail to present it because of a lack of command of English. Therefore, the debate approach is good for developing students' communication skills. (Interview, Mr Nkanda, V1, T22)

As the English language was considered as a barrier to the students' learning, Mr Nkanda tried to show the importance of integrating communication skills within their assessment practice. Teaching science through a foreign language was perceived by this teacher as limiting students' ability to explain their understanding. The debate was cited as an assessment practice that might reduce the problems with communication skills. This response was derived from the teacher's personal view.

In addition, some teachers' responses expressed their dissatisfaction with their ability to apply the language of instruction during curriculum enactment. During the interview, teachers connected the ability to develop scientific argumentation with the language of instruction used for the enactment of CBC.

(...) you cannot develop argumentation while all of us teachers, as well as students, are less competent in the language of instruction. Language barrier is the reason that makes students opt for the memorization way of learning ... (Mad. Nema, 10/2016).

Here, the teacher's response to the reform was linked to language ability. Her focus was on her professionalism and students' ability with respect to intended competencies (*scientific argumentation*). Mad. Nema conceptualised scientific argumentation in terms of their language ability. In Tanzanian secondary education, the English language is used as a medium of instruction which is different from the native language. This is a common experience in most African countries. This language ability seems to affect teachers' practice as well as students' performance. The medium of instruction in Tanzanian secondary education is identified by other researchers (e.g. Brock-Utne, 2010; Mwinsheikhe, 2007; Qorro, 2006) as a challenging aspect for both enactment and the received curriculum, not only in science but across the entire secondary education. This was supported by another teacher during the focus group discussion:

(...) we are teaching in English, a language that students and sometimes even teachers are not conversant with. So, it is hard to develop argumentation if you are running short of vocabulary, you find most teachers cannot go beyond the textbook. (FGD4, Mr Wadu, T22).

Similar to the previous teachers, this teacher also shows how the language of instruction negatively impacted the CBC enactment. It was very clear that the language of instruction was not only a challenge to students but even to the teachers who were responsible for the CBC enactment.

7.2.3 External school context influence

The external influences have consequences for the teacher in terms of their teaching practice. In the CBC enactment, in the context of this research, teachers also described how the external factors of the school influenced their teaching practices. The teacher-centred approach, including learning by doing as well as assessment for learning, is highly recommended in the process of CBC enactment in the Tanzania educational context. The findings of this research revealed that the teachers' practices were influenced by three external factors: curriculum goal, inspectorates, and the national examination. The inspectorates and the external examination were identified as pulling in a different direction from the goals of the CBC. This resulted in high tension among teachers about CBC enactment. The external influence related to teachers' practice was discussed by all 21 teachers involved in the face-to-face interviews as well as across all four focus groups discussion. However, it was revealed that the examination and the inspectorates had more influence on external factors, and thus, fewer teachers responded to the goal of the CBC reform. This section is organised into three parts; the first part presents the goal of the curriculum, followed by the inspectorates and ending with the external examination as the factors influencing teacher's practices toward CBC enactment.

External school curriculum goal

It has been revealed in this research that the learning goal laid down in the syllabus served as the prerequisite for the teachers' practice. Out of 21 teachers, only eight reported that their practices were influenced by the goals of the curriculum. In this section, four responses will be presented which indicate clearly how the curriculum goal influenced teachers in their assessment practice. The example taken from the teacher's interview extract explained his assessment practice this way:

(...) I assess through verbal questions, presentation and using written exams; there are goals in the curriculum we are required to achieve; the curriculum specifies the goal for every topic to be achieved at the end of the lesson (...), so, I'm trying to ensure I achieve those objectives.
(Interview, Mr Nasa, V1, T21)

Here, an external factor appears to influence the teacher's assessment practice. Although the teacher failed to illustrate what objectives he focused to attain because of his assessment practices, his responses show that teacher's practices were influenced by externally imposed curriculum reform. Other teachers also supported this response:

I assess both; students' content knowledge and skills development, however, this depends on the nature of the topic; the learning objectives

are not the same for all topics. There are topics you can evaluate different skills such as measurement skills, practical skills, observation skills so, it depends on the objectives stated in the curriculum (Interview, Mr Kasu, V1, T33)

The curriculum objectives were reported to have a direct influence on the teacher's assessment practice, and Mr Kasu shows that he was submissive in his practice and therefore, his assessment practice was largely dependent on the objectives as set by the curriculum.

During the classroom practice, teachers responded to the goal of the CBC. The teachers described applying the teaching methodology because of the CBC. The example taken from the interview extract below emphasises how the curriculum influenced his teaching practice:

You know, when we are teaching there is a guide that guides us. And the guide that leads me is a syllabus which emphasis the use of participatory approaches of teaching. But if you have listened to me well, there is also emphasis from the TC (Teacher Centre) who are representing the Ministry (employer). So, I am trying to use a participatory approach as recommended by the curriculum. (Interview, Mr Ndama, V1, T12)

At the beginning of the quote, the teacher indicated that his teaching was driven by an external agency, referring to the syllabus rather than the CBC as the external document that informed his teaching. In the context of this study, in most cases, the teachers are interacting with the syllabus rather than the curriculum document. This leads the teachers to look at curriculum and syllabus as synonymous. The teacher indicated that the participatory teaching approach is the concern of the CBC reform. Therefore, he decided to apply the participatory approach to comply with the syllabus. This also is a sign of the teacher's accountability to the external curriculum board. Another teacher in response to the teaching methodology said this: "*I am using the student-centred [approach] as we are required by the curriculum; under this new curriculum students are required to take major roles in their learning*" (Interview, Mr Ole, V1, T30). This teacher indicates that his decision to apply a student-centred approach was influenced by the present CBC. Unlike many teachers, these teachers show less resistance to applying the student-centred approach in their responses to the CBC enactment.

Another teacher, a head of a department, showed how his teaching practice was influenced by the CBC, though it was clear that his leadership position also helped him towards a positive response to the CBC.

I have accepted this curriculum [CBC] with a clear heart; I ensure that students are learning through active engagement same as recommended by the curriculum. I am a head of department, sometimes teachers are too rigid to change, but the curriculum makes clear how teaching should be

done, you try to force them to see if they can teach as per the curriculum but still they teach the same. (Interview, Mr Kauka, V1, T33)

Again, the external influence emerged from this teacher but the personal influence emerged too. He showed his accountability to the external board of curriculum as a teacher but also as a leader at the department level. His leadership role might be the reason he complied with the CBC in terms of the recommended teaching pedagogy. This is the same teacher who was positive about the lesson plan while the majority were opposed to it (see section 7.3). Mr Kauka's response indicates that there is some resistance to the teacher in connection to the implementation of the CBC.

External examination

Many teachers in this study indicated that external examination had a big impact on their teaching practice, including the selection of teaching pedagogy. The analysis of this research revealed that teachers were more accountable to the external examination board than to the CBC as a policy. This was revealed from the responses of 18 out of 21 teachers and the example taken from the interview with Mr Jecha indicated the impact of the external examination on the teachers' pedagogical approaches:

I am among the teachers who are very dedicated; one thing making me devote my time is to avoid shame. When you hear your students failed in the national examination, as a teacher you feel inferior (...) I ask student to stay for extra lessons in the afternoon. I am doing this because I want students to learn my subject and succeed. (Interview, Mr Jecha, V2, T4)

Here, two factors are revealed: one is internal, the other external. Mr Jecha was a chemistry teacher for Form-4 level students whose national examination was at the end of the year. The teacher decided to spend more time with the students and gave them extra lessons to prepare for the external examination. Moreover, Mr Jecha wanted to keep himself comfortable, psychologically. Poor performances by students in the external examination were found to have a negative impact on the teacher psychologically. Spending more time with the students in the teaching and learning process was regarded as having a positive impact on students' scores.

The impact of external examination on teachers' practices was also common to other teachers. It was noted that instead of teachers engaging their students in learning by doing as recommended by the CBC, teachers tended to apply the scientific approach to respond to the external examination. As Mad. Maua said:

I put students in groups, I am using groups of three students, I supply the materials and give them instructions like what they are given from the national exams. For some experiments I do expect students to go through

all stages of scientific process but also there is the very important issue of working collaboratively. (Interview, Mad. Maua, V1, T28)

In this quote, there are two issues. First, it is about the teacher's accountability to the external examination board. The focus of the teacher in involving experimentation was on the national examination. Secondly, it was about developing collaborative skills. This focus was rooted in the teacher's personal goals. The following teacher also shows how the examination drives teachers in their teaching:

Now, I am teaching at Form 2, at this level students have only one examination paper, I mean theory paper; they do not have practical. That's why in most cases I only use classroom demonstrations at least to make students see how a certain experiment can be conducted when they reach Form-4 is where they will be fully involved in the experimentation. (Interview, Mad. Reki, V1, T5)

Mad. Reki was teaching physics with Form-2-level students. The teacher decided not to involve students in experimentation because it was not assessed in their examination. She decided to perform demonstrations to the students rather than carrying out individual experimentation because experimentation was not assessed at the level she was teaching. However, in practice, all the students at all levels were supposed to perform experimentation, this teacher was teaching to respond to the examination demand. Again, this is the evidence of how the external examination impacted negatively CBC enactment.

The finding of this study revealed that many teachers rely heavily on written assessment techniques when trying to comply with the national assessment. Here, the teachers appeared to be extremely accountable to the external examination board. However, some teachers were not satisfied with such an assessment but reported to comply with the national assessment because the results of it were used to measure the teacher's ability. Their main concern was that the written assessment is only focused on those students who will proceed to the next level of education.

We assess through paper and pencil testing; we focus more on content mastering. So, I don't think if such assessment corresponds with the goals of the curriculum, but this is the way students are assessed at the national level. At this level, we do not assess through experimentations and I think this is the reason some students run away from the examination. Some students do not have the ability to express the concepts in the paper, but if you are going to tell them to perform certain experiments they can do it correctly. (Interview, Mad. Aliye, V1, T33)

Assessing students through paper-and-pencil testing was deemed irrelevant as it did not consider other students who have difficulties in presenting their ideas in the written form. However, although the teacher did not believe in assessing students

through paper and pencil only, the teacher decided to employ written assessment practice because she was trying to respond to the national assessment.

The assessment at the national level was considered a factor that persuaded teachers in their practices in the classroom setting. Bearing high examination pressure, teachers appeared to lose their teaching autonomy and be driven by the national assessment.

(...) we are only using a few assessment techniques identified in the curriculum; we are more concerned about paper and pencil assessment as well as experimentation. Because these are, the common assessment techniques even appear in the national examination. (Interview, Mr Ole, V1, T32)

Here, the teacher's decision to select a few assessment techniques among many proposed by the curriculum was influenced by the national examination. Under high examination pressure, he tended to pick out assessments techniques that were favoured at the national level. In response to such tension, teachers were trying to use classroom assessment as a tool for preparing students for the examination rather than helping students learn. The interview excerpt is taken from Mad. Sayda went as far as involving her students in solving past-paper exams to ensure that the students are well developed to face the examination:

I do several exercises, such as quiz, homework, classroom test, I even used to solve several past papers and to give them (students) techniques on how to tackle some challenging questions. These students are nearly going to have their examination. (Interview, Mad. Sayda, V1, T20)

This quote shows Mad. Sayda was assessing for the national examination, which means that her practice was externally influenced. Later, she explained that "our assessment cannot contradict with the national assessment because, in the end, the examination stands as the criteria for the students to enter into different career fields" (Mad. Sayda, V1, T27). Her concern was for those students who will proceed with further learning. She did not consider other groups of students that might drop out because of the examination results. Like the teachers above, the external examination board seems to rule out the teachers' decision on their assessment practice. When the teacher's practice is judged by the examination results, the teacher could find a different way to ensure that a student's examination attainment is achieved. For instance, the following teacher, Mr Jecha, said this:

Yeah! I often assess students through classroom presentation but also, I use frequent testing. I am a teacher who gives students lots of tests. You know the focus of my employer and even the parents are on the examination. Parents feel very happy when their children succeed (...) so, even my assessment must focus on the examination. (Interview, Mr Jecha, V1, T36)

The decision of doing periodic testing was made to prepare students for the examination attainment and Mr Jecha was trying to fulfil the expectations of his employer and parents. With the primary concern being examination results, the teacher's practice focuses only on students' success. Somewhere in the interview, he explained that he spends a lot of time with students to avoid shame from their failure. This is to say that the external pressure because of the examination results made him work under pressure.

The interview findings based on factors influencing teachers in the examination were triangulated with the focus group discussion findings. Many of the teachers across all four focus groups were well informed that the participatory teaching approach including learning by doing has been recommended for implementing the CBC. For instance, in the fourth focus group discussion, the teachers had this to discuss:

(...), the type of questions I asked now in my classroom test are different from the previous where the question was straight; memorising questions. The curriculum now and even the exams focus on application skills (...) my assessment now focuses on measuring different skills ... (FGD4, Mad. Agnes, T15)

Long before I was constructing tests, looking at the student's ability to remember the content knowledge, I have been involved in what was called INSET; we were also trained on how to construct the application questions, so, to somehow it shaped me on my assessment practice even at classroom level (FGD4, Mr Alison, T16)

To me still, my assessment relies on paper and pencil testing; we have not yet reached assessing on application skills; we haven't yet achieved the goal of CBC; and here, my colleague [Mr Alison] touched on a very important point: training. The ministry might organise in-service training, but you find that for the whole school only one get opportunity to attend, our practice cannot change ... (FGD1, Mr. Kitua, T18)

A mixed response is revealed with two teachers showing their assessment practices have changed compared to before because of the new CBC reform. Mad. Agnes's assessment practice was influenced by two external factors: examination, and the national curriculum – CBC. The change to her assessment practice was made in response to the change that had occurred at the national examination and with the curriculum. Rather than responding to curriculum reform, the second teacher changed his assessment practice because of the training he received. Some of the teachers, many from Tanzania Mainland, showed that INSET training helped them with knowledge of CBC implementation. However, not all teachers received it, as explained by Mr Kitua, and this might be the reason of limited understanding to teachers on the CBC. In other words, teacher efficacy might be the factor that influenced teachers in their teaching practice including assessment. In the other FGD, the teacher also responded like this:

Because at the end of the day, when they [inspectors] come to find out why the students have failed they will start looking into whether the teacher covered the syllabus or not. So, if you did not cover the syllabus the case starts from there (FGD3, Mr Kalima, T6).

Why are we focusing more on the examination? Because all evaluations are done through examination; a good teacher and bad teacher are determined from the examination, the teacher has taught or not, they look at the examination, students have understood or not also the reference is the examination (FGD3, Mr Kibua, T7)

Researcher: If the students pass the examinations, does this mean you have achieved the curriculum goal?

Even if we have not achieved, but the Director and all leaders and even the parents they are looking at what percentages students have success; when the school got poor results, becomes an issue; all leaders will come to the school (FGD3, Mad.. Kalorine, T8)

Here, the number of external factors are identified by the teachers that influenced their teaching practices. In this focus group discussion, Mr Kalima expressed the rationale of teachers focusing on syllabus coverage. The inspectorates were identified as exerting high pressure to the teachers on syllabus completion. The study here shows that the teachers were more accountable to the examination than the CBC. The rationale is that the examination result was used not only as a measure of teacher's competency but as a measure of curriculum implementation. The focus on the teacher to do the examination was to respond to several external agencies such as external educational leaders and parents.

7.3 Tension and Accountability

In responding to the conceptual framework (see section 2.6), I have shown that teachers' responses to an externally imposed curriculum reform involve teachers' negotiation with various factors also that the enactment process takes time. The analytical outcome of this research shows similar results with Ryder and Banner (2013), that the interaction of those factors discussed above (personal, internal and external) sometimes pull in different directions and causes some conflict but in some cases pushed in the same directions. Thus, in my research, tension, resistance and the expression of accountability of teachers not only to the external curriculum reform but also to the external educational authorities and examination board was revealed. In most cases, it was indicated by the teachers that the major resistance to the imposed CBC reform resulted from the external inspectorates and the external examination board pulling in different directions to that of the goal of CBC reform. In responding to the tension, some teachers resisted the reform and tended to be accountable to other external forces including inspectorates and external examination

board. This research shows that teachers' tensions and accountability occurred across all the processes of CBC enactment from the planning stage to real classroom teaching through pedagogical and assessment practices. The tension experienced by the teacher during the planning stage was followed by the tension experienced during the teaching practice.

7.3.1 Tension and accountability on the planning

Lesson preparation is a formal procedure prior to classroom teaching in the context of this research. This had a significant impact on the teachers' responses to the CBC enactment. Somewhere in the interview and focus group discussion, teachers described their practices by referring to the preparation of lesson plans as a formal procedure in the CBC enactment. Such responses brought contradictory views among teachers for different reasons. For instance, some teachers considered their teaching experience a sufficient criterion for teaching with less preparation, while others totally opposed this. There were other teachers, however, who were not comfortable in preparing a lesson plan at all because they believed that it does not help them in their teaching and in the CBC enactment in particular. Five out of 14 teachers indicated mixed responses but cut across the response of all teachers, so they will be presented in this study.

For example, Mad. Pamela tried to relate preparation to the experience of the teacher.

(...), if you want to teach you must prepare the topic you want to teach, but since I have taught for many years. I have the notes almost for every topic in the syllabus. So, if I want to teach I look what I want to teach today and go in the classroom. (Interview, Mad. Pamela, V1, T2)

Mad. Pamela was a physics teacher with 34 years of teaching experience. Her responses to the CBC enactment were informed by her teaching experience, which drove her into resistance in responses to the planning before the teaching. The teacher here indicates that she was less accountable to the reform and even to her educational authorities because planning prior to teaching was considered as not necessary step toward CBC enactment.

The idea of the previous teacher concerning teaching experience was criticised by other teachers. For example, Mr Ole, who was teaching biology when he was talking about his preparation before the teaching, he discouraged teaching without having lesson plans and commented that:

(...) we must first prepare a lesson plan. The lesson plan is the most important tool to help teachers in the classroom. I have 31 years of

teaching but going into the classroom without preparation is not good. Because learning should go sequentially, when the teacher goes in the classroom without lesson plan he will not be “consistent”, he will touch here, touch there; the lesson will not flow well. (Interview, Mr Ole, V1, T4)

This teacher indicated that he was accountable to the CBC reform as well as to the authorities. His engagement in the writing lesson plan was the consequence of his professional beliefs about teaching. This teacher conceptualised the planning before teaching in several stages of preparing documents including preparing lesson plan. This was a formality and one of the basic rules of CBC enactment in their context of this study. With this said, the teacher’s response seems to coincided with their rules of teaching and he was fully accountable to the reform to the planning prior to the teaching.

However, the responses of Mr Ole were criticised by other teachers and, in fact, preparing those documents prior to teaching was considered chaotic. The formality of preparing those documents brought about a sense of resistance and *subterfuge* to the teachers, as revealed by Bowe et al. (1992). For instance, one teacher commented that:

(...) I do agree we should plan but what inspectors and school’s leaders focus on are the written document and not teacher’s plan per se. And you can see that when the inspectors come, they always pay more attention to those documents. Thus, we just write it because if they find you did not write, you will be in trouble. (Interview, Mad. Nashda V1, T9)

The mismatch is revealed here between the teacher’s professional understanding concerning preparation and formal procedures in response to the CBC enactment. Writing step-by-step lesson preparation as a process for planning for teaching was regarded by Mad. Nashda as valueless in response to the CBC enactment. However, because of the high pressure she was experiencing from the authorities including the inspectorates, the teacher tended to hide her professional believe and decided to conform to the rules of planning as per the CBC. The teacher conformed with the rule of planning for teaching to respond to the external pressure she was facing at her context of work. Indeed, such external pressures were the causes of some tensions with the other teachers as well. For example, in two consecutive turns, Mad. Njage made the following remark about planning as an issue prior to teaching according to what they are required to do by the rules:

Yeah! this lesson preparation disturbs me a lot, it wastes my time; instead of looking for learning information, I should sit and write a lesson plan; a time that I could go to prepare for some teaching materials. That’s why today since I came this morning, I was sitting and writing a lesson plan because today is Friday and we should submit it to the head of the department and I find myself with only ten minutes before submitting time. (Interview, Mad. Njage, V1, T5)

Here, the teacher's preparation was influenced by the internal administration in their working context: her head of department. For her, writing a formal document such as a lesson plan during the preparation was considered extra work. Because of this, she hides the truth from her leader and tends to write the lesson plan after having taught instead of before teaching. The teacher's response was rooted in her professional belief that the lesson plan has no impact on her teaching. Here, the teacher was talking more about the preparation of paperwork which also changed because of the CBC reform. This was indicated as one of the major practices that make teachers uncomfortable towards curriculum enactment, as noted by the following teacher:

In fact, this curriculum has increased the work, especially in the preparing these documents; lesson plan, log book. These documents I just write as what I have said to please my boss only. Myself, I want to be free, this makes the teachers write because they have forced to do so, but what we are writing might not reflect what the teachers are doing in the classrooms. (Interview, Mad. Pamela, V1, T28)

At the start of the quote, a teacher indicates that she experiencing high tension in responses to the CBC reform enactment. Writing the lesson plan was considered by the teacher to have a negative impact on the teacher's CBC enactment. Responding to a different working document during the planning stage was tiresome to the teacher. In the second part of the quote, Mad. Pamela raised concerns about teacher autonomy versus authority. The teacher felt that their professional autonomy was denied by their authority in response to the enactment of the CBC. Therefore, the teacher forced herself to write those documents to respond to the tension of the authorities; school leadership and inspectorates. In other words, she showed that she was accountable to authorities and thus had a big impact on the teacher about lesson preparation prior to teaching.

Like what happened in the interview, the teachers from the focus group discussion also when they were describing their planning practices prior to the teaching they were reflected to different factors. Across all focus group discussions, teachers reflected on similar factors in relation to their preparation stage; responses from two focus group discussion will be presented that represent the responses from all four groups. For instance, teachers from the second focus group discussion:

(...) in teaching there is a procedure to be followed by the teacher before you even get into class. First, you use a syllabus and write a scheme of work and later you write a lesson plan that you will use in the classroom for the implementing the curriculum. (FGD3, Mad. Kalorine, T31)

The lesson plan does not have impact on the implementation of the curriculum; the leaders think that if you did not record, it means you didn't work; if I have seven classes, I should prepare seven lesson plans; this is difficult. (FGD3, Mr Kibua, T32)

I think the lesson plan is to show how you are going to teach in the classroom. You cannot have one lesson plan for all classes because students are not the same. So, to say you should prepare one lesson plan for all classes because you are teaching similar topic, I think it is wrong because students do not have same understanding (FGD3, Mr Kalima, T33)

Again, the issue of lesson plans emerged and the teachers also brought out different responses on it. Mad. Kalorine showed accountability to the reform and complied with no resistance to the formality of lesson preparation in response to the CBC enactment. Conversely, Mr Kibua considered that lesson plans have zero impact on the CBC implementation. Differently again, Mr Kalima believes the lesson plan has a positive impact on teacher's teaching. Two teachers, Mr Kibua and Mr Kalima extended the discussion about lesson plans in this way:

Although the students are different, if you tell me to write, how I will teach this class, how that class and so forth, it means you are giving me the writing task not the teaching task. How I'm going to teach it will remain in my mind. (FGD3, Mr Kibua, T33)

Maybe I should say, a teacher like this is a teacher who looks at the syllabus and goes to deliver the content and finishes; he does not look at individual difference. But the teachers who are competent must write everything because it is a guide to your teaching; you must be systematic; lesson plans also serve as a record for the administration. (FGD3, Mr Kalima, T34)

Here, teachers looked at the lesson plan from different angles and this was a major disagreement between them. Mr Kibua considers writing lesson plans and teaching as two different things, but Mr Kalima indicates that writing a lesson plan is an integral part of the teaching process. Mr Kalima linked the lesson plan with two main purposes within his teaching practice, which show how teachers are accountable to education leaders: guiding the teacher in his teaching, and a personal record for the administration.

7.3.2 Teachers' tension and accountability

Referring to the conceptual framework, it was shown that teachers' capacity to respond to imposed curriculum reform was maybe formed from their personal character and tended to respond to the external influences. This was clearly shown in the context of this research when the teachers responded about their teaching practices. Analysis of this research revealed that the teachers' tensions were the results of how their practices were framed within their internal and external authorities. We have seen that majority of teachers had positive beliefs about the intended goal of a CBC reform. However, teachers' responses to their practices did not reflect their beliefs. The inconsistency between teachers' practices and beliefs were the results of the pressure teachers experienced within schools' contextual

reality. Teachers identified several tensions which in most cases seemed to enlarge the gap between the policy text and policy of practice or between teacher's beliefs and their practices. Moreover, the results show that the teachers' tension because of the external examination results many teachers to be accountable for the external examination board rather than accountable to the goal of the CBC.

A curriculum has emphasised the application of knowledge outside the classroom but in practice, it is very superficial, because we [teachers] always race to finish the syllabus and prepare our students to answer the examination questions rather than focusing on knowledge application. (Interview, Mad. Nuru, V1, T23).

In this response, the teacher expressed dissatisfaction in her practice with respect to the intended goals of the curriculum. This dissatisfaction was the results of tension between the intended goals and the external examination results and syllabus completion. The examination is a very important aspect in the teaching and learning practice; however, if a teacher concentrates on the examination results, the intended goal of the curriculum is likely to be distorted (see section 2.5). The tension of teachers from the syllabus completion was firstly motivated by the students; to cover learning area that going to be examined. Secondly, the tension created by their educational authorities. In the Tanzanian context, the teachers were not only assessed on their teaching practices but also on completing the assigned piece of curriculum content. Thus, the pressures on teachers to complete the syllabus and external examinations were the evidence for the teacher diverting the intended goals of the CBC.

It was also realised that apart from using the participatory approach as recommended, other teachers used different approaches to respond to the pressures of completing the syllabus and thus become accountable to the inspectorate. Teachers felt the pressure of syllabus completion from the external inspectorates, which influenced teachers to accommodate teaching approaches opposite the CBC recommendations a way of being accountable to their educational inspectorate.

Involving students in groups and making presentations are the methods that we are required to apply as per the curriculum, but in fact, I rarely apply it because if I do it for every lesson I won't finish the syllabus; and this is the first question I will be asked by the inspectors, whether I have covered the syllabus or not (...) Therefore, through random questions I let students respond; writing on the board while students take notes. (Interview, Mad. Njage, V1, T13)

Here, the teacher shows how she enacted the CBC reform through chalk and talk. Such teaching approaches show the resistance of teachers to the CBC enactment. In this excerpt, a sense of teachers' accountability to the external agency:

inspectors revealed. She was very aware of the teaching methodology necessary for CBC enactment. However, she failed to put them into practice due to the pressure of syllabus completion, which, is rooted in pressure from the inspectors.

I'm looking at an easier way to cover the syllabus because this is the concern of our inspectors; what they are looking for, either you have taught all the content or not. I make sure I complete the syllabus on time to avoid problems. I do not spend much time on participating students. I always give students what they are supposed to have for them to sit the examinations (Interview, Mad. Pamela, V1, T6)

Again, rather than the CBC reform, the teacher showed their accountability priority is to the external inspectorates to avoid getting themselves into trouble. The tension of syllabus completion appeared to be a major factor behind teachers' resistance against the CBC enactment, for the teachers to resist using a participatory approach and opt for a deductive approach. Also, the teachers showed concern for the examination. Thus, syllabus completion and examination attainment appeared to be the factors that influenced her teaching practice. Similarly, the following teacher expressed similar comments about the tension of syllabus completion and its impact on CBC enactment:

The learner-centred approach for this curriculum is a problem because the syllabus is so broad. Therefore, you can see many teachers use the teacher-centred approach because if you will use the student-centred approach alone, you will not manage to cover the syllabus (Interview, Mr Kapu, V2, T43)

This quote expressed the dissatisfaction of teachers with the weakness of the CBC. The main perspective of the teachers reflected on their responsibility to finish the syllabus. The learner-centred approach seemed the inappropriate pedagogy for the CBC because of the broadness of the curriculum. This perception of unsuitability led to resistance from the teachers. From this excerpt, it was clear that teachers responded to the tension of syllabus completion and tended to apply by using the teacher-centred instead of student-centred approach as recommended by the CBC reform.

The analysis of this research revealed that the teachers tended to use the deductive approach during their practice to respond to the tension of syllabus completion, which was a consequence of the curriculum inspectors following up on the curriculum implementation. Mr Usi posited:

Let me tell you one thing, the teacher most of the time is rushing to finish the syllabus. So, how I can cover the syllabus? to integrate activities into my teaching is a time-consuming; then my teaching will be dominated by lecture strategy rather than teaching by doing. So, here you can see; that is why today you find a student has been taught about the uses of Vanier

calliper, but if you ask them to perform real measurement they can't (Interview, Mr Usi, V1, T23)

Again, a sense of tension is seen in this quote. Although the teacher was aware of the impact of practical activities for students' learning, he refused to apply them to his students because of the tension of syllabus completion. The mismatch between the curriculum content and the instructional time appeared to be the major factor influencing him to use a deductive approach. The issue of teaching by focusing on the syllabus because of the pressure from inspectors was mentioned by another teacher:

In fact, I teach using methods that lead me to cover syllabus on time. This is the major concern of the inspectors and if they will find you have not covered the syllabus on time you have questions to answer. I also ensure that I cover syllabus to keep students comfortable. When a student completes the syllabus, and able to do revision, they feel comfortable and confident that they can perform well in the exams. (Interview, Mr Nkanda, V1, T4)

Here, again, syllabus completion was the main concern in response to the tension of inspectorates. This is to say that the teacher's practice was externally driven. Secondly, the teacher was trying to associate the syllabus completion with the students' confidence in facing the examination. The external examination also influenced this teacher's strategy for syllabus completion.

7.4 Chapter summary

This chapter presented the teachers' descriptions of their CBC enactment in the Tanzanian secondary educational context. The chapter described that the teachers were more accountable to the external agencies than the goals of the CBC because of the tension of the external examination and syllabus completion. In addition, the second part of this chapter presents various factors that influenced teachers on their CBC enactment. The teachers' practices were influenced by both personal, internal and external factors. However, this study shows that the internal and external factors had more impact on teachers' decisions about the CBC enactment than their internal influences. Many teachers in this study tended to resist the CBC reform in response to the tension of syllabus completion and external examination attainment.

Chapter 8 An Overview of the CBC Across Two Areas

8.1 Introduction

The previous chapters presented the qualitative findings from face-to-face interviews and the focus group discussions (FGDs) data. This chapter corroborates those findings through statistical results and specifically intended to respond to the fourth research question RQ4 (see Chapter 3, section 3.4). As I have pointed out previously in section 3.5, the RQ4 was structured with the aim of corroborating the interview and FGD findings with a broader population of teachers. The analysis here shows that the survey questionnaire corroborated many of the interview and FGD findings, but also raised some significant differences in teachers' responses about the CBC across the two areas of the United Republic of Tanzania. Thus, this chapter is organised into two key findings: corroboration, and differences across the two areas.

8.2 Corroboration of findings

The questionnaire was used to corroborate the key findings in the qualitative strand, the first being the range of aims in science education, as conceived by teachers (see Chapter 5). In the questionnaire (see Appendix D), question 12, the aims represented in the interview and focus group discussion findings were set out and the teachers were asked to scale their agreement in response to those aims in relation to their personal theories; professional beliefs and teaching experiences. Question 13 then allowed them to reflect on those aims in response to their present science CBC reform. This was to respond to the second research question (RQ2) in the qualitative strand, presented in section 6.3. The focus was to understand the teachers' personal views and judgements on the present CBC reform. Moreover, the way that a CBC was enacted was also among the key findings in the qualitative strand (see Chapter 7); therefore, the questionnaire was also constructed to investigate the same aspect with a larger population of teachers. Thus, questions 16 and 17 (see Appendix D) were constructed to understand how teachers enact the CBC within their local school settings. In this section, the corroborated findings were set out – the aims of the curriculum, conceptions of the CBC reform, and CBC enactment, as well as teachers' tension in response to CBC enactment. This section is organised around these four aspects.

8.2.1 Aims of the science curriculum

As previously pointed out in the qualitative findings in chapter 5, there are ranges of aims perceived by teachers as the key focus of the science curriculum. In response to the results from the qualitative strand, the aims of science curriculum were expanded to nine; question 12 (see Appendix D), and teachers were asked to indicate the scale of their responses to those aims in relation to their professional beliefs, understandings, and interests. As pointed out in section 4.6.2 (see Table 4.9), quantitative data were analysed through descriptive statistics, in which the frequency distribution was used to illustrate the percentage of teachers' responses to each individual curriculum aim. Using SPSS, the results summarised in the Table 8-1 were obtained.

Table 8-1: Teachers' responses in relation to the curriculum aims

Very Important (%)	Important (%)	Neutral (%)	Not Important (%)	Completely Not important (%)	Total (%)	
Fostering post-secondary education						
26.6	59.2	0.0	13.9	0.4	100.0	
Fostering vocational skills						
16.1	50.2	1.5	31.5	0.7		
Fostering future scientists						
23.6	54.7	1.9	19.5	0.4		
Fostering investigation and scientific process skills						
18.4	44.9	2.2	34.1	0.4		
Focus self-employment						
16.1	53.9	1.1	28.5	0.4		
Fostering the application of technology						
24.3	53.2	1.9	19.5	1.1		
Fostering environmental issues						
16.1	48.7	1.5	27.7	6.0		
Fostering scientific argumentation						
19.5	62.5	0.4	16.9	0.7		
Fostering socio-scientific issues						
13.5	45.3	0.7	38.6	1.9		

Teachers' responses were set on a scale of 1 to 5, where 1 means *very important* and 5 *completely not important*. The quantitative results show that the majority of teachers' responses in relation to each identified aim were rated 1 and 2; meaning *very important* and *important*. This means that, on average, the majority of teachers believed consideration of those identified aims was important in the science curriculum. In the qualitative findings (see Chapter 5), many of these aims were also identified as key focuses of the science curriculum. The results show that a higher percentage of teachers (85.8%) of cumulative frequency positively responded to the aims fostering students for post-secondary education, and followed by future scientific career at 78.3%. Increasing the pool of scientists seemed to be the main

concern of the majority of teachers, as revealed in the qualitative findings. It is important to note that in the qualitative results, many teachers thought about science and living in terms of individual economic gain.

In this quantitative result too, about 70 % and 66.3% of teachers' responses reflected on the aim of fostering students into self-employment and vocational skills, respectively. The aims of fostering vocational skills and self-employment appeared to be rated above the aims of preparing individuals for socio-scientific issues, by 7.5% and 11.2%, respectively. As in the qualitative strand, the results in the quantitative strand show that the teachers thought about what I call "*couplet aims*". This corroborates with the interview and FGDs, suggesting that teachers' concerns about the aims of the curriculum were more on science-related to individual economic gain, than science fostering individuals in decision-making about science-related issues.

8.2.2 Teachers' conceptions about CBC reform

In the interview and focus group discussions (see Chapter 6), teachers' responses to the CBC reform varied from positive to negative, across three aspects of the curriculum: aims, pedagogy and content. Moreover, in the interviews, teachers showed that there is a disjuncture between curriculum aims and national assessment. In the questionnaire (see Appendix D), question 13 was constructed using those three elements – aims, pedagogy, and external examination – to corroborate with the qualitative findings. Moreover, the open-ended questions (question 20; see Appendix D) were used to understand teachers' perspectives on the CBC in response to the curriculum content. The questionnaire was structured to obtain teachers' personal views and judgements on the CBC in terms of those four curriculum elements. Therefore, this section is organised into two parts. Teachers' responses to the curriculum aims, pedagogy and external examination are presented first, followed by responses to the curriculum content.

8.2.2.1 Teachers' conceptions on the aspects of CBC

Teachers' views and judgements about the CBC were investigated through its aspects – aims, pedagogy, and external examination. As seen in section 8.2, all teachers indicated the nine identified aims in the questionnaire were important within the science curriculum. In this section, the teachers were asked to consider those aims in response to the present CBC, but, at the same time, how it could be achieved in response to the pedagogy suggested by reform and nature of the national examination. To illustrate the results, the frequency distribution through percentage was used as a statistical analysis technique to understand the distribution of teachers'

responses, along the three aspects of the curriculum. In question 13 of the questionnaire (see Appendix D), the teachers were asked to scale their response where 1 is *excellent* and 5 is *very poor*. Using SPSS, the analysis of these three aspects of the curriculum were summarised, shown in Table 8.2.

Table 8-2: Responses on the aspects of the CBC

Excellent (%)	Good (%)	Average (%)	Poor (%)	Very Poor (%)	Total (%)
The present CBC matches with the aims indicated					100.0
9.4	35.6	0.4	52.1	2.6	
Teaching pedagogy as per the CBC is appropriate to attain those aims					
27.0	34.1	22.5	15.0	1.5	
National assessment reflects the aims of the curriculum indicated					
7.5	28.5	1.1	58.8	4.1	

Table 8.2 indicates that more than half of the teachers' responses regarding the aims and national assessment in response to the CBC fall under the fourth Likert scale response, *poor*. Also, 52.1% of teachers indicated the aims of the present CBC are poorly matched with their beliefs. This is similar to the national assessment. It may, therefore, be said that teachers do not feel that the aims of the CBC coincide with their prior identified aims and the national assessment was found to pull in opposite direction from what the science curriculum should be about. Connecting with the teachers' responses in section 8.2, this implies the aims of CBC in the Tanzanian educational context are inconsistent with the teachers' beliefs about how science curriculum aims should be about. This result corroborates with the interview and FGD findings (see section 6.3), as many of the teachers had negative perspectives of the CBC aims. Many teachers in the qualitative findings felt the aims of the CBC were contextually irrelevant, and it was superficial to put those aims into practice. Similarly, in the case of national assessment, many teachers felt that the national assessment does not correlate with the aims of the CBC reform. This means teachers felt the national assessment pulled in the opposite direction to that of the aims of the CBC as well as to the teachers' beliefs about how science should be assessed. This finding echoes the qualitative part of this study, and was one of the major causes of tension experienced by teachers in their practice. Many teachers in the interview and focus group discussion revealed that, despite the fact that the CBC focuses on application skills, the national examination still focuses on content mastery. Thus, examination was considered to be one of the factors that enlarged the gap between the intended CBC and the enacted.

Contrary to these aforementioned aims and the external examination, many teachers about 61.1% have positive responses about the suggested teaching pedagogy

promoted by the curriculum. In the context of this study, student-centred approaches were the suggested approaches for the enactment of a CBC. Table 8.3 shows the majority of the teachers' responses fall on the Likert scale at 1 and 2, meaning *excellent* and *good*, responding to the specified pedagogy. That is, the majority of teachers felt that the interactive teaching pedagogies are appropriate teaching approaches in response to the intended aims of a CBC reform. However, this does not mean that teachers exercised interactive approaches in their teaching practices, but rather represented their beliefs on how science should be taught, not what they actually do in the classroom. The details of their classroom practices are explained in section 8.4.

8.2.2.2 Content in relation to science CBC reform

In the questionnaire, (question 20; Appendix D), teachers were asked to respond to the curriculum content in relation to the CBC. In the interview and focus group discussion findings, it was shown that the CBC was overloaded with content, and as a result it fails to respond to local community needs. Therefore, to corroborate the qualitative findings, the questionnaire asked teachers to list topics they think should be added to the curriculum, to make it more relevant to the community. Teachers were also asked about the topics they considered difficult to teach. Thus, in this section, contents that need to be added to the CBC are presented first, followed by the contents that are difficult to teach.

Topics to be added to the curriculum

To explore teachers' perspectives about CBC reform, they were given an open-ended question to list the topics they think it is important to include in the curriculum. Teachers used different terms when listing the topics to be included in the curriculum, therefore, during analysis, some topics that featured in the same areas were combined. For example, teachers listed climate change, ocean environment, marine environment, and environmental science; all these were combined into one topic, *environmental science*. The findings of this variable are summarised in Figure 8-1.

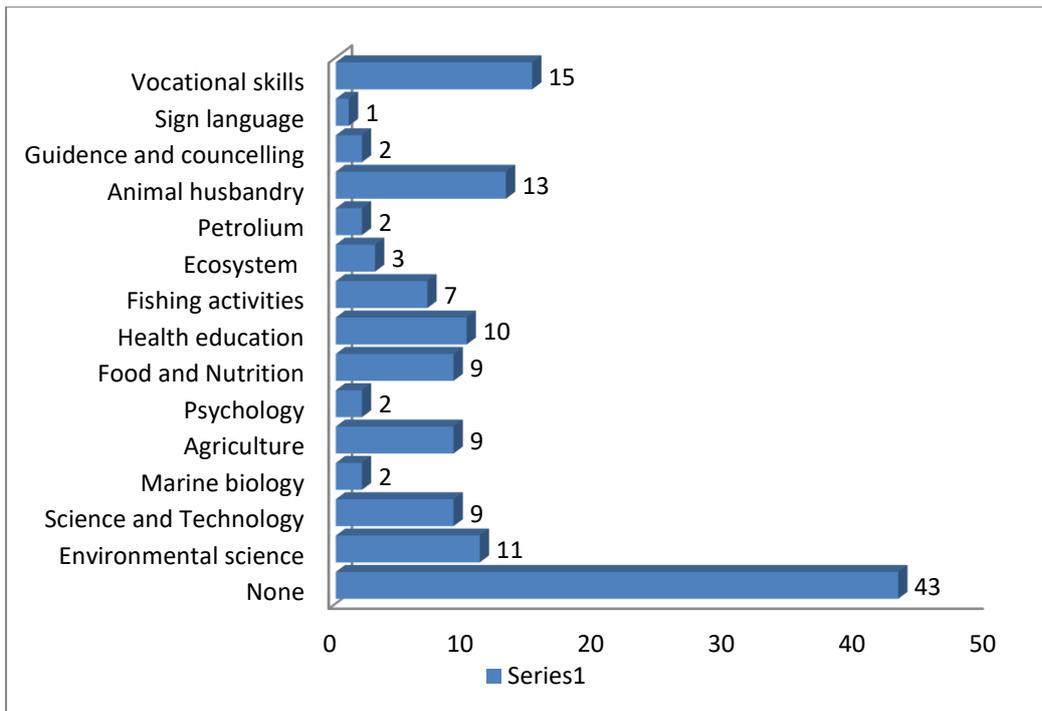


Figure 8-1: Content to be added in the CBC

This was an open question and therefore was not answered by all teachers, just 138 out of 267, and many teachers (43 out of 138) responded that no more topics should be added. They did not provide any reasons for not adding more topics to the CBC. The responses from the qualitative results showed that teachers refused the addition of any other content in the curriculum because they felt that the Curriculum was already very bulky. In the qualitative study, teachers argued that due to the bulkiness of the CBC because of too much content, they were always under pressure to complete the syllabus, which stops them from teaching science as they would like. Teachers argued that they constantly employ the chalk-and-talk teaching approach (see Section.7.3.2) to ensure that they complete the syllabus within schedule. This might be the reason that many teachers rejected any suggestion of adding new topics in the curriculum.

However, while there were teachers who disagreed with adding any content to the present CBC, others (95 in total) saw a need for additions. For instance, topics such as agriculture, food and nutrition, fishing, animal husbandry, and vocational skills were of interest to many teachers. In total, 95 teachers who proposed content additions, 53 (55.8%) wanted such topics, a direct link to vocational skills being added to the curriculum. In the Tanzanian context, most of these topics are taught at technical schools and vocational training colleges. Thus, it seems here that the teachers' focus was on the incorporating some vocational skills into the school

science curriculum, which could prepare students with manual and entrepreneurial skills, in turn engaging them in self-employment. The findings from the qualitative strand (see Chapter 5) are similar: the teachers' focus was on vocationalising the secondary curriculum in order to prepare individual students for their work lives. Here, the teachers were trying to refer to science and living: science that is not necessarily related to solid scientific issues, rather science that directly related to individual living and economic gain. Moreover, environmental and health education were also a concern for some teachers. They did not explain the reasons for incorporating these topics into the curriculum, but the qualitative findings revealed that teachers tried to reflect their local context. Topics relating to disease and environmental issues were suggested as important in the curriculum in order for students to cope with existing social problems.

Difficult topics in the curriculum

Teachers were asked to indicate topics they find more difficult in the CBC, giving their reasons why. The idea of this question was to find contributing factors behind teachers experiencing difficulties with particular CBC topics. Respondents listed a number of topics within the curriculum with which they experienced difficulties in their teaching practice, displayed in Figure 8.2.

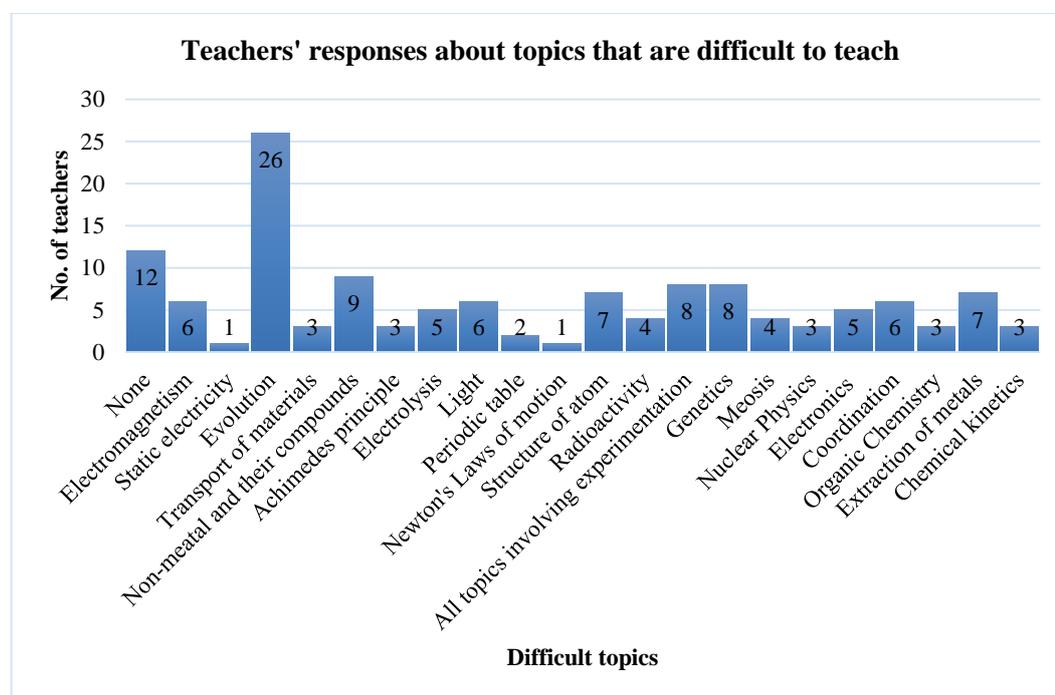


Figure 8-2: Difficult content/topics in the CBC

Out of 267 teacher respondents, only 132 answered this question. The results showed that many teachers, 26 out of 132, reported that they found teaching evolution (a biology topic) to be difficult, and a small number of teachers referred to

other topics as shown in Figure 8.2. In chemistry, the compounds of metal and non-metals seemed difficult, compared to other topics, such as atomic structure and the extraction of metals. Electromagnetism, light, and electronics were also listed by many as difficult, compared to other topics in physics. Topics involving laboratory experimentation also appeared to be a challenge for teachers in response to the CBC.

Further analysis indicates that across all topics, teachers had a similar rationale, that the difficulty in teaching those topics was the result of a scarcity of teaching and learning resources. In section 7.2.2, the qualitative findings showed that the scarcity of teaching and learning resources is one of the major factors impacting negatively on CBC enactment. However, in the case of evolution, instead of resources, teachers raised two other reasons: teachers' efficacy, and religious beliefs. The second reason was reported more by teachers from Zanzibar than Tanzania Mainland. This reflected the contextual impact on CBC enactment. Teachers in Zanzibar work in the community that are closely tied with Islamic culture and values, which appears to have a negative impact on CBC enactment in teaching evolution, in particular. These findings corroborate with the interview and focus group discussion findings (see section 7.2), wherein the majority of teachers also showed concern about the impact of teaching evolution to their community. Twenty-six teachers provided open responses, which were further analysed to show the differences between teachers in Tanzania Mainland and Zanzibar (see section 8.4).

8.2.3 Teachers' classroom practice

This section discusses how the teachers enacted CBC in the classroom setting. The classroom practice was measured in terms of teaching pedagogy and types of assessment practice that teachers employed in their practices. The qualitative findings showed that CBC reform was not enacted as intended, due to various factors (see section 7.2). The teachers reported that the interaction of those factors sometimes pushed teachers in a different direction to the CBC reform intended. Thus, many teachers reported using teacher-centred approaches, chalk-and-talk, and paper-and-pencil tests, which were not recommended by the CBC, nor reflected to the teachers' beliefs about how science should be taught. The questionnaire was used to corroborate the findings from the interviews and FGDs. A list of teaching pedagogies and assessment techniques were identified in questions 16 and 17 (see Appendix D). Many of those teaching pedagogies and assessment techniques were those identified by the teachers in the qualitative strand of this study. There are others that were not identified during the qualitative strand but were listed in the CBC

document. The teachers were asked to scale their responses based on how they used those teaching pedagogies and assessment techniques when enacting CBC reform. This section covers two responses about the conceptualisation of teaching in the questionnaire. First, the responses about teaching pedagogy will be presented, followed by responses about assessment practice.

Teachers' pedagogical practices

Eight teaching pedagogies were listed in the questionnaire, and teachers were asked to scale their responses in relation to how often they employed the named teaching pedagogies on a scale of 1 to 5, where 1 means *always*, and 5 *never*. The results are summarised in Table 8.3.

Table 8-3: The teaching pedagogy

Always (%)	Very often (%)	Sometimes (%)	Rarely (%)	Never (%)	Total (%)
Lecture					100.0
17.2	24.0	32.2	19.9	6.7	
Chalk and talk teaching					
28.8	41.6	18.7	6.0	4.9	
Questions and answers					
31.5	39.7	24.3	4.1	0.4	
Inquiry teaching					
2.2	19.5	27.0	32.2	19.1	
Classroom demonstrations					
20.6	40.1	33.0	5.6	0.7	
Laboratory experimentation					
17.2	33.0	41.2	6.7	1.9	
Group work					
6.4	35.6	41.9	16.1	0.0	
Role-play teaching					
8.2	19.1	31.1	30.3	11.2	

The results show that the chalk-and-talk, question-and-answer, and classroom demonstration strategies were popular as compared to the participatory teaching approaches (inquiry, laboratory experimentation and role play). This result shows that non-participatory approaches (chalk and talk, question and answer, and classroom demonstration) were frequently applied by teachers during the CBC enactment. For instance, the chalk-and-talk teaching approach was applied very frequently by 41.6% as compared to inquiry which was applied by only 24.0%. The findings of this study revealed that many teachers believe in teaching science through laboratory experimentation (see section 5.4). However, these questionnaire results show that a higher percentage of teachers (41.2% only sometimes involve their students in laboratory experimentation as compared to 17.2% who always apply experimentation teaching technique. These results show that inquiry teaching approaches were rarely applied as compared those listed in the questionnaire. This shows that CBC reform

was enacted as intended. In response to CBC reform in Tanzania, teaching and learning science must be undertaken through a student-centred approach, with the integration of ICT. However, this result shows that many teachers used opposite teaching approaches to what was suggested by CBC reform. These results corroborate with the findings in the interviews and FGDs, where many teachers reported using more teacher-centred approaches than student-centred. In the interview and focus group discussion findings, the major reason for teachers using this approach was to respond to the pressure for syllabus completion and external examination, which were coupled with the limited resources allocation.

Teachers' assessment practice

Teachers were given eight assessment techniques to indicate how frequently each features in their teaching practices. Apart from paper-and-pencil assessment techniques, the rest were identified in the Tanzanian CBC document. However, the paper-and-pencil assessment never mentioned in the CBC document within the list of assessment techniques, but was included in the questionnaire because many teachers in the qualitative strand reported of applying it in their classroom. This was also revealed in the quantitative study, as shown in Table 8.4.

Table 8-4: Teachers' responses on the assessment technique

Always (%)	Very often (%)	Sometimes (%)	Rarely (%)	Never (%)	Total (%)
Paper and pencil test					100.0
43.4	38.8	6.9	6.4	4.5	
Portfolios					
1.9	8.6	11.7	23.6	54.2	
Rating scales and rubrics					
8.2	11.7	12.1	32.1	35.8	
Observation using checklists					
8.6	15.8	28.2	37.6	9.7	
Oral presentations					
13.5	15.0	24.3	42.3	4.9	
Project work					
7.1	22.1	25.5	36.3	9.0	
Analysing the scientific information					
3.6	7.1	8.5	35.6	45.2	
Experimentations					
14.6	33.7	49.7	9.7	2.2	

These results show that paper-and-pencil assessment techniques were highly applied by many teachers compared to those assessment practices encouraged in the CBC. A higher percentage of 43.4% of teachers always assess their students using paper and pencil as compared to those of 1.9% who always use portfolios. In the CBC document (see TIE, 2007, p. 32), the portfolio and rating-scale assessment

techniques are among those recommended in order to develop students' engagement with learning. However, the results from this study indicate that a lower percentage (8.6% and 11.7%) of teachers were only very often used portfolio and rating scale respectively. This is similar to other recommended assessment techniques such as oral presentation, analysing scientific information and project work (see Table 8.6). This indicates many teachers were strongly against using the recommended assessment techniques as per the CBC reform. These results corroborate with the qualitative strand findings, because across all interviews and FGDs teachers confirmed using neither the portfolio nor rating scale in their assessment practices. Again, these results show evidence of teachers' resistance to CBC reform in terms of assessment practice.

8.2.4 Teachers' Tensions

In the interview and focus group discussion findings (see section 7.3) it was shown that, during the CBC enactment, teachers interacted with a broader range of personal, internal, and external factors. On the one hand, some factors pushed teachers in the same direction as the CBC reform and forced them to comply with them. On the other hand, other factors that pulled them in the opposite direction with the CBC and resulted high of tension to the teachers in their responses to a CBC reform. Therefore, the survey questionnaire (Appendix D) was developed to corroborate such findings across a larger population of teachers. In the questionnaire (question 19), a list of tensions were addressed, and the teachers were asked to scale their responses along the Likert scale of 1 to 5, where 1 means *strongly agree* and 5 is *strongly disagree*.

Table 8-5: Teachers' tensions from CBC enactment

Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Total (%)
Length of syllabus					100.0
40.4	41.9	1.5	14.2	1.9	
Teaching and learning resources					
29.6	50.2	3.4	16.5	0.4	
Instructional time					
24.0	46.8	1.1	25.8	2.2	
Work load (number of periods per week)					
37.5	36.7	1.1	20.6	4.1	
Class size					
34.1	39.3	1.5	23.6	1.5	
High-stakes assessment					
18.4	44.9	2.2	32.2	2.2	
School leadership					
20.6	33.0	2.6	34.8	9.0	
Inspectorates					
47.9	34.1	1.1	12.7	4.1	

School policy				
15.4	32.2	1.9	43.8	6.7
Personal beliefs about how science should be taught				
13.9	34.8	1.9	41.6	7.9

The teachers' responses to those tensions were distributed in Table 8.6. The results show that teachers experienced various tensions but the highest was syllabus completion, followed by scarcity of material resources, then inspectorates. Table 8.6 shows that a cumulative percentage of 82.3% of teachers felt that syllabus completion exerted high tension toward CBC enactment. This finding corroborates with the interview and focus group discussion findings, where many teachers reported employing the chalk-and-talk method to foster syllabus completion.

This tension was the result of how teachers' accountability was framed by the inspectorates. The teachers often reported that their quality was framed in terms of two main aspects: syllabus completion, and students' examination attainment. These were the key concerns of the inspectorates, and thus in this quantitative result, 82.0% of the teachers reported that the inspectorates were a cause of tension during the CBC enactment. This is similar to the responses regarding material resources, whereby a cumulative percentage of 79.8% of teachers' responses were between 1 and 2 on the Likert scale, meaning *strongly agree* and *agree*, respectively. In addition, the results of this study show that teachers' beliefs about how science should be taught pulled in the same direction as CBC reform, but many internal and external factors pulled in the opposite direction.

8.3 Differences of teachers' responses across two regions

As mentioned previously, the surveys' findings raised some similarities and differences in teachers' responses to a CBC reform in terms of the two areas of the United Republic of Tanzania. This section highlights those questions in the survey that showed significant differences between the two areas: availability of teaching and learning resources, and religious beliefs connected to teaching evolution. To illustrate these differences across the two areas (Tanzania Mainland and Zanzibar), a chi-square statistics test was applied to test the following null (H_0) and alternative (H_1) hypothesis. The level of 0.05 was used as a significance level that help us to make decision about the differences between the two regions.

H_0 : There is no difference in responses about a CBC between teachers across Tanzania Mainland and Zanzibar.

H₁: There is a difference in responses about a CBC between teachers across Tanzania Mainland and Zanzibar.

Thus, by conventional we will look for the p-value and if $p < 0.05$, we will reject the null hypothesis and accept the alternative one. In addition, the effect size was used to emphasise the level of differences, rather than just identifying them. Therefore, material resources will be presented first in section 8.3.1, and the teachers' religious beliefs will follow in section 8.3.2.

8.3.1 Availability of teaching and learning facilities

In section 7.2, many teachers reported resisting the CBC reform because of the scarcity of teaching and learning resources. In the questionnaire (Appendix D) questions 10 and 11 include a list of material resources, including laboratory, library, ICT, and internet connectivity, given to teachers to describe the status of each at their school. The analysis was intended to understand how the allocation of resources differs across the two areas, and results for each resource are presented.

Laboratory and laboratory resources

Figure 8.3 indicates that the availability of laboratories in regional wise was that, each region was quite good in terms of laboratory availability, with 90% of schools in Zanzibar having laboratories, and 99% of secondary schools in Tanzania Mainland, and Dar es Salaam in particular.

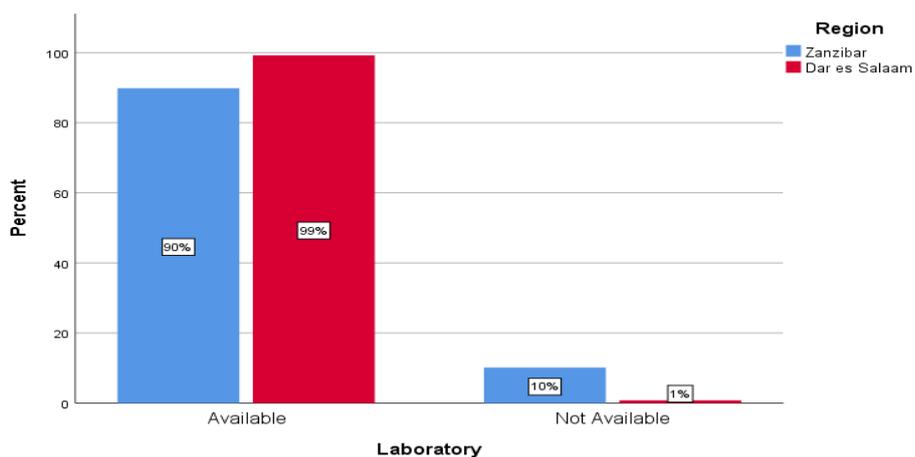


Figure 8-3: Laboratories

Further analysis through crosstabulation shows that country wise, the availability of laboratory in Dar es Salaam (Tanzania Mainland) was about 51% as compared to that of 49% in Zanzibar. This difference in the availability of laboratories between the two regions was significant ($\chi^2(1, N=260) = 11.04, p < 0.001$). This means that there

was evidence to reject the Null Hypothesis and this is to say that there was a difference in the availability of the Laboratory between the schools in Tanzania mainland and Zanzibar. How strong the difference was, an effect size test was carried out and it was found that Cramer's $V=0.2$ was obtained which can be interpreted as a small effect size. This means, however, there is significant statistical difference in terms of laboratory availability between Zanzibar and Tanzania Mainland, and Dar es Salaam in particular, but its impact is very minimal, as verified by the value of effect size. In the context of this research, every school that teaches science was expected to have laboratory space. Here, the teachers were referring to the actual laboratory room rather than laboratory materials. However, the results show higher levels of laboratory availability across the regions, but the availability of resources in those laboratories was different story. Therefore, teachers were asked to scale the level of resources available at their schools. Figure 8.5 summarises the findings in terms of laboratory resource availability. The results show that although a higher percentage of schools across all regions have laboratories where science experiments can take place, most of those laboratories run with limited resources. The result showed that Zanzibar schools suffer more with this resources problem, compared to Dar es Salaam.

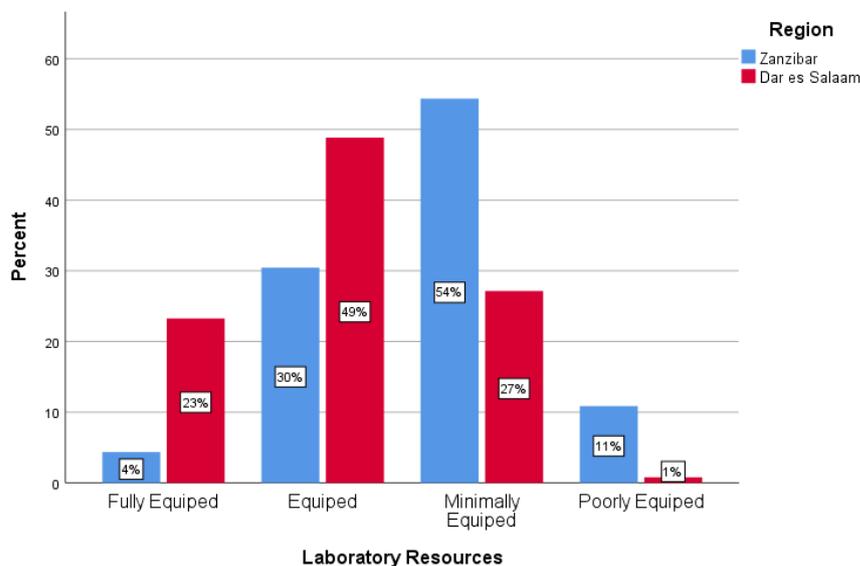


Figure 8-4: Laboratory resources

School laboratories in Zanzibar appeared to be poorly equipped with resources by 10% more in laboratory resources than school laboratories in Dar es Salaam. Moreover, the availability of laboratory resources in Dar es Salaam exceeded Zanzibar for fully equipped and equipped by 21 and 19 %, respectively. This means teachers in Zanzibar might experience more difficulties in teaching science,

compared to their colleagues from Tanzania Mainland. A chi-square value of 46.75 with a degree freedom of 3 and p-value of 0.001 were obtained, which suggests a statistical difference in the availability of laboratory resources between schools in Tanzania Mainland and Zanzibar. The rate of difference in equipped laboratory resources for Tanzania Mainland is 49%, compared to 30% for Zanzibar. A Cramer's V calculation of 0.4 suggests that the effect size between Tanzania Mainland and Zanzibar was large, implying that such differences of resource allocation might impact on teachers' responses to CBC, especially implementation. As mentioned in section 1.2, these two areas use the same CBC but two different educational authorities. This might be one of the reasons for these differences, alongside issues of economical differences across the two regions.

Internet connectivity

Internet connectivity was another major concerns about the CBC and the technological literacy through online learning. This is best carried out in schools with good internet connectivity, so teachers were asked to indicate the level of connectivity in their schools and Figure 8.5 summarises their responses. Despite the fact that the CBC emphasises the application of ICT, a huge percentage of schools in Zanzibar (95%) did not have internet connectivity, while in Dar-es Salaam about 78% of schools also were not. This might have a negative impact on the enactment of CBC. Reflecting on the qualitative findings, I met with teachers who expressed how they experienced difficulties illustrating abstract concepts due to the absence of connectivity at their schools.

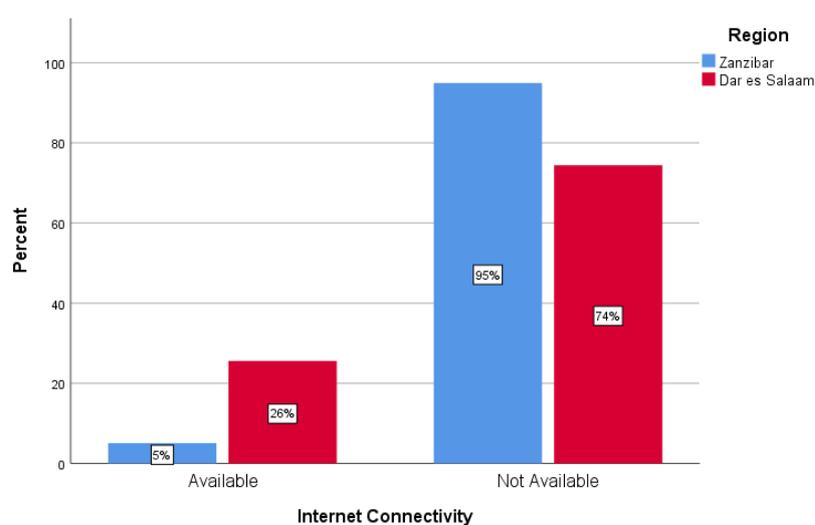


Figure 8-5: Teachers' responses on the availability of internet connectivity

Again, this result shows that Zanzibar suffers more with connectivity problems than Tanzania Mainland. A chi-square test indicates a value of 22.01 and the degree of freedom of 1 under the p-value of 0.001 were calculated. This suggests rejecting the null hypothesis and concluding that there is a significant statistical difference in internet connectivity between secondary schools in Dar-es Salaam and Zanzibar. The rate of difference in availability in Dar-es Salaam is 26% compared to 5% in Zanzibar. In terms of effect size, the Cramer's V is 0.3 which can be interpreted as a medium effect-size. This means that the impact difference from internet connectivity between Dar es Salaam and Zanzibar is an average.

Religious beliefs

In the qualitative findings, I have pointed out various personal factors influencing teachers in CBC enactment including cultural and religious beliefs (see section 7.2.1), especially regarding teaching and learning evolution and the origins of man. Question 21 (see Appendix D) was designed to ask teachers to list the difficult topics to teach in the CBC and the reasons for their difficulties. Teachers listed several such topics (see Figure 8-2) in section 8.2. The scarcity of teaching and learning resources (largely laboratory resources) and lack of internet connectivity were significant factors. However, the issue of teaching evolution showed teachers' religious beliefs to be a considerable factor. Similar to findings in the qualitative strand, there were significant differences between teachers from Zanzibar and from Dar es Salaam. The question was answered by only 26 teachers among the 267 respondents, but the responses were classified along three factors and the results summarised in Figure 8.6.

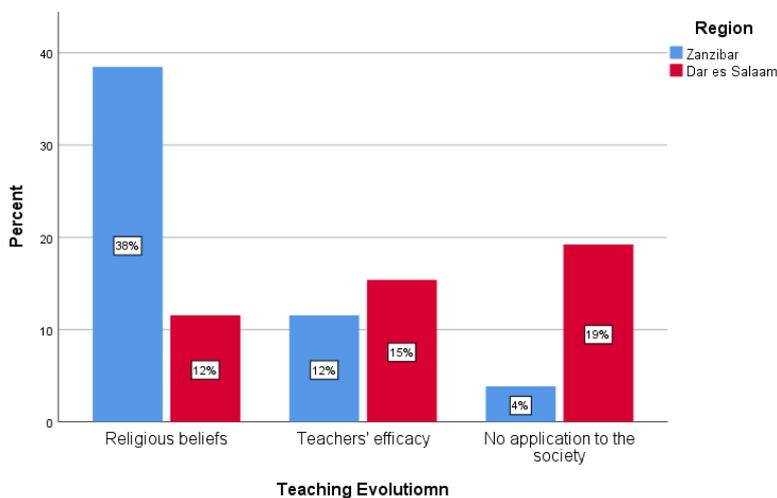


Figure 8-6: Teaching Evolution

The result shows that a higher percentage of teachers in Zanzibar reported problems about teaching evolution due to religious beliefs. The results here show that the teachers in Zanzibar whose teaching was negatively impacted by their religious beliefs was higher by 26%, compared to those in Dar es Salaam. On the other hand, many teachers in Dar es Salaam found that teaching evolution was difficult because it has no real application in the community. The teachers in Dar es Salaam were numbered 15% than Zanzibar in relation to the application of evolution to society. Further analysis from the chi-square test was described as $\chi^2(2, N=26) = 6.46, p=0.04$. This implies that there was evidence to reject the null hypothesis. In other words, we can say that there was statistical differences in responses to teaching evolution in Dar-es Salaam and Zanzibar. When the effect size was determined it was found that a Cramer's V of 0.5 was obtained. This can be interpreted as a very high effect size, and might also have a very high effect on teachers across the two regions in terms of teaching evolution and CBC enactment at large. These results reflect the contextual effects on the science curriculum. Teachers in Zanzibar looked at the science content in relation to their cultural and religious beliefs, while teachers in Dar es Salaam looked at the science content more in terms of impact on individual economic gain. Teachers in Zanzibar were more connected with the region's beliefs than teachers in Dar es Salaam, because of the cultural values of their communities. For instance, during Ramadan, the schools often close, and when they are open, the day is shortened to allow teachers and students to exercise their religious practices with little pressure from the school. It appeared that this culture has influenced teachers' perceptions about what science curriculum should be about.

8.4 Chapter summary

This section explored the extent to which the qualitative findings are consistent with a larger population of teachers from the quantitative strand. Moreover, it compared CBC responses between teachers from Tanzania Mainland and Zanzibar. The quantitative results indicate that there were high levels of corroboration across the two regions. However, although teachers across all regions experienced similar tensions with external examinations. Moreover, the results show that there were significant differences in terms of resource allocation, particularly laboratory resources, and internet connectivity with teachers in Zanzibar suffering more than their mainland colleagues. This chapter also shows that teachers in Zanzibar were at a disadvantage for CBC enactment as religious beliefs in their regions pull in opposite directions when teaching some science content, like evolution.

Chapter 9 Discussion

9.1 Introduction

In this chapter, a detailed discussion of how the research findings contribute to the existing literature will be organised by the following three aspects:

1. Couplet aims for science education
2. Teacher agency for the imposed curriculum
3. Science curriculum and socio-cultural practices

The couplet aims in science education are twofold: preparing individuals to increase the national pool of scientists, and fostering knowledge and skills for living. This discussion includes how the science curriculum and its aims are presented and formulated in relation to the national and socio-economic status within which the teachers work. The teachers' agency will be discussed because they had to interact with various factors. This section will discuss the broader responses of teacher to a CBC in relation to the factors that informed their decisions. The constraints and challenges teachers faced in facilitating the CBC reform helped to express their resistance, subservience, accommodation, and accountability to other external agencies. Thus, I consider how teacher agency influenced their personal decisions regarding the CBC reform enactment.

Finally, focusing on two regions of the same country with close proximity in terms of economic, social and cultural backgrounds produced insightful revelations about how the local context, community practices, values and cultural issues impacted on teachers' responses to the science CBC reform, revealing a complex interplay of socio-economic and cultural values within the local context and the general settings of the school and its impact on the school science curriculum.

9.2 Couplet Aims for Science Curriculum

The findings presented in section 5.2 in the qualitative strand and corroborated by the survey results (see section 8.2), revealed multiple aims of the school science curriculum. The consideration of educational aims in the science curriculum is not something new. For instance, Fensham (2009) write a lot about the aims of science education and how tensions interplay across these aims. Also, Ryder and Banner (2011) talked about multiple aims and shows how tension exist between these aims focusing largely on the policy document. In my study too, from the teachers' responses, I observed a ***couplet of aims for the science curriculum***. The word couplet is a physics phrase derived from the word "couple", literally means two equal

forces acting in two different directions. In my study, couplet aims meaning two aims of the science curriculum that sometimes pull teachers in opposite directions. The new aspect in my study is the way teachers brought out these couplet aims at a specific context of Tanzania and how the tensions of an increasing pool of scientists and the aims of responding to other social challenges interplay within teachers' responses. This means that the teachers had a very particular take on their social-cultural context. The teachers considered that an effective science curriculum, on one hand, to prepare students for science specialisation towards increasing the pool of science-related professionals, and, on the other, to prepare students who will not become scientists but simultaneously need to apply science in their living environments to respond to the trauma of shortage of employment and other social challenges.

The findings of this research call the need of a responsive science curriculum that could fully respond to the contextual reality of Tanzania in terms of its economic and broader social problems such as employment, health and others. This study also shares a close concern with Fomunyam and Teferra's (2017) work in South Africa. While their study indicates the importance of contextualising the curriculum as a way of decolonising the university curriculum, in Tanzania, in this present research, teachers show the need for contextualising the secondary-school curriculum to respond to the recognised social problems. The couplets aims in this study include the situation where the specific focus of the curriculum is to respond to the economic demands and challenges as well as responding positively to social and cultural norms of a particular context. Decolonising the curriculum may be a next step for school policy, but first we must make content relevant to context. My study indicates that the effectiveness of the curriculum not only depends on how the four elements of the curriculum – the goal, content, pedagogy and assessment – align together to respond to the contextual reality of society, but also how the teachers make the alignment feasible within their teaching practice. Here, two key aims will be discussed: economic aim, and the individual aims in response to the school science curriculum.

9.2.1 The economic aim in the curriculum

Like many studies across the globe (see section 2.6), the teachers in my study also believed that preparing students to become future scientists should be one of fundamental aims of the school science curriculum. This study revealed that the dearth of engineers, doctors and other experts in science-related fields within their living world were a major indicator for teachers' responses to the science educational aims. I am not trying to argue that in the so-called developed worlds there is no

shortage of scientists, obviously a similar problem exists there (see Smith, 2017; Smith and Gorard, 2011). However, the unique and distinctive finding in my study is the way teachers brought their local context into the science curriculum. While in the developed world, teachers talk about the shortage of scientists in terms of international competition (see Smith, 2017), in this study the teachers talked about the shortage of scientists while reflecting on social concerns such as health, education, sanitation, early pregnancy and the environment. There is clear evidence from this study that the contextual living environment and the social challenges have influenced teachers so that they wish to prepare individuals to be future scientists. In order to achieve this, a curriculum should support students to realise their living world within school curriculum. Here, it was not necessary to follow direct science-trajectories like engineers, doctors or teachers did, but there could be other forms of opportunities available locally to help individuals economically and socially. Because of the unsatisfactory standards of life and of social services, the teachers brought together the aims related to science and individual wellbeing.

In the literature review, I have shown how the internal and external school contexts influence teachers' responses to the goals of the science curriculum (see section 2.4). According to the teachers in this study, the shortage of skilled science personnel could be minimised if the curriculum effectively responds to what Fensham (2009) calls *subject maintenance demand*. Banner et al.'s (2009) study with lower secondary school teachers revealed that some teachers prioritise subject maintenance demand because of the context in which the teachers were working. Similarly, teachers in my study considered post-secondary science education to be the best gateway towards responding to economic issues via increasing the pool of experts in various scientific fields. As pointed out in section 1.2, the Tanzanian secondary education system has O-levels and A-levels and this study was carried out at O-level. Therefore, several teachers believed that the school science curriculum must focus on preparing students for A-levels as an avenue toward science career specialisation (see section 8.2). However, in terms of couplet aims the teachers were simultaneously concerned about students who might not continue their studies. For them, scientific knowledge could support their income in various jobs and their lifespan in general. In other words, teachers tried to bring together subject maintenance demand and science for individual wellbeing. This study stresses the role of local context in the conception of the school science curriculum, which is defined within the local boundaries.

A second example wherein teachers viewed the science curriculum in couplet aims was the association of scientist shortages with the poor structure of the school science curriculum. While the school science curriculum has a major policy role in

responding to national demand, including the shortage of scientists, the policy cannot stand on its own (Bowe et al., 1992). Effectively responding to multiple demands, including the dearth of science teachers, depends on how the policy is put into place. The teachers in this study reported feeling that the science CBC resulted in underserved teaching and learning environments. including lack of internet connectivity, shortage of laboratory resources (see section 7.2), and large class size hampering teachers' ability to enact CBC as intended. Such conditions were evident in other studies in similar contexts that found demoralising students to specialise in post-secondary education (see Ndalichako and Komba, 2014). In fact, increasing the pool of scientist personnel requires a constructive reform of the science curriculum that could respond to national need, including well-qualified teachers that could effectively structure the science curriculum and motivate students to remain in science (see Smith and Gorard, 2011). On the other hand, the school's contextual reality within which the curriculum is enacted really matters and has a major impact on retaining students in science. Therefore, whatever impact policy-makers think the curriculum should make, it is unlikely to be successful if the school teaching and learning environment is not taken into account for the enactment of that curriculum.

9.2.2 Individual aim in the curriculum

As pointed out above, the teachers raised similar concerns about students who would not be proceeding into science specialisation and those who would. Looking at the existing literature, this was also a key issue in developed countries. However, in the developed countries (Europe and the US, in particular) the focus is on scientific literacy that could help students analyse information and make personal decisions about science-related issues (see section 2.6). In my study, the teachers considered the science curriculum in relation to multiple social problems. Connecting these trends, it appeared that teachers in my study looked at the issue of scientific literacy slightly differently than in Western communities. Rather than talking about science in terms of preparing non-scientists that could engage in scientific debate and decision-making on issues such as climate change, global warming, genetics, biotechnology, and vaccination as commonly discussed in Western communities (e.g. Bybee, 1997; DeBoer, 2000; Ryder, 2001), in the context of my research, teachers thought about science content that could help students cope with everyday social problems. Several teachers in my research, coupled the aim of preparing students to become future science professionals with preparing secondary-school graduates with science knowledge on issues like drug abuse, early pregnancy, diet, personal hygiene, humans using dirty water and so on. These issues were very demanding in the social

settings where this study was carried out and include real scientific substance with current advancements.

In addition, the teachers used their identity to bring their context closer to the school science curriculum. Again, social challenges forced teachers to use their identities to reflect on the goal of science education. For example, Ms Kalorine (see section 5.1.2) was teaching biology in Dar es Salaam and identified herself as a mother. She coupled the aims of science education with the social challenges of early pregnancy and disease, suggesting that the school science curriculum should include content on these problems to avoid school dropout. It is well understood that teachers' identities derive from their "career history" (Buchanan, 2015) or from their professional specialisation (Ryder and Banner, 2013). In my study, the teachers' identity has gone beyond professionalism or from their school and classroom context to guardian roles in their local context. This is in line with Barrett's (2005) study, which was carried out in a similar context but with a different topic and with teachers who taught at a different level. Where the entire community faces several challenges that disrupt students' learning, such as early pregnancy and disease, teachers tend to be more concerned with the application of scientific knowledge to social challenges, especially science-health related issues. Because of such challenges in the community, *human biology*, which focuses on the body and health, received strong emphasis among biology teachers in my study. Aikenhead (2006, p.1) called such goals an "alternative rationale for science curriculum", the "science-related to daily activities, personal problems, social issues, or global concern" (p.2). In the context of this study, the democratisation of involving students in debating about socio-scientific issues was not a matter of concern; the teachers were rather referring to the utility of science education to the individuals as citizens. Rather than considering science education for preparing students to join a national dialogue on science-related issues, teachers in my study thought about science and individuals and their lives rather than broader perspectives where the students could participate in open debate as a free citizen. This might be another issue to be considered in the educational context of this study.

Here, the O-level is a terminal point for the majority of students; however, several got the opportunity to proceed with A-level studies. Some also attained scores sufficient to join vocational science certificate courses, including training courses. There are still many students who miss the identified opportunities due to performing poorly in their examinations or family economic reasons. As results leave huge numbers of youngsters in the streets with no work to do. Thus, the teachers coupled the aims of

science with preparing individual students for self-employment³, which is a common goal of school curricula in most African countries (see Akyeampong, 2014; Andrew, 1988). In this study, the teachers were not referring to big enterprises, but self-employment in terms of small entrepreneurial or manual work like agriculture, fishing, farming, carpentry, welding, electricians, business etc. The teachers in this study tended to criticise the present CBC for not considering vocational skills that could prepare students for self-employment. In fact, the emphasis of the current CBC is on scientific and technological literacy developed by enquiry and argumentation (see, TIE, 2007). The teachers' ideas of incorporating vocational skills within science curriculum were influenced by the shortage of local employment but the policy-makers' concerns were about scientific literacy across both Vision I and Vision II (see section 2.4)

The idea of a vocationalised school science curriculum is not a new phenomenon in science education, not only in developing countries, but even developed ones (see Bell and Donnelly, 2006). In the Tanzanian context, vocationalised school curricula began with the policy of self-reliance developed following national independence in the 1960s. During that time, some vocational aspects were incorporated into school curricula to prepare students for the real-life world of work (see section 1.2). This appeared to have a major impact on the teachers' beliefs about the goals of school science curricula. In practice, the goals of vocationalised school science curricula nowadays give little emphasis to the most identified common goals of science education. It is difficult to identify the vocational goals in science educational goals listed in the school science curriculum (Bell and Donnelly, 2006) or the other popular seven school science educational aims identified by Fensham (2009). But in my research, the teachers still consider vocational subjects as paramount within the school science curriculum (see section 5.1.2). The findings of this study indicate that the vocational components within the school science curriculum were considered an alternative means of helping students who could not manage to pursue further studies. In schools in England, vocationalised secondary science curricula were "driven by political/economic agenda that focuses on supply of trained personnel" (Bell and Donnelly, 2006, p.1404). In Tanzania, the vocational aspect in the school curriculum is influenced by the scarcity of employment opportunities. Teachers were that aware science knowledge and skills could enable students to utilise their

³ Self-employment is non-government employment that individual operating enterprise for themselves and sometimes might employ others.

environment for social and personal economic gain, to prepare individual students to meet their needs in a real-life context. The teachers were trying to respond to the national economy and the serious constraints of employment that students face when they complete secondary education. Again, this shows how the socio-economic status of the nation interplays with teachers' thoughts about the science curriculum, which has often been overlooked when curricula are implemented and arguably during their formulation too.

9.3 Teacher Agency for the CBC Reform

In Chapter 2, I emphasised that the teacher's capacity to act or make meaning about the imposed external reform is the result of the negotiation of teacher's theories with the social milieu with which they interact and live. I reflected on several aspects both personally and socially, that help to inform teacher agency. I also showed how such agentic forces interact within teacher's theories leading them to take several decisions regarding the reform: acceptance, rejection or constraint. Through my conceptual framework (see section 2.6), I have shown that teachers do not accept reform as naïve readers, so it is important to understand how teachers respond in terms of *resistance, accommodation, subterfuge and conformity* (see Bowe et al., 1992). This study shows that teachers' responses to the CBC reform were not always affected equally by all factors; the context in which the reform is enacted matters. For instance, investigating how schools do policy, Ball et al. (2012) showed that internal factors have a big impact on teacher agency in response to the school policy reform. However, other factors exist, such as accountability mechanisms and inspections, but the teachers' negotiation at school and departmental level had more impact. Other studies revealed similar factors, but the teachers' professional identity and personal goals had a strong impact on teacher agency in responses to the imposed curriculum reform (see sections 2.5 and 2.6). In my study, it was clear that external factors had more impact on teacher agency in responses to a CBC reform. In other words, teacher agency was much manifested from the external framing discourses and other social forces of the local community. In this research, the emphasis on examination had a big impact, the lack of resources had a big impact, and the regional and district educational authorities also had a major role in shaping and informing teacher agency.

These several external agencies were the main causes of the loss of teachers' autonomy, making them more accountable to external influences. The teachers often reported not enacted the CBC reform as intended by the policymakers. They usually

tried to negotiate their understanding of how CBC was about and enacted by considering several factors within and outside the school context. This study argues that powerful internal and external forces can weaken the teacher's autonomy and, subsequently, affect the efficiency of curriculum enactment. Therefore, the educational authorities, especially the leaders, need to provide balance to ensure that there is close alignment between the school's internal/external influences and the goals of the curriculum. In this research, teacher agency organises teachers into four major responses: personal evaluative, complement and adaption, constrain and subterfuge and tensions. In this section, I will present the four predicaments of teacher agency in response to the CBC reform.

9.3.1 Personal evaluative

This is about making decisions and judgements based on personal framing discourses in response to the imposed CBC. It is about intrinsic agency to the imposed curriculum reform. Despite the encouragement of CBC to improve the quality of teaching and learning in science, it seems that teachers were not enacting it as intended. Among other reasons were the limited understanding the teachers had on the real meaning of the science CBC. It appeared that there was no common consensus among the teachers and between teachers and policymakers about what the CBC was all about in responses to the teaching and learning science. Curriculum reform becomes alive when there is shared meaning among key educational players (Fullan, 2008), which was almost absent here. This shared meaning is expected to be observed across the whole pool of educational authorities; teachers, external policymakers, and parents (Helsby and McCulloch, 1997). However, many of the teachers had positive perspective on the CBC for science teaching and learning but they failed to act accordingly. The limited understanding of a CBC reform among teachers and between teachers and policymakers negatively affects the reform's enactment. This study recognises the argument that negotiation of meaning between teachers and external policy-makers is a long-term process. Hyun (2006) stated the teachers require detailed dissemination of the information about the reform. Here, I argue that although CBC has been accepted by many teachers in response to teaching and learning science, for effected implementation, this must also be accompanied by a good understanding of the real meaning of it with the shared model for the enactment.

The findings revealed the disjuncture between teachers and the external CBC reform in many ways. This was largely informed by how the teacher conceptualise and internalise the CBC within their personal discourses. Firstly, teachers' understandings

of what constitutes competencies concerning the CBC reform varied considerably. The teachers in this study framed the competencies in terms of abilities for students to develop hands-on skills (hard skills). As a result, the teachers were focused on preparing students for examination through scientific laboratory experimentation and competencies related to technical skills. Meanwhile, soft skills such as communication skills through debating, presentation and argumentation were side-lined despite their potential positive impact on students in their everyday lives. Thus, teachers' practices only focus on hard skills, yet the teaching and learning science must focus on both the scientific and general competencies or hard and soft skills (see TIE, 2007). The science CBC is intended to develop competencies related to both solid science and science for citizenship (see Bybee, 1997; DeBoer, 2000; Fensham, 2009). Surprisingly, the teachers from this research who focused on hard skills were those who spoke about the need for contextually-relevant science curriculum content to help students in their daily lives. This finding concurs with other empirical literature carried out elsewhere (e.g. Bantwini, 2010; Lee and Yin, 2011); that to facilitate effective curriculum implementation, the teachers must have clear understanding of the reform. Thus, the meaning of the reform needed to lead teachers into the enactment must be infused across all groups of teachers to keep the reform alive.

The lack of shared understanding also manifested through the different ways in which the teachers framed the meaning of the CBC, which put them in one of two divergent analytical categories. The first considered the CBC a pedagogical instrument of teaching, while the second considered it in terms of its educational aims (see section 6.2). This problem can be traced back to the fact that the CBC was described differently by different authors and even within the Tanzanian CBC document (see section 2.4). Evidently, this confusion does not start with the teachers but they surely magnify it. Teachers with two different understandings of the same curriculum might be an indicator of disjuncture in their practices. Their understanding of the reform – how they internalise the meaning of a particular reform – always serves as a road map for their practices (Bantwini, 2010). This is Fullan's (2008) argument, that when teachers differ from each other in their understandings of the reform, they likely differ in their enactment of it in their real school settings. When teachers lack shared understanding of the policy reform, their responses are likely to be driven by their knowledge (beliefs, personal biography, experiences and identities) rather than the official policy. This in turn supports the argument of Day et al. (2006), that when teachers' enactments are driven by their knowledge, beliefs and desire they might undergo the reform without taking into account its intended purposes.

The lack of shared meaning of the CBC also manifests through the divergent understandings of the CBC held by the teachers in Dar-es Salaam and Zanzibar. Beside its practical collaboration on political, economic and educational practices in the secondary curriculum, the teachers in Zanzibar appeared to be disadvantaged. This study revealed that the teachers from Zanzibar were at greater risk of failure at implementing the CBC as intended because their understanding of the CBC reform was inconsistent with their colleagues in Dar es Salaam. The major underlying factor was poor communication across the regions. The potential loss of shared meaning might create serious turbulence and might not only widen the gap of implementation between the teachers, but also disperse their educational outcomes. When the teachers across the region are provided with similar information about the curriculum, they might have similar commitment and accountability to the reform (Datnow and Park, 2010). According to Pont and Viennet (2017), effective policy implementation that leads to achieving the intended goal depends on practitioners receiving clear and correct messages from policymakers. As these regions have different educational leadership practices and their internal policies to address, sharing equal information about the reform is vital for any educational policy implementation. This study suggests that collective responsibility between the leaderships of the two regions is crucial for attaining similar educational outcomes; otherwise, the gap will always exist. There are economic inequalities between the two regions for historical reasons, which will not be delved into further here; however, it is crucial that education policies implemented today do not reproduce these inequalities but rather aim to address them. A very simple step is ensuring a rigorous amount of information is provided as clearly as possible, which currently is not the case.

As previously discussed, this study indicated that teachers had different views about the CBC reform. Further analysis of this was that teachers were either supportive of or negative about the CBC reform because of the meanings of the CBC they had. The study conducted by Bantwini study (2010) on perceptions of teachers about outcome-based curriculum reform in South Africa reaches a different conclusion, where one group of teachers were negative and unconstructive and the other was neutral about the reform. In my study, it was revealed that one group of teachers spoke positively and constructively about the reform while those who were negative acted destructively with it. The opposing views of teachers on similar reforms are common in the existing literature that studied similar theme like this elsewhere (e.g.Chang et al., 2009; Mellegård and Pettersen, 2016). The uniqueness of each study in most cases lies in the factors that influence teachers towards such divergence. For instance, teachers' beliefs, identities and perceived audiences were a major influence

on English teachers who had mixed responses to the statutory curriculum reform about teaching socio-scientific issues and the nature of science (see Ryder and Banner, 2013). In Taiwan, teachers had different perceptions about the goal of earth science education because of their teaching experiences, personal biography and the nature of the schools where they taught (see Chang et al., 2009). In my research, the intrinsic agency of teachers regarding the CBC reform was manifested by how they operationalised the meaning of the curriculum.

The concern is growing across the world and African governments, in general, have been emphasising science education for all to prepare students with all dimensions of knowledge – individual, social and environmental (Barrett, 2005). According to this study, the CBC reform has contemporary science-related content, such as renewable energy, personal hygiene, diseases, HIV/AIDS as well as content related to environmental issues that are contextually relevant. Indeed, the first group of teachers reported that the inclusion of such content made the CBC reform more relevant. This study shows that teachers associated such contemporary science content with the livelihood of individual students and the community at large. Referring to national and international literature, the individual and socially related aims serve as key predictors of science curriculum quality (e.g. Ryder and Banner, 2011; Semali and Mehta, 2012). In fact, the teachers' value judgements about the curriculum were entirely based on the policy text rather than how such a policy would be enacted in their context. The idea of looking at the curriculum from a single perspective – aims, content, pedagogy – without taking into account the socio-economic aspects have been criticised (see Su, 2012). The curriculum should be judged and defined beyond its instrumental goals, extending it to the context for which it has been written.

Furthermore, in looking to a specific element of the CBC such as content, as mentioned in section 7.3, this study showed that some curriculum content received less attention from teachers. Again, it was noted that the intrinsic agency of teacher such as religious beliefs influenced the teachers' personal evaluative about the content. Instead of looking at the relevance of the content in terms of time and objectives (Stuckey et al., 2013), the teacher here looked content and context. This study highlights the potential lack of local science content within the CBC. As it stands, the Eurocentric nature of the science CBC content means its application within the local community is not feasible. However, such curriculum content (e.g. static electricity, thermionic emissions, the structure of an atom, atomic theory, logic and gates) is very important in contemporary life with the development of science and technology. In relation to socio-economic and technological barriers, the CBC appeared disconnected from the students' real-life local context. Various evidence in

this research showed that the teachers were encouraged to focus on science content that was *more relevant* for the individual in relation to their local community, culture and economic status. To clarify, the teachers in this study were talking about the scientific knowledge necessary to prepare students for personal, professional and vocational futures as discussed more in section 9.2.

9.3.2 Compliment and adaptation of the CBC reform

There is a broader concern across the literature regarding the impact of personal influences on curriculum enactment. Similar to much of the existing literature (see section 2.5), I also revealed that teacher agency in response to the CBC reform was manifested within the personal boundary of teachers. The teachers do not always respond to reform in similar ways; how they construe the reform into their frame of reference informs their decision on how to respond to it (see section 2.5). In this study, there were few teachers, however, where teacher agency was featured within their personal boundaries with respect to the imposed CBC reform. This study shows that teachers' responses to the reform reflect not only on the relevance of that reform to their students but also to themselves in their role as a teacher. They adopted the external reform because they found it fitted within their frame of reference. Luttenberg et al. (2013) identified as framing the reform under assimilation. The teachers reported complying with writing lesson plans as a formal process of CBC enactment because of their personal discourses about what teaching should be about. According to these teachers, writing lesson plans was very important as it helped them to be systematic and confident in their teaching process. This agrees with McCutcheon's (1980) study, which found that planning not only helps teachers with "organising classroom instructions but also serves as a psychological benefit for teachers" (p.9). They demonstrated preparing a lesson plan as a guide in their teaching practice.

It must be noted that the social milieu not only conditions teachers' responses but also individuals. Sometimes, it is more about the proactive agency⁴ than reactive⁵ (see section 2.5). In the present study, three overarching personal influences: teachers' personal goals, teachers' professional experiences and teachers' personal biography inform teachers' decisions to comply with the CBC reform. These three influences appeared to pull in the same direction as that of a CBC reform in terms of

⁴ Teacher response to the imposed reform based on personal will, interest, desire and their personal goals.

⁵ Teacher response to the imposed reform based on norms and cultural milieu of the school; their practice is informed by their authorities.

how science should be taught. Interacting with the former content-based curriculum helped teachers to realise the advantages of the CBC reform, which internally serves as an agentic force to comply with it. This concurs with the argument that if the teachers experience success or failure in a certain practice, such experiences shape the teachers' practice (see Guskey, 2002). It was reported by several teachers that their decisions to adopt student-centred teaching were informed by the advantages of its interactive teaching pedagogy over teacher-centred teaching in terms of student's understanding. Therefore, enactment of the curriculum reform is the process whereby the teacher construes the meaning based on the interaction of physical and social settings within their teaching environment. This study recognised the idea that the teachers adopt or reject the reform based on its consequences or impact on the students or even on the teacher personally (see Goodson, 2001).

The motivation for teachers to adopt the school curriculum increases when the curriculum goals fit within the teacher's frame of reference (see Luttenberg et al., 2013). In this study, however, few teachers indicated that their personal teaching goals influenced them to employ participatory teaching approaches over non-participatory. Their goal was the development of multiple competencies including critical thinking and creativity skills and developing students' confidence. Their teaching goal seemed consistent with the Tanzanian CBC reform (TIE, 2007, p.13). The teacher's personal goals serves as agency and foster individual commitment to curriculum enactment. Therefore, some teachers whose personal goals align with the external reform expressed a greater sense of accountability to that external CBC reform than those whose concerns were about external examination.

However, not all teachers become reactive agents to the reform simply because they have been asked to by their authorities. Rather, the teachers' biography inform their agency to comply with the external CBC. This study concurs with the argument that teachers' responses to curriculum reform are not only politically and socially constructed (see, Luttenberg et al., 2013), but also reflected their personal live history (Goodson, 2014). For instance, several teachers in this study judged the present CBC by reflecting on the former content-based curriculum. Studying science through alternative to practical during their schooling helped teachers to accommodate the external CBC. The teachers reflected on the way they struggled at A-level because of being taught through alternative to practice, so they did not want their students to experience similar situations. This study argues that teachers' responses to curriculum reform and enactment represent the complex nature of teacher's lives from their student hood to present, including their interactions with their social and cultural context. As argued by Goodson (2001), the parameters of

teachers' practices in response to the curriculum reform, which include acceptance, rejection, resistance, subterfuge and accountability, range across broader terrain (p.31).

Teachers' personal goals tended to increase the sense of accountability to the external CBC reform, a finding echoing DeLuca and Johnson (2017), who argued that if teachers value formative assessment, they are more likely to practice it. In the context of this study, the challenges of resources and overcrowded classrooms cannot be overlooked due to their negative effect on teachers' assessment practices. However, some teachers (though few in number) were more accountable to adopting the assessment practice like those in the CBC reform document because of personal influences. Thus, because of the teachers' personal goals, they could not focus simply on grading targets as most teachers did. It is common for teachers across the educational literature, and science in particular, to hear about developing hard skills⁶ in their teaching.

Many teachers across the literature described applying certain pedagogical or assessment practices to develop such hard skills (Black et al., 2004; Harlen, 2013). However, my study revealed that some teachers' personal goals in assessment focus on developing soft skills, the non-scientific skills that could help students in their lives, especially in the world of work. I came across teachers who reported using individual and classroom presentations, debate and focus group discussion assessment techniques to develop communication, confidence and personality skills. The teachers' personal goals of using such assessment techniques were influenced by their personal reflection on poor soft skills some people had within their working environments. In my study, teachers argued that assessing scientific skills are important, but other transferable skills that could help students to communicate effectively within their future working environment is equally important. With these findings, my study concurs with others studies from other parts of the world and from different disciplines (e.g. Aresta et al., 2013; Nadais and Mocetão, 2019), agreeing science curricula should not only include fostering scientific competencies directly related to science and technical skills but also soft skills to link teaching and learning with real-life experiences. In the context of my study, the soft skills are well articulated in the CBC reform document but only few teachers were exercising them within their teaching practices.

⁶ Hard skills are those standard defined scientific skills such as laboratory and experimentation skills, scientific process skills, starting from data collection to interpretation and others.

9.3.3 Constraints and subterfuge in curriculum enactment

Pre-planning before teaching is a common practice. For example, in the UK, this is considered an important aspect of teaching and learning (Black et al., 2019; John, 1991). However, in the UK, Ofsted, the standard for educational inspection, “does not require the school to provide teachers’ individual lesson plans” and instead it leaves the responsibility to the individual schools (Ofsted, 2018, p.13). In the context of this study, writing lesson plans was considered a formal procedure of enacting the CBC. In fact, such formal processes, and lesson planning in particular, received two different responses among teachers - acceptance and rejection.

The issue of lesson planning prior to classroom teaching as a formal procedure for curriculum implementation recognises two descriptions. The first is in line with much existing literature that teacher's professional beliefs and their identities have a significant impact on their responses (Hermans et al., 2008; Levitt, 2002; Mansour, 2009), although it does not mean that professional beliefs or identities must match with the curriculum reform. In fact, the teacher's professional beliefs about what teaching should be or how it should be carried out are often more stable and harder to change (Pajares, 1992) with external instruction imposed (Day et al., 2006). My study shows that external pressure can force teachers to accommodate the reform into their practices, even if it contradicts with their professional beliefs.

Secondly, to respond to the curriculum reform, teachers receive different instructions that seem to help them with implementation. Instead of teachers finding such instructions helpful, they feel unsatisfied with the imposed reform (Zheng, 2013). As a result, a large group of teachers in my teachers felt that they were in control and the process of writing regular formal lesson plans reduced their professional autonomy. But because the teachers were always under pressure from several external demands imposed on them (Bowe et al., 1992), the alignment of external impositions with the reform helped to facilitate enactment. This study revealed that despite many teachers being less satisfied with the formal planning, they complied with the procedure nonetheless to avoid clashes with the authorities. This was the evidence of how teachers were expressing passive agency with the formal way of planning (see section 2.5). It was revealed that many of these teachers would write the lesson plan but ignore it during their teaching however, submitted it to their head of department to avoid clashes with their authorities. Their practices were conditioned by local school leadership and external assessment by the inspectorate, which in turn defines their accountability. The teachers’ negotiation with internal and external authorities

often “results in the mechanism of accountability” to the reform (Ryder et al., 2018, p. 98). In fact, they often wrote the plans to comply with internal and external demands rather than satisfying their professional views. This is consistent with McCutcheon (1980), who calls it the internal and external reasons for teachers planning the lesson.

While in other studies, such as Ryder and Banner (2013) the teachers shared their feelings about their students and the reform, in this study teachers spoke about how they feel about themselves in relation to the curriculum. While writing the daily standardised lesson plan was taken as a routine toward CBC enactment, the teachers in this study felt that it was extra work and less important than other aspects. This is what Zheng (2013, p.603) calls the *professional self*; how practices are good or bad as defined by the teacher themselves. The mismatch between teachers’ professional beliefs and the formal instruction of CBC reform enactment shifted the teachers into subterfuge (see Bowe et al., 1992). The study revealed that teachers resisted the reform and responded with subterfuge to hide the clashes between their professional beliefs and authorities; both internal and external. Teachers might resist the reform when they feel that it does not help their students (see Ryder and Banner, 2013). The evidence in my research shows that teachers might also reject the reform if they find that it threatens their autonomy or professional beliefs. Drawing from Day et al. (2006), a teacher’s professional beliefs have the power to support or suppress the enactment of reform. Thus, the policymakers not only have to focus on the benefits for students but also how the reform favours teachers in their teaching process. Where reform is imposed on teachers externally, not all of them can accommodate it into their practices; personal factors such as teachers’ professional beliefs and identities hinder them from adopting the reform (see Ball et al., 2012). Policymakers must clearly consider the teachers’ responses and try to consider their voice to enable effective reform implementation.

Sánchez and Valcárcel (1999) identified five factors influencing science teachers in their planning practices in Spain. These include content knowledge, students, objectives, teaching strategies and assessment. McCutcheon (1980) identified five elements of the internal school that influence teachers in planning in the US. These include teacher isolation, materials, administrative practices and school policy, school schedule and class size. Again, these studies indicate that the school’s internal influences have a big impact on teachers’ planning practices. In my study, which was conducted in a different context, I have come across similar factors including the teaching and learning resources; however, external and internal school authorities were strongly influencing teachers. Many reported planning laboratory lessons for

those levels sitting exams because of the shortage of teaching and learning resources. According to Ball et al. (2012), during policy enactment, teachers take different directions: of acceptance or avoidance. To the teachers in this study, it was not about acceptance or rejection, but internal/external motivation and accountability. Teacher agency was a feature of external framing discourses about who are good and bad teachers, about how the teacher is judged by internal and external authorities, media and other external agents such as parents. As a result, teachers demonstrate passivity before the external reform but are conservative with the external examination (see Day et al., 2006), no matter how aligned or misaligned it is with the external reform. This study suggests that increased external pressure should be used to support teachers in balancing their professional autonomy and the external reform, rather than oppose them.

Several studies focusing on teachers' planning practices identified textbook and syllabus as the key factors in planning practice (see Roche et al., 2014). In my study, it was revealed the external examination has a profound impact on teachers' planning practices. Several of them in my study reported that during the planning stage they were referring to the syllabus but also looked at past examination questions and incorporated some concepts that appeared in the exams but were not well emphasised in the syllabus. This was done purposefully to respond to the pressure of national examinations that teachers were experiencing internally and externally. The study revealed that the teachers became more accountable to the external examination board than the objectives of the CBC. Hardy (2013) also indicated that higher examination tensions result in low teacher concentration on student-centred learning. Therefore, if the teachers are working under an overemphasis of external assessment, their practice is likely to affect the whole range of curriculum enactment from planning to assessment practices.

Like many other developing countries, Tanzania adopted the CBC and defined it from Western educational policy perspectives; however, the teaching and learning contexts are dramatically different from Tanzania. In reflecting on teachers' practice through the lens of the teaching pedagogy, my findings show that many teachers' practices clashed with the underlying principles of CBC reform. The reality of internal school settings and infrastructure including the scarcity of teaching and learning resources, laboratory materials, and textbooks coupled with overcrowded classrooms, had a big impact on teachers' practices. Initially, almost all teachers' beliefs and understanding about teaching and learning science were aligned with the CBC reform. However, because of the barriers named above, teachers' classroom

practices fitted neither within their professional beliefs and understandings nor with the external CBC reform. Teachers' enactment of the CBC reform in my study encountered barriers that were not unique, especially in the educational context of developing countries (Chisholm and Leyendecker, 2008; Schweisfurth, 2011; Vavrus, 2009). In my study, unfavourable teaching and learning environments drove teachers to accommodate the CBC in their own ways. Many teachers expressed enacting the CBC through deductive teaching approaches, using chalk and talk combined with question and answers as alternative ways of at least making their lessons interactive.

In practice, such approaches are often different, as depicted in the pedagogical literature of teaching in response to the CBC (e.g. Byrne et al., 2013; Jones and Voorhees, 2002; Patrick and Bristow, 2014). However, the teachers were trying to accommodate the CBC reform the way they saw it fitted within their real-life teaching and learning context. Vavrus (2009) agreed that economic and cultural settings must be considered within teachers' practices. My study indicates that the conceptualisation of CBC teaching can include different features depending on the local setting where the implementation takes place. My study supports the suggestion of Ryder and Banner (2013) that rather than enacting the CBC reform as intended, the teachers were enacting the CBC by adapting it to the local school settings. In less educationally privileged settings like Tanzania, the CBC cannot be conceptualised in the same way as other countries especially those that are well resourced.

This study's findings call for curriculum reform to balance with the local school settings, including the school schedule. The teachers reported that the CBC reform made the syllabus to be too much content. However, they believed topics such as renewable energy, family planning, diseases, environmental issues and the like were very important in responding to socio-scientific issues. At the same time, it was thought to increase teachers' workloads, which is a common impact between curriculum reforms across the world (Day et al., 2006). In my study, the external reform was blamed by the teachers for lacking balance between instructional time and intended content and teachers felt pressure to adapt student-centred teaching and, in most cases, they tended to employ teacher-centred methods. Those teachers who tried to adopt the CBC reform and applied student-centred approaches found themselves lagging behind and unable to cover the syllabus on time unless they spent extra time on it outside the school schedule. While those able to cover the syllabus on time failed to apply interactive teaching approaches as suggested by the CBC reform, this situation was much fairer to the teachers of Zanzibar than of Tanzania Mainland. Due to the shortage of school buildings in Zanzibar compared to the student

population, almost all schools worked double shifts: morning and afternoon. Because of this, school hours in Zanzibar are two hours shorter than in Tanzania Mainland. With this observation, we can argue that teachers' adaptations of policy reform, such as the CBC, must consider the *local* and *cultural* context within which the policy is to be enacted (Braun et al., 2011). Again, my study shows how different contexts might affect the enactment of the same curriculum differently, not necessarily between developed and less developed countries, but even in the same locality.

9.3.4 Teachers' tensions

The pressure of external examination results in a lack of accountability of teachers to the statutory CBC reform. Several existing studies show the impact of teachers' beliefs on their practices; teachers who believed in teacher-centred approaches may limit involving students in their teaching practice and vice versa (Johnson, 2009; Levitt, 2002). In my study, however, the teachers believed that science should be taught through laboratory experimentation, though they did not apply the approach across all levels of student. Because of the limited laboratory resources and the external examination tensions, teachers negotiated these tensions and tended to teach by preference. Instead of teaching laboratory experiments across all levels as per the national science CBC, teachers gave priority to those classes sitting the national examination. There was no doubt that the teachers did not fully implement the CBC reform as intended. but this does not mean that the teachers were truly in opposition to the reform, but were showing what Lutzenberg et al. (2013) called *toleration*. However, rather than showing toleration towards the external curriculum reform, in this study, teachers showed toleration to the external examination board. They were able to make compromises with their personal beliefs about teaching science through experimentation across all levels and tended to focus on a specific level because of the examination. In other words, teachers shifted their accountability from the statutory CBC reform to the external examination board.

Moreover, the tension of external accountability overrides teachers' resistance towards enacting the CBC reform as intended. In responding to the CBC enactment, teachers were responding to multiple demands such as written documents, syllabus coverage and students' examination attainment, everything used to measure their abilities. Thus, the evidence of the study shows that teachers responded to the CBC reform with anxiety about their abilities (Ball et al., 2012). The tension the teachers experience because of their professional beliefs and their authorities challenged their practices, and therefore rather than teaching as per the CBC reform, teachers focused on the coverage of the syllabus and examination attainment. This shifted

teachers' accountabilities from the external CBC reform to the external inspectorates, which in turn distorted the CBC enactment. In the context of this study, the inspectorate distorted teachers' practices especially as their main concern was syllabus completion and written official documents, like a lesson plan. Such tensions influenced teachers to teach at very high speed to manage the syllabus coverage. My study supports Ryder et al. (2018) in that the powerful accountabilities of teachers to external agencies such as inspectorates, parents and other educational authorities distort the real implementation of the CBC reform. My present study highlights the role of the external authorities in the curriculum enactment. As a result, this study argues that external school authorities are likely to distort the policy enactment if their concerns fail to incorporate the complete policy objectives into leadership practices, including how they evaluate teachers' abilities.

Assessment practice has been found by many studies to have a powerful effect on strengthening or breaking up the enactment of any school's curriculum (see section 2.4). This study revealed similar findings to other studies conducted elsewhere like the US and Taiwan (e.g. Barnes et al., 2017; Wang et al., 2010). However, all these studies focused on pre-service teachers, but their conception and goals of assessment for teaching and learning are closely related to my study. Barnes et al. (2017) revealed three purposes of classroom assessment: for accountability, teaching and learning, and irrelevance. In my study, teachers' assessment practices were on assessment for learning and for accountability, but accountability had a major impact on their practices. Moreover, Wang et al. (2010) revealed that teachers' assessment practices intended to measure content knowledge, process inquiry, and attitudes towards learning. In this study, most teachers' assessment practices focused on measuring content knowledge and laboratory experimental knowledge to prepare students for external examination. Some teachers, however, used assessment practices to develop soft skills such as communication skills, as in section 9.3.

Involving students in formative assessment practices such as self-assessment and peer assessment (Wanner and Palmer, 2018), group discussion and project work and experimentation portfolio and rubrics (Bell and Cowie, 2001; TIE, 2007) can show good practices toward CBC reform enactment. However, in many cases, this was not feasible because of the challenging teaching and learning environments (Broadbent et al., 2018; Hanushek, 1997) or high-stakes assessment (Hargreaves, 2005; Kelly, 2009). My study also found teachers' assessment practice in response to the CBC was challenged by internal school influences, coupled with external ones. Thus, because of the overcrowded classroom and other internal schools barriers (a)

teachers were forced to apply different assessment practices, which undermined their autonomy; (b) teachers failed to provide effective individual feedback, and therefore relying more on ticks and crosses rather than written feedback so students might understand their mistake and improve; (c) students' understandings were measured by the grades from written tests rather than presentation or any forms of social learning, which is the key idea of the CBC; and (d) the laboratory experimentation and project assessment were only employed in selective classes across all levels. Responding to Izci (2016), about the factor impact of teachers adopting assessment for learning, my study revealed that the school context and resources-related factors negatively impacted teachers' ability to apply assessment practices in response to the CBC reform. Thus, this study argues that teachers are unlikely to adopt curriculum reform such as CBC simply because of the good instrumental goal it has in relation to students' learning. The school's contextual reality, including resources allocation, should be considered to ensure they fully support the underlying principles of the intended reform.

This study shared findings with other studies conducted in Tanzania (e.g. Semali and Mehta, 2012) and elsewhere in the world (e.g. Crujeiras and Jiménez-Aleixandre, 2013), that poor teaching and learning environments hamper teachers' practice on reform enactment and assessment, in particular. However, my analysis for this study revealed that even when those barriers were taken into account, the mismatch between teachers' practices and the external CBC reform would still exist. This is because of enact curriculum under high tensions of both internal and external which sometimes does not in line with the intended goal of the curriculum. For instance, in this study, the tension of schools' performance held several teachers' assessment practices accountable to a high-stake assessment. The relationship between schools' orientation and the external reform played a significant role in the teachers' classroom practice (Izci, 2016), including assessment practices. The performance-oriented conceptions the schools hold influenced teachers to lose their sights towards assessment for learning as suggested by the external CBC reform; instead, their assessment practices were examination-driven.

Due to the schools' performance-oriented practices, none of the internal school policy focused on facilitating or motivating teachers to apply assessment practices that support the enactment. All schools' assessment policies aim to attain students' pass rate. The teachers failed to accommodate the external CBC reform assessment practices because the internal schools' concerns were more about performance orientation than learning orientation. Havnes and McDowell (2008) show similar concern when teachers experience the high tension of a high stake assessment from

the internal school authorities; teachers' resistance towards employing formative assessment were associated with performance-oriented school practices. For instance, I came across many schools with reward systems wherein teachers' abilities were assessed according to the credit students received from the national examination. There were even schools that paid teachers according to the As and Bs students attained in the national examination. This results in teachers' competition than teachers' collaboration that had negatively affected the CBC enactment. The teachers spent their time drilling students with content knowledge to prepare them for the examination. In addition, the teachers taught at high speed to ensure that they finished syllabus early with enough time to solve some past examination papers. This implies that teachers lack the support from the administrators to effectively enact the external CBC reform. If the same effort were used to motivate teachers to apply assessment for learning that supports the CBC enactment, the teachers could be likely to accommodate the CBC reform into their practice. Thus, I argue that policy reforms such as CBC are barely adopted by teachers because they lack a better teaching and learning environment; this will remain unchanged unless schools' official administrations are educated to provide effective support to teachers complying with the reform.

Many external educational stakeholders conceptualised effective curriculum implementation in terms of students' examination attainment. Thus, the good and bad school or teachers, the competent and less competent, the responsible and less responsible were judged by external examination results. For instance, while I was reporting the findings of this study, the national examination council of Tanzania – the responsible board of national examination – publicly announced the examination results and listed the top and lowest ten schools in terms of the national examination results. Such emphasis on students' examination attainment harms teachers' practice in response to the CBC enactment. For example, many teachers explained their situation in terms of sports players, suggesting that their success is determined according to the number of goals scored. This might be the reason for many teachers expending all their efforts and energy to learn new tricks to winning easy goals (obtaining high student attainment scores) rather than learning new assessment techniques related to the new reform. The teachers' assessment practices were shaped by how their abilities were conceptualised by the external educational authorities (Poulson, 1998). The external examination policy was reported to have similar effect on teachers who adopt assessment for learning in other countries (McMillan, 2005). The examination tension the teachers experienced from their educational authorities and parents forced them to adopt assessment practices

neither in line with the CBC reform nor with their own beliefs and understanding, but to make them valued by their educational authorities and parents. This study revealed that regardless of the call from the curriculum developers, teachers should employ varied assessment techniques which facilitate students' learning, the external influences prevent teachers from improving assessments, instead partaking in practices for the immediate attainment goals.

As mentioned in Chapter 1, through the CBC, teaching should focus on many competencies such as problem-solving, creativity, argumentation through modern interactive pedagogy etc. (see TIE, 2007). Despite this concern, tensions between the intended goals of the CBC and the nature of the CBC document (the relationship between instructional time and the amount of the content) are obvious. These mismatches contrast with the principles of the CBC policy, thereby placing teachers on a difficult negotiating ground between traditional modes of teaching focused on syllabus completion and the application of new interactive pedagogies. This study showed that teachers devalued the current CBC because of the insufficient instructional time allocated and the amount of content within the curriculum. As a result of this mismatch, teachers experienced tension between teacher-centred and student-centred teaching – the latter being a key facet of the CBC. Such tensions between traditional modes of teaching and the new are not odd (see Byrne et al., 2013). Byrne et al. argued that teachers' experience of applying traditional modes of teaching might be a cause of tension. Thus, Ryder and Banner (2013) suggested that teachers need enough time to make the reform a part of their practice. However, in the context of this study, it has been more than a decade since the inception of the CBC, yet teachers were still sceptical about it. This study shows that teachers looked at the reform from multiple angles driven by *personal* knowledge before putting it into practice, and this might lapse when reforms fail to meet teachers' professional criteria. Thus, it is evident that policy implementation is not as straightforward as teachers always experience different tensions; tensions of their personal beliefs and understanding and tensions due to the internal constraints of teaching and learning resources and instructional time. The policy itself must be transformed, based on the feedback from those enacting it – the teachers – and must reflect on the real context of the school.

9.4 Science Curriculum and Socio-cultural Practice

The need for cultural sensitivity was evident through some of the concerns expressed by the teachers. In the broader international literature, under-representation of girls

and women in science education and science-related careers is identified as a clear cause for concern. Typically this is ideologically framed as a demand for global social justice and equality. The gender equality argument tends to be expressed in terms of equal representation of gender on science specialisation to ensure gender balancing in the workforce (e.g. Fensham, 2009; Gough, 2002). In contrast to this perspective on gender equality in the wider literature, the teachers in this study emphasised gender equality in science education in relation to maintaining their cultural and religious values. In the context of this study, because of religious and cultural context, women being attended by male doctors for some procedures such as maternity care is considered unethical (see section 5.1). Thus, as a result of this local cultural emphasis on women being attended by only female doctors for some issues, there is a strong need for a science curriculum to encourage girls on science specialisation in order to have more female doctors. This was more of a concern for the teachers from Zanzibar where society remains closely tied to Islamic culture than on the Tanzania mainland. Thus, my study shows how the social and cultural norms stimulated teachers' responses to the science curriculum. This is the evidence of the sensitivity of the context and its impact on science curriculum and its enactment.

Religious and cultural beliefs have a big influence on teachers' decisions regarding curriculum and teaching in this study. While in the US, topics like evolution appeared repeatedly in the science curriculum reform document and considered as important in fostering development of scientific literacy (Sickel and Friedrichsen, 2013). The science CBC in biology for the Tanzanian secondary education articulates teaching evolution to develop a critical and cognitive understanding of theories of evolution in science education (URT, 2013, p.163). That is, evolution considered as among the key topics in the science curriculum. However, the evidence from this study indicated that such curriculum content lacked considerable attention for teachers and many of them rated it as irrelevant and even proposed it to be removed completely from the curriculum. It is not within the scope of this study to talk about the impact of religious beliefs on teaching evolution, but the findings of this study highlight the impact of social-cultural beliefs and values on science enactment. This is indicative of a lack of knowledge among teachers based on the difference between acceptance and understanding in relation to science education (Borgerding, 2017). The study indicates the importance of considering teacher efficacy in teaching about controversial scientific issues such as evolution. The evidence of this study showed that several teachers were reluctant to teach evolution because it contradicted their religious faith as well as that of their students. Again, this also was more severe for teachers in Zanzibar as their culture is more connected with Islamic beliefs as

compared to the teachers in Tanzania Mainland: Dar es Salaam in particular. The clear message of this finding in relation to the goal of this study is that the personal variables like a teacher's religious beliefs as well as external variables such as socio-cultural values are among the key predictors of teachers' response to curriculum reform and teaching.

When Aikenhead and others subsequently (e.g. Aikenhead and Jegede, 1999; Borgerding, 2017) talked about border crossings in science education, they focused on challenges and difficulties experienced by students when they crossed from "everyday life to the world of science". In my study, the difficulties and challenges of crossing the border from the social-cultural life to the world of science education were relevant to the teachers too. This happened across all parts of the study but it was more common in Zanzibar than in Tanzania Mainland. The evidence of this study gives out a different sense of the critical picture of the context within science education and curriculum enactment across the regions. It is more about the holistic way of looking at the impact of the cultural forces within the county which many pieces of literature have not yet widely talked about. I argue here that the socio-cultural variation is very important in taking forward science curriculum enactment particularly for teaching universal knowledge, for instance, the origin of man or evolution. This shows the problem of looking at education separately from social-cultural norms and values particularly when it is often western perspectives that dominate. The trend of many developing countries copying curriculum concepts based in western communities needs to be considered before taking the policy forward by making a clear reflection of their social and cultural background. This study suggests that if the policy-makers tend to ignore the reality of the socio-cultural values and teachers' religious beliefs, the science curriculum is unlikely to be implemented as intended especially on those controversial scientific issues.

There is a growing concern nowadays across the globe about integrating environmental education into school science curricula (see Fensham, 2009). This lead to some strong recommendations: that a science curriculum should be structured with theory and activities to support students' on environmental knowledge to develop future pro-environmental citizens (Littledyke, 2008). All teachers in my study shared concerns about the importance of environmental education to the local community. However, integrating environmental education with physical science produced contrasting remarks. Littledyke (2008) suggested some limitations of integrating environmental education within the science curriculum because of the negative attitudes' students have towards science. Thus, students might lack interest in environmental education because they are in the science curriculum. In my study, the

teachers opposed integrating environmental education within science because it made the science curriculum dense, which would negatively impact its enactment. I argue that unless the curriculum developers select the additional environmental content with direct links to a particular science subject, its impact will probably not be observed as intended by the developers.

Alongside this, the teachers who support the insertion of environmental content within science curricula consider science education has a fundamental role in developing understanding and knowledge. Also focused on developing awareness of environmental issues and their impact on the local community. The teachers' responses were influenced by a lack of knowledge and awareness in the local community about environmental conservation and waste management. Activities like deforestation for charcoal production, burning plastic materials and increasing plastic waste played on their minds. The teachers looked at environmental education in the science curriculum as close to their local context (see section 5.1.3). The environmental activities in their community linked directly to common environmental issues such as global warming, climate change, ozone depletion and ecological systems that are globally renowned but rarely heard about from the teachers; instead, the teachers were linking environmental pollution with health issues and cleanliness. This reflects basic sociocultural theories in the sense that "what is considered as important in one context may not be seen the same way in another because of the cultural or economic reasons" (Taylor, 2009, p.4). The teachers in my study looked at the science curriculum and teaching as changing students' attitudes so that they become future pro-environmental citizens that could respond positively within their local community. This contradicts Cotton (2006), who claimed the teachers' concerns were about bringing out the balance of environmental issues to students and not changing their attitudes. My study shows similar concerns to many studies in the existing literature on the role of school curriculum to the environmental education (see Littleddyke, 2008; Taylor, 2009).

In addition, the sociocultural sensitivity in relation to environmental issues revealed economic activities exercised locally. The study revealed, however, the CBC reform made strong efforts to increase some environmental content, but still local communities lacked knowledge or awareness in environmental education. It was reported that some vegetable farmers used untreated wastewater such as sewage water or wastewater from the industries for farming (see section 5.2.4). The teachers thought about social activities with direct links to scientific understanding in terms of human health and safety. The study shows the need for the science curriculum to focus on developing cause-effect knowledge about environmental education. This

was expected to develop knowledge and understanding of environmental issues and to empower students to become change agents within their community. This reflects the idea that “an effective curriculum should focus on developing application knowledge to the individual and community rather than knowledge itself” (Ryder, 2001, p.35).

With this said, it was surprising to find through my study that the teachers’ concerns about environmental education were closely related to the current CBC reform. However, the findings show that the impact of the curriculum on the local community, based on environmental conservation and management, not only lacked recognition from policy-makers but also those who implement it (teachers). The study revealed that teaching and learning science was offered to prepare students for subject knowledge acquisition. The teaching was driven by the external assessment and pressure from external educational authorities. For developing true future pro-environmental behaviour, environmental education needs to be taught through outdoor approaches (Coertjens et al., 2010; Littledyke, 2008; Taylor, 2009). Methods such as field trips whereby students can be involved in real experiences are highly recommended. While such approaches are recommended within the CBC, there is a lack of evidence of teachers using such approaches. Instead, their teaching relied heavily on chalk and talk where the classroom assessment and activities are exam-oriented. External pressure forced teachers to race through content to complete the syllabus.

This study argues that to develop a well-informed environmental decision community, curriculum alone will not work. The educational authorities must recognise multiple aims for the science curriculum rather than concentrating on immediate aims such as examination results and syllabus completion. Finally, it is integral that the immediate context be taken into consideration when constructing curricula. This can positively influence the uptake of science and make significant steps towards the development of a knowledgeable, healthy and potentially more engaged citizenry.

9.5 Summary of the Research Contribution

In this research I have developed an understanding of teachers’ responses to the imposed curriculum and its enactment. In the literature review and in the conceptual framework, I emphasised that teachers’ responses to the imposed curriculum are about personal agency. Teachers responded to the reform because of the interaction of sociological forces with their personal desire, understanding and professional beliefs about how science curriculum and teaching should be about. Through this

research, I have shown how the interaction of teachers within various factors informed their decision about the CBC reform and its enactment. The research illustrates that teachers' responses to an imposed curriculum are not only a process over time but also a complex process whereby teachers undergo ranges of responses for a single reform informed by different agencies.

This research outlines two key issues in the teacher's response to the CBC reform. First, the teacher agency is featured within their local and socio-cultural context where they are living. A clear relationship was revealed between the political, economic and cultural backgrounds of the country and the teachers' response to the science curriculum. The interplay of socio-cultural and economic activities exercised by the local community was found to have a strong impact on teachers' response to the curriculum. Secondly, the teachers' responses are manifested within the external framing discourses. The power of the external accountability mechanisms and how they influenced teachers in responding to the imposed external school science curriculum. In this study it was shown that external educational authorities both at district and regional level have a significant impact on teachers in responding to the school curriculum. The external examination results, which serves as a criterion for judging teachers' responsibility and accountability, also influenced teachers' responses to the reform. Therefore, this section is summarised by these two aspects. Of course, the research revealed many findings that already existed in the literature, but the present research enriches the understanding and important considerations of context and the high tension of external accountability in the science curriculum.

9.5.1 Contextualisation of Science curriculum

In response to the literature review presented in Chapter 2, science is constructed to meet multiple aims in the real world. The teachers' responses to such educational aims indicated similar concerns as other studies (see section 9.1). Like many other studies (Hodson, 2014; Roberts and Bybee, 2007) this also revealed the dualistic nature of science curriculum aims: preparing students for future scientific careers and preparing students with science for living. In this study, the teachers responded to those aims reflects the sensitivity nature of the context. A CBC was intended to prepare individual students who are competent for science in post-secondary education. Also, to develop a range of scientific competencies for their social and economic benefit. The study indicates that the CBC was idle and passive in responding to the realities of the Tanzanian context.

Indeed, the study indicates that although the canonical science knowledge for preparing students to increase the pool of science-related experts is important, the

goal of the CBC will not be attained by such limited focus. The teachers in this study were 'thinking about science for all' - preparing students for broader scientific literacy in the particular context of Tanzania. For instance, usually, when you read about scientific literacy from the developed world, it is more about freedom and democracy where individuals have scientific knowledge necessary to interact on a large global scale of scientific issues such as global warming, vaccination, and acid rain. But the teachers in this study scientific literacy is more local based, it is more about self-employability, more vocational capabilities, more about individual health and their wellbeing. It is about knowledge of science that could support individuals on issues related to socio-economic income and general health issues. The teachers were referring to science and entrepreneurship, science and technical skills, science and personal hygiene, science and diet, science and early pregnancy, science and disease and so on; problems that are socially and culturally relevant. This study suggests that the goal of the science curriculum is multicultural but not common to all cultures, one goal can be valued in one culture and less valuable in another. As argued by Hodson (2010) a science curriculum always valued based on its ability to respond to social and economic problems, rather than fostering students' freedom and choices. What was missing from the teachers' response in relation to the aims of science education is civic scientific literacy (Hodson, 2010), knowledge and skills for students to participate in dialogues about scientific issues towards decision-making.

Further analysis provided an insight into the impact of cultural and religious beliefs on science education. As pointed out previously, this study was conducted in two parts of the URT with very close proximity in terms of economic backgrounds, but the regions are slightly different in terms of socio-cultural practices and values. The findings of this study shows slightly different responses about the CBC reform between the two groups of teachers. The study revealed that teachers from Zanzibar were less informed than their colleagues from the mainland. Moreover, the study revealed that socio-cultural beliefs had more impact on teachers' practices in response to teaching universal science concepts such as evolution and origins of man. The effects were more obvious in Zanzibar as their community was strongly tied with Islamic beliefs compared to Dar es Salaam. The study suggests consideration of cultural knowledge and managing borders for teachers to implement the science curriculum more effectively.

9.5.2 Accountability in the curriculum enactment

Various factors influence teachers' accountability whether to the imposed curriculum reform or other external agencies (Ball et al., 2012; Ryder and Banner, 2013). Goodson (2001) streamlined these factors into three sets of influences: personal, internal and external. However, the study revealed that external factors had more impact on teachers' responses to the CBC. Evidence revealed that the interaction of these sets of factors within teachers' practice resulted in what Ball et al. (2012) called accommodation, subterfuge, and resistance. The external tensions from the educational authorities, including parents, made teachers more accountable to the external examination board than to the CBC reform. Approaches used by both internal and external authorities, such as school leaders and external school inspectorates, to increase pressure on teachers, exposed them to poor enactment of the CBC. Moreover, the study revealed that many schools' policies forced teachers as well to be more accountable to the external examination board than the imposed curriculum. Rather than having school policy helping teachers to effectively implement the CBC, they dragged teachers into competing against each other via syllabus completion and examination results. I have argued in this study that teachers' practices will hardly promote the teaching and learning that could respond to the CBC, if teachers' accountability shifted to the external examination board.

The effective enactment of the curriculum much depends on the mutual understanding among the key respondents on the meaning of the imposed curriculum. Given the complexity of the whole concept of the CBC as well as the skills that should be developed to the student, reflects the difficulty the teachers experienced in linking their practices to the intended competencies to provide the practices that could lead the effective CBC enactment. The real confusion about the meaning of the CBC between the teachers and their educational authorities both internal and external negatively impacted the enactment of the CBC. The teachers' practices in response to the CBC were informed by how their performance was framed by all those in charge of the curriculum. The research shows the convincing power of the authorities in sharpening the teachers' practices. Thus, the curriculum is more likely to be enacted as intended if the authority able to exercise good quality of curriculum supervision including assessing the teachers within the underlying principles of the imposed curriculum.

Furthermore, the study found that teachers had two contrasting views about the CBC reform: positive and negative. These views were rooted in the way teachers operationalised the meaning of the curriculum treating it as a product, looking at the

curriculum in terms of its intended goal created positive views of the CBC reform. On the other hand, other teachers who conceptualised the curriculum as a process involving the interaction of the intended goals with the teaching and learning context argued that the CBC is irrelevant. In light of the findings of this study, the enactment of the CBC requires a common framework derived from broader discussions of educational stakeholders including teachers and accepted educational theories that describe clearly the competencies to be attained by the students.

Chapter 10 **CONCLUSION**

10.1 Introduction

This study was designed to explore the responses of secondary science teachers to a competency-based curriculum (CBC). This chapter will present the conclusion and implications together with potential recommendations from the study findings. The chapter is in five sections: the first presents the implications of the study. The limitations will be presented in section 10.3. Before presenting the reflection for the study in section 10.5, section 10.4 comprises the recommendations for further study.

10.2 Implications of the study

The implications of this study include a contribution to broader information and knowledge about the curriculum in science education and the CBC reform in the Tanzanian educational context. In Chapter 1 and the literature review in Chapter 2, I have argued that understanding the curriculum is to hear how the teachers respond to it. While many of the previous studies on this theme looked at the curriculum by focusing on the process of the reform and the challenges of CBC implementation, this study focuses on aspects from the intended curriculum (policy text) to the enacted (policy of practice) in order to glean wider knowledge of the CBC and its implementation. Thus, the implications of this study lie in the significant contribution made by the secondary science teachers based in Tanzania. Therefore, in this section, the implications for two major areas will be highlighted: policy and practice.

10.2.1 Implications for policy makers

The findings of this study recapitulate the recognition of many other studies that the science curriculum be context-lead rather than concept-lead (Otulaja and Ogunniyi, 2017; Schweisfurth, 2011; Voogt et al., 2009). This means that the curriculum elements – goals, aims, pedagogy and assessment practices – should be organised to compliment the real environments of the individual students. Alongside this, the science curriculum should not be taught or organised from the perspective of the scientists (Evans and Old, 2015, p.7). The school curriculum would be more effective if it was contextually relevant in terms of the socio-cultural and economic situation of the nation. According to Taylor (1997), educational policy including curricula should be developed to respond to the broader “social, cultural, economic and political” context where it is going to be used. Therefore, policy-makers should structure and set goals for the curriculum that are not only relevant to the world economy of science

and technology but also locally. For instance, instead of the school secondary curriculum purely focusing on preparing students for post-secondary education and increasing the pool of future science, it is very important to reflect critically on those who will not proceed with further studies. Therefore, this study recommends that policy-makers should ensure that the socio-scientific issues are given strong and equal emphasis within the science curriculum study to ensure that the goal of science for all is attained. This will help to broaden the scope of scientific literacy and expand beyond preparing future experts and scientists to the preparation of citizens informed by the socio-scientific issues needed to prepare individuals with life skills for independent living (Barrett, 2017; Bybee, 1993; Hofstein et al., 2011). It is essential for the science curriculum to focus beyond scientific knowledge to preparing students for science specialisation; this is important, but curriculum must also focus on preparing democratic citizens who will take part in open dialogue about socio-scientific issues (Hodson, 2010).

Misinterpretation of the CBC may limit achievement in other essential competencies, which might lead to the question of the quality of the curriculum. The evidence from this study revealed that teachers conceptualised the science CBC only in terms of hard scientific skills; less consideration was given to the soft skills that are important for social and career development. According to Nadais and Mocetão (2019) to respond the market demands of the twenty-first century, it would be a mistake for education to focus only on technical skills and neglect soft skills. The evidence from this study shows that the CBC reform is jam-packed with content. The teachers are always under tension to complete the syllabus and worry about being blamed for not doing so within the required time. Because of such structures in the curriculum, the soft skills such as communication skills, presentation, personality, argumentation, collaboration skills and other forms of social interaction lack emphasis. It is the role of the policy-makers to ensure that there is good correlation between the instructional time and the intended content. This might reduce pressure on the teachers for content coverage, leaving them ample time to involve their students in developing soft skills that play a big role in the life of the individual.

Lack of shared understanding of the CBC among teachers and between teachers and external educational authorities may lead to confusion about implementation which in turn distorts the intended outcome. This study agrees with many studies that a shared understanding of the actual meaning of a curriculum or curriculum objectives is a major impetus for successful curriculum implementation (Fullan, 2000; Hargreaves, 2010). It is expected that the shared meaning and understanding of the curriculum between teachers and the educational authorities would help reduce

pressure on teachers by responding to different external demands. This study argues that it is not defining the CBC either in terms of teaching methodology or curriculum aims that ensures its successful implementation. Rather, it must include how such meaning is supported and agreed on across all pools of educational stakeholders, teachers, the internal and external educational authorities as well as parents. In the context of this study, lack of shared meaning between teachers and external leadership resulted in high tension around the teachers' practices that in turn negatively affected the CBC implementation. It is recommended that policy-makers strive to establish positive and effective communication at the national, regional and district educational authorities to help the schools and the community to understand the focus of the curriculum. This could reduce conflicts of interest and in turn reduce the tension on the teachers' practice in responding to the curriculum reform. This is in line with Fullan (2008) who suggested that policy-makers create *permeable connectivity* where those sets of stakeholders focus on the same goal and working collaboratively to attain the intended desire.

It should be remembered that curriculum as policy is structured to work in a specific context using sets of resources (Braun et al., 2011; Evans and Old, 2015). Therefore, if the same policy is required to work in a different context, the environment should be created to ensure that policy fits it. According to Bowe et al. (1992, p. 12), the policy text should have a *clear relationship with the context* in which it is going to be used. In this study, however, many teachers viewed the CBC reform positively, but they kept saying that the CBC was contextually irrelevant. Most of the teachers referred to the irrelevance of the CBC by reflecting on the school's contextual reality including resources allocation, overcrowded classrooms as well as no ICT and internet connectivity. Thus, the study recommends that the policy-makers should ensure the school contexts are prepared and empowered to effectively respond to the policy needs. Moreover, all resources necessary to facilitate the curriculum implementation should be supplied in equal proportion across all schools in the nation. Failure to do so it is more likely to increase the gap between the intended and enacted curriculum.

A clear implication in response to this study is that a curriculum-as-policy must make clear consideration on the impact of personal, internal and external school influences on implementation of that curriculum. As Goodson (2001) noted in his paper about educational change, *without sensitive negotiation of balancing* these three sets of factors, the implementation of the reform will be less likely to mature. This study shows that the mismatch between the internal school influences and the external CBC reform was among the reasons teachers subverted the latter. In addition, before

the inception of the policy reform, the teachers' personal influences – including their beliefs, efficacy, and personal biography – must be harmonised with the reform.

Finally, whenever there are two different parts of a country sharing the same educational curriculum, the curriculum reform needs to consider clear interaction and collaboration to ensure that every part has equal contribution to the reform. The evidence of this study revealed that many teachers from Zanzibar feel less confidence in the reform, as it was not developed based on their will. Generally, the teachers from Zanzibar were reported as disadvantaged compared to the teachers from Tanzania Mainland. For instance, the instructional time in Zanzibar is two hours less than at Tanzania mainland, yet the teachers worked with the same length of the curriculum and sit the same national examination. Therefore, the educational leader should take this difference seriously and try to minimise it. Moreover, these findings revealed the need for good communication and collaboration between the two boards of curriculum development from both Tanzania Mainland and Tanzanian Zanzibar to ensure that teachers from both sides share equal knowledge and understanding about the statutory curriculum.

In addition, this study shows the negative impact of teachers' religious beliefs on teaching science, especially universal scientific concepts like evolution. In the context of this study, several teachers were sceptical of teaching evolution because of their religious faith. It is always important to know that science is "grounded on metaphysical and epistemological" knowledge that sometimes teachers and even students may not believe; the ability to separate belief and understanding is very important (El-Hani and Mortimer, 2007). This study shows that when the teachers lack understanding of the difference between beliefs and understanding or consider understanding the same as acceptance, this may be why they resist implementing the reform as intended. Teachers should focus on developing students' understanding and not changing students' beliefs (El-Hani and Mortimer, 2007). This study suggests the importance of teachers in understanding culture and managing borders in science education. The study indicated that even in very close proximity of socio-economic status, cultural practices such as religion might cause disparity in teachers' responses about the science curriculum reform. The study calls for policy-makers to consider such social-cultural values seriously to ensure that it does not distort the science curriculum implementation. Policy-makers should consider border crossing seriously even for teachers; otherwise, science curriculum implementation will be problematic, especially in a culture strongly tied to religious beliefs. Professional development is recommended to teachers that will enable them to cross the border between their social-cultural beliefs to the culture of science and creating

good knowledge of the difference between understanding science, acceptance and belief.

10.2.2 Implication for practice in schools

The evidence from this study shows that teachers received the curriculum reform while they have their own existing understanding rooted in their personal knowledge about how science curriculum as well as teaching and learning should be about. It can be expected that such understandings could result in resistance to the imposed reform. The findings of this study show that this is not always the case. Several teachers in this study reported that their beliefs about teaching and learning science in fact aligned with multiple aims of the CBC reform. However, their practices tended to be at a mismatch the reform because of factors experienced internally to the school setting and external from it too. Thus, finding of this study implies that even when the teachers' personal knowledge aligns with the reform, it does not guarantee its effective implementation. The internal and external influences have major impact on teachers' practices.

This study did not directly focus on leadership and school management. However, the evidence from this study suggests that effective teachers' practice in response to the reform is impacted on by the internal school leadership and administration. This study has shown that school policy like assessment policy that only focus on examination attainment, is not fruitful for the reform implementation. This kind of policy leaves many teachers concentrating on external pressure and schools' league tables and tended to focus on the examination attainment. In fact, the teacher needs to be seen and valued, thus when teacher's ability is assessed by the student's examination attainment, it is less likely for teachers to switch their pedagogical practices that focus on active engagement of the students in their teaching. Rather, their energy might be better used more by drilling students on examination skills to ensure that the students' pass rate raises. The study shows that it is not always that the teachers resisting the imposed external reforms but sometimes the school system forced them to do so. The evidence of this study revealed that the internal school policy has great influence over the teachers' practices in response to the reform. Therefore, the school should ensure that they establish an internal policy that helps to attain broader goals of the curriculum rather than focusing on immediate goal of examination attainment.

Teachers' instruction practice is done in response to the reform needing commitment and ownership of the reform. Several teachers considered themselves as outsiders of the reform. Being outsiders they tend to be less responsible and more sceptical

about risk from implementing the reform. In this study, many teachers reported not implementing the CBC as intended because of the shortage of teaching and learning resources. However, there is less evidence from this study of the teachers taking any initiative to making improvisation as alternative ways of solving the problem of shortage of resources. Talking about the impact of the school commitment to implementing policy text, Bowe et al. (1992, p. 118) asserts that “low commitment cause high degree of reliance of the policy text”. This also applies to the teachers; when they lack commitment to the reform, they make less effort to resolve even a small challenge within their classroom setting. Thus, it might be this lack of commitment that widens the gap between the intended and enacted curriculum reforms. This study recommends that without teachers’ commitment in the context of developing countries including Tanzania, in particular, the implementation of the curriculum is unlikely to be attained.

10.3 Limitation of the study

The limited number of regions and teachers involved in the research compared to the total population of Tanzania is one of the limitations of this research. As mentioned previously, there are 31 regions in Tanzania, and this research only involved four. Moreover, while the teachers taken from Zanzibar were from three regions, in Tanzania Mainland all were taken from just one region; Dar es Salaam. However, this was done purposefully due to the nature and geographical size of Zanzibar compared to the mainland. Including three regions in Tanzania Mainland would require a prohibitively high cost and amount of time, well outside the study budget. A total of 300 teachers were involved in the study, across all parts of the United republic of Tanzania, which is a very small sample of science teachers compared to the total number of teachers in Tanzania. In addition, in Tanzania, the CBC is the statutory and central curriculum, nevertheless, this study was limited regions in the country – the majority of them being in the central city. The geographical locations of secondary schools in Tanzania are more scattered, with some of them located in remote areas, different from the schools that were involved in this study. Thus, it was difficult to make a valid generalisation on the CBC from the responses of 300 teachers for the entire population of science teachers in Tanzania.

The implementation of the curriculum usually does not involve the teachers alone; school leaders and other regional and local educational authorities are very important, and this study did only covered the science teachers and left the large number of educational stakeholders who have potential responsibility for the reform

implementation. Despite these omissions, the focus on city-based provision nonetheless offers a good control for factors that are missing owing to it being remote and so on.

Another limitation of this study is the method of data collection. Multiple data collections have been used, but omitting classroom observation in order to understand teachers' practices limited witnessing any live evidence of teachers' practices. The interview, focus group discussion as well as questionnaire, might give biased results as the teachers might tend to hide some of their weaknesses. The data collection for this study was done when the teachers were very busy preparing for the national examination, so the overall majority of teachers did not find opportunities for the researcher to enter in their classroom as most of them they were doing revision and solving past examination papers as way to give their students skills for answering the exams. Nevertheless, the use of interviews and focus group discussions in particular offered a different type of information or 'data': namely, in-depth accounts of perceptions.

My initial plan was to have participants with at least 10 years of teaching experience that have taught the former content-based and the new CBC. However, some of my participants were less experienced and they started teaching while the CBC reform had already happened. Such teachers might be less informed about the reform but because of the shortage of science teachers, I had to involve them in the study regardless of their short teaching experience. Also, the plan was to interview each teacher over two separate visits, but this was not possible as three teachers did not turn up for the second interview; therefore, I had to recruit new teachers for second visit interviews. This not only meant a loss of the initial rapport that had been developed with the original interviewee, but also a loss of the good flow between the first and second interviews. A divergence from my initial intention, this proved to add to the richness of the data. It was evident that there were some different experiences of different curricula; however, in the end, both sets of teachers faced very similar difficulties in implementation. This proved to strengthen the data as it challenged the stereotype of immediate uptake by junior teachers.

The qualitative data interview and focus group discussion were carried out to in the language which the participant was familiar with (Swahili). This brought clear communication between the researcher and participants as both of them were using their mother tongue, but the limitations crept in during the translation process. To quote Temple and Young (2004), translation sometimes might result in the researcher to subvert some information. I tried hard to distance myself from the bias,

but Swahili cannot be translated word for word into English. After translating I shared the translation with the participant to agree what had been translated were their words, but in fact the teacher's quotation might lack the original sense of what was said by the teachers. One might ponder on the hegemony of the use of English language in academic research and the limitations of the same in translation, which are beyond my control as a researcher.

For the social aspects of data collection, interviews or focus group discussions, the issue of privacy is crucial for keeping conversation running smoothly and interviewees feeling comfortable. This was very challenging, as in many schools, interviews and discussions took place in areas without much privacy, as it was not possible to find empty rooms to carry out interviews or focus groups within the schools. Therefore, interviews were conducted in the teachers' staff room, laboratories, or sometimes even outside where we were able to arrange chairs under the trees. This was likely to lead to greater interruption as teachers were disturbed by their colleagues and students regarding school matters and the recordings would be stopped while teachers responded. This negatively impacted the flow of conversation and, to some extent, also reduced confidentiality.

The data collection's timetable was another limitation. Data were collected over a very limited time. As mentioned in Chapter 4, this research employed a mixed method model, consisting of qualitative and quantitative approaches sequentially. Hence, it required a long period, because, after the qualitative data collection, more time was required for data analysis and to find themes for setting the follow-up quantitative questionnaire. Instead, due to shortage of time, I was unable to conduct a detailed analysis, instead, I was only able to carry out a quick check of teachers' responses. The themes used to develop the questionnaire were obtained by listening to the audio and transcribing it, and I was able to pick out common themes and compose the questionnaires. The sequential approach requires a good amount of time to widen the first results before moving on to the second strand. For instance, I could not enquire about the issue of religion and the cultural impact of CBC implementation, which were issues that I came to discover during the immersive analysis.

10.4 Recommendation for further studies

This study was conducted to explore the responses of secondary science teachers to the CBC reform in Tanzanian educational context. As I have mentioned in the introductory section of this thesis, much research conducted in Tanzania concerning CBC reform was carried out in Tanzania Mainland despite the fact that Tanzania

Mainland and Zanzibar shared the same curriculum at secondary level but under different educational autonomies. It is surprising to find no comparative study has been done to understand how teachers in these two parts match or mismatch the similar curricula. This study gives some highlights and contributions to understanding the responses of teachers from both sides of the United Republic of Tanzania. The evidence of this study shows some disparity in the responses between the teachers from Tanzania Mainland and those of Zanzibar. It might be this disparity in teacher responses on the CBC that make their national examination differ dramatically. Thus, my study suggests a cross-sectional survey research to be carried out across all regions of Tanzania to give the general picture of how teachers respond to the science CBC reform.

Evidence from this study also revealed that the opposing views about the science CBC reform were not only between the teachers from Tanzania Mainland and Zanzibar but even among the teachers on the same side. An in-depth study is required to understand the reasons for disagreements between teachers about the science CBC reform. As mentioned in the introduction section, the CBC's inception in Tanzania started in 2007. My study revealed that teachers do not have similar understanding of the CBC despite the fact that it is now also taught at all teacher-training colleges and universities in the country. Further research is required to investigate how the CBC is presented in those teachers' colleges and university.

A wider gap between the intended science CBC and the teachers' practice was revealed in this study. Among other reasons reported by teachers not to implement the CBC as intended is that they are teaching to respond to the national examination. Yet, it was expected that the national examination would have very close correlation with the national CBC. This is also a topic to be researched to understand how the national examination responds to the statutory CBC.

My study did not look directly at how the school leadership influences teachers when responding to the science CBC. The school leadership practice plays a major role in facilitating effective curriculum implementation (Fullan, 2001). My study indicates that teachers were working in isolation and in the form of competition rather than collaboration. It might be the reason that school leadership practice put teachers in such isolation. Thus, I find it is important to understand the competence of the school management in supervising the implementation of the CBC.

In Tanzania all the triple-science subjects (physics, chemistry and biology) are among compulsory subjects when students start secondary education (at Form 2 and Form 3). In my study, all teachers reported there were two common goals of the

science curriculum: preparing students to become future scientists; and for science for citizenship. Despite all the ambitions the teachers have regarding the curriculum, the number of science personnel including science teachers falls dramatically short. My study revealed that there were some teachers, especially in Zanzibar, who never specialised in science, but they were forced to teach science to cover the shortage of science teachers. Preparing students to become future scientists as well as science teachers is a process that mainly starts way back at the beginning of their science (and even primary) education; therefore, in-depth longitudinal research is needed with students as well as teachers to understand how teachers might nurture their students towards increasing the national pool of future scientists.

Lastly, further research into the CBC and its implementation are needed, as suggested previously, to better understand the reflections of teachers on the CBC reform and how effectively it can be implemented in relation to all socio-economic, cultural and contextual environments within the school settings. It is also important to make some comparative studies with other countries that had success in employing similar curricula in their educational systems in order to gain knowledge on how the curriculum developers and practitioners can benefit.

10.5 Chapter summary

This study also shows the effect of applying Bowe et al., (1992) policy process framework to study the responses of teachers to a CBC reform. Such a framework have been applied in Western countries (see Ryder and Banner, 2011), to investigate curriculum reform through policy text. My study has been conducted in a different context focusing on the responses of teachers by linking both policy text and policy of practice but indicated similar effects. Through teachers responses, I have able to clearly observed both long term and immediate aims from the teachers as revealed in the study carried out by Ryder and Banner (2011). The framework also shows was effective to identify the sociological forces and the tensions interplayed between them and the teacher's personal influences. My study indicates that of the three sets of factors, internal, external and personal also show a positive effect on understanding teachers' responses to any curriculum reform. I argue in this study that the policy process framework can be applied in broader ranges of teachers' responses to a curriculum; from the process of development to the enactment.

This thesis is the reflection of my whole journey in professional learning and as a PhD student. As a science teacher trainer responsible for developing both content and pedagogical knowledge and skills for the pre-service teachers, this PhD journey assists in developing my knowledge and skills on analysing academic literature

toward helping to improve the quality of the curriculum as well as teaching and learning. Through this study, my knowledge of the curriculum is extended and I have comprehended that science education has multiple aims, but it is culturally and contextually sensitive. This means that the goals of science education need to respond positively with the economic and cultural context it serves. Thus, for those countries, especially developing countries, whose reforms in education are influenced by Western educational policies, this is a very important consideration. In addition, combining new approaches (qualitative and quantitative) gave me an understanding of investigating educational issues using varied methods of data collection. Also, this led me to believe that qualitative research is more informative than the quantitative study. Lastly, I must make clear that completing the PhD is a good foundation for me to move towards becoming a skilled researcher in the near future that could become fully involved in finding evidence to assist the development policy and improve the practices in the educational field in general.

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APPENDICES

Appendix A : Interview guide-Visit 1

Interview schedule (Visit 1)

- 1. Tell me about your teaching practice**
 - Describe the process which you undergo for curriculum implementation.
 - How do you plan your teaching?
 - What teaching and learning materials do you involve in the planning process?
 - How do you organise your classroom environment during the teaching process?
 - What influences your teaching practice?
 - Which teaching strategies do you use in your science classroom?
- 2. How would you describe good science teaching?**
 - How would you characterise good science teaching?
 - How does your teaching practice meet those criteria?
- 3. What is your personal goal of teaching science in your classroom?**
 - Developing scientific attitudes and value
 - Preparing students for methods of scientific investigation
 - Arousing students' interest in future careers in science
 - Preparing students for the examination attainment
- 4. Describe your assessment practice?**
 - What do you assess, e.g. content mastered, conceptual scientific knowledge, practical skills, understanding scientific theories and principle etc?
 - How do you assess your students?
 - What factors influence your assessment practice?
 - How do you structure your assessment practice?
 - How often do you assess your students?
 - How does your assessment practice relate to the goals of the curriculum?
- 5. Describe your school's assessment policy?**
 - What does the policy cover?
 - What are the aims of the assessment policy?
 - How is the policy relevant to the teaching and learning of science?
 - How does this assessment policy relate to the intended goals of the curriculum?
- 6. In your view, how should science be assessed?**
 - What do you think about the national assessments?
 - To what extent do the national assessments reflect the aims of the curriculum?
 - How does the national examination influence your assessment practice?
- 7. Are you satisfied with your teaching?**
 - Are there any things you would like to change?
 - If so, what? Why and how are you going to change them?
- 8. What do you see as the greatest challenges in your science teaching?**
 - Intended content
 - Teaching methodologies
 - Assessment
- 9. Do you have any other issue you want to express about what we have discussed in our conversation?**

Appendix B : Interview guide-Visit 2

Interview schedule (Visit 2)

- 1. In your view, describe what the science curriculum should be about?**
 - What aspects should a good science curriculum cover?
 - How do these aspects fit in with the curriculum that you have now?
- 2. Tell me about the curriculum reform you have recently experienced?**
 - What were the aims of the reform?
 - How can you describe this reform with respect to science education?
- 3. How do you describe a competency-based curriculum?**
 - What learning aims does this curriculum intend to fulfil?
 - How would you describe the relationship between the contents of the curriculum and its intended competencies?
 - How do you differentiate the competency-based curriculum from another type of curriculum, such as the content-based curriculum?
- 4. Which skills do you think have been prioritised in the curriculum?**
 - Students' examination attainment
 - Social scientific issues such as genetic engineering, environmental issues, impact of heavy metals and the like
 - Post-secondary science specialisation
 - Student independent living
- 5. How might the competency-based curriculum change students' attitudes to learning science?**
 - How has this curriculum impacted on students' lives outside the classroom?
 - What are the students' reactions to this curriculum?
- 6. What is your evaluation of the current science curriculum?**
 - What positive aspects does this curriculum have in science teaching?
 - What negative aspects does this curriculum have?
 - How do you consider this curriculum within science education?
 - What other learning areas do you think should be added to this curriculum?
- 7. How do you consider this curriculum with respect to your teaching practice?**
 - Which topic(s) or learning area(s) do you find more challenging for
 - yourself as a teacher?
 - for students as learners?
 - How does this curriculum help you to strengthen your science classroom teaching?
 - What tensions do you experience in curriculum enactment?
 - How do you position yourself in curriculum enactment?
- 8. Think about the most recent science curriculum reform that you have experienced, how did this reform affect**
 - Your lesson preparation?
 - Your teaching methodology?
 - Your methods of assessment?
- 9. Do you have anything you would like to add?**

Appendix C : Focus group discussion guide

Focus group discussion guide

1. Describe the process to which you undergo for curriculum implementation.
 - What teaching and learning materials do you involve in the planning process?
 - Which teaching strategies do you use in your science classroom?
2. What influence your teaching practice?
3. What is your personal goal of teaching science in your classroom?
4. **Are you satisfied with your teaching?**
 - Are there any things you would like to change?
 - If so what, why and how are you going to change them?
5. **In your views, describe what should science curriculum be about?**
 - What aspects should a good science curriculum cover?
 - How does these aspects fit-in with the curriculum that you have now?
6. **Tell me about the curriculum reform you have recently experienced?**
 - What were the aims of the reform?
 - How can you describe this reform with respect to science education?
7. **How do you describe competency-based curriculum?**
 - What learning aims does this curriculum intend to achieve?
 - What are your views on the aims of this curriculum?
 - How do you differentiate competency-based curriculum from another type of curriculum such as content-based curriculum?
8. What do you consider as the improvement in terms of teaching because of using this reform?
9. **What is your evaluation of the current science curriculum?**
 - What positive aspects does this curriculum have in science teaching?
 - What negative aspects does this curriculum have?
 - How do you consider this curriculum within science education?
10. **Do you have anything you would like to add?**

Thank you for your participation

Appendix D : Survey questionnaire

Survey Questionnaire for secondary science teachers

Greetings!

I am currently undertaking a PhD in Education at the University of Leeds, United Kingdom. The aim of this study is to investigate secondary science teachers' responses to the delivery of a competency-based curriculum. Therefore, I am interested in understanding the implementation process of the science curriculum at secondary level in Tanzania through gaining an understanding of the perceptions of secondary science teachers. Through this study, I would like to hear teachers' independent thoughts about the curriculum itself as a policy document and their approaches to implementing the curriculum.

This survey is one of the data collection instruments I am using to elicit teachers' information for my study. The aim is to give you the opportunity to reflect on the relevance of the current curriculum for the teaching of science from the perspective of your own professional beliefs and teaching experience. Your participation will facilitate understanding around how a competency-based science curriculum is enacted in secondary education. In addition, the study will provide an understanding of how teachers define a competency-based curriculum and view its relevance. This will help to inform policy-makers and educational authorities to take any necessary measures to make the curriculum more efficient to both learners and the community.

Therefore, in order to make this study successful, you are kindly invited to participate in this survey by answering the attached.

Confidentiality

All the information that you provide in this study will be treated in a confidential manner, and your identity will not be displayed anywhere in my report or any associated materials. Your participation is voluntary, and you have the right to withdraw at any time whenever you wish to do so.

About the questionnaire

- ❖ When a question refers to science this covers any of the three science subjects at secondary level (i.e. Physics, Chemistry or Biology).
- ❖ Guidelines for answering the questions are provided. Most questions can be answered by marking (X) against your most appropriate choice or by providing the required information based on your own understanding and context.
- ❖ When you have completed this questionnaire, the researcher will contact you for collection.
- ❖ If you have any concerns about any aspect of the questionnaire, or if you would like more information about the questionnaire or the study, please do not hesitate to contact the researcher or the supervisors of this study using the contact details below.

Mohamed Suleiman
PhD Student
School of Education
University of Leeds
Leeds LS2 9JT
Mobile Phone: +255778335306
Email: edmms@leeds.ac.uk

Supervisors

Prof. Jim Ryder
School of Education
University of Leeds
Email: j.Ryder@education.leeds.ac.uk
Phone: 01133434589

Mr. Innocent Tasara
School of Education University of Leeds
Email: i.Tasara@leeds.ac.uk
Phone: 0113343462

Part A: Background information

In this part of the survey you will be asked for information about yourself and your school context. Please mark (X) against your chosen answer or provide the required information where necessary.

1. Are you male or female?

- Male
Female

2. What is your highest level of education?

- Certificate in Education
Diploma in Education
Bachelor degree
Master degree
PhD
Other (Specify)

3. Which teaching subject(s) did you specialise in during your teacher training course?

_____ subject(s)

4. What is your teaching subject at this school?

- Physics
Chemistry
Biology
Physics and Biology
Physics and Chemistry
Chemistry and Biology

5. What class level are you teaching?

- Form 1
Form 2
Form 3
Form 4

6. How many years have you been teaching?

- Under 5
5-9
10-14
15-19
20 or more

7. How many classes are you teaching?

_____ classes
(Write in number)

8. What is the average number of students per class?

_____ students

9. How many teaching periods do you have per week?
 _____ teaching periods
 (Write in number)

10. What is the current situation regarding access to the following physical resources in your school?
 Please mark one (X) in each row

Facility	Available	Not available
a) Laboratory		
b) Library		
c) ICT facilities (computers, TV, radio)		
d) Internet connectivity		

11. If the physical resources given in question 10 are available in your school, how do you rate them with respect to your teaching subject(s)?

Please mark one (X) in each row

Facility	Fully equipped	Equipped	Minimally equipped	Poorly equipped
a) Laboratory				
b) Library				
c) ICT facilities				
d) Internet connectivity				

Part B: Beliefs about aims of science curriculum

12. Below are eleven goals of the science curriculum. How important are these goals in the science curriculum?

Please put (X) to indicate your choice corresponding to each statement

	Very Important	Important	Neutral	Not Important	Completely Not important
a) Fostering post-secondary education					
b) Fostering vocational skills					
c) Fostering future scientists					
d) Fostering investigation and scientific process skills					
e) Fostering self-employment					
f) Fostering the application of technology					
g) Fostering environmental issues					
h) Focus on scientific argumentation					
i) Focus on socio-scientific issues					

13. To what extent does the present CBC match with the aims indicated above? Please select the answer in response to your beliefs.

Excellent	Good	Average	Fair	Poor

14. To what extent is teaching pedagogy as per the CBC appropriate to attain those aims?

Excellent	Good	Average	Fair	Poor

15. To what extent does the national assessment reflect the aims of the curriculum indicated above?

Excellent	Good	Average	Fair	Poor

Part C: Enactment of the competency-based curriculum

16. Which approaches inform your teaching to achieve your goal? Please rate your level of agreement. Please put (X) to indicate your response

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Lecture					
b) Chalk and talk teaching					
c) Questions and answers					
d) Enquiry					
e) Classroom demonstrations					
f) Laboratory experimentation					
g) Group work					
h) Role play teaching					

17. Which assessment techniques/method do you use to achieve your goal of teaching science? Please put (X) to indicate your choice in each statement

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a) Paper and pencil test					
b) Portfolios					
c) Rating scales and rubrics i.e. Assessment tools which allow teachers to systematically collect data about the learning behaviour of the students					
d) Observation using checklists					
e) Oral presentations					
f) Project work i.e. engaging students in a practical problem and allow them to solve it for a certain period and then write a report					
g) Analysing the scientific information					

h) Experimentations i.e. Performing laboratory experiments to investigate certain scientific phenomenon.						
--	--	--	--	--	--	--

18. What factors influence your teaching practice? Rate your level of agreement from the following goals.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a) The goal of the curriculum					
b) Personal goal of teaching					
c) Nature of the students/Level of the student					
d) Number of students per classroom (student-teacher ratio)					
e) Availability of teaching and learning resources					
f) School policy					
g) Internal school leaders					
h) External school leaders (e.g. Inspectors)					
i) Examination attainment					
j) Parents					

Part D: Teachers' tensions toward curriculum implementation

19. Below are the factors that hinders the enactment of the curriculum. To what extent do you agree or disagree as the following effect your teaching practice?

Please put (X) to indicate your choice in each statement

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a) Length of the syllabus					
b) Teaching and learning resources (this includes both textual and non-textual materials)					
c) Instructional time					
d) Working load (number of periods per week)					
e) Class size					
f) High-stakes assessment i.e. internal and external tests and examinations					
g) Inspectorates					
h) School policy					
i) Personal beliefs about how science should be taught					

20. What topic(s) or area(s) within the science curriculum do you consider

a) Very important and should be included in the syllabus?

b) Not relevant and should be removed from the syllabus?

21. (a) What topic(s) or area(s) in the curriculum do you find more challenging teaching in the curriculum?

(b) Please explain why.

Thank You for Your Participation

Appendix E : Research information sheet



UNIVERSITY OF LEEDS

Informed Consent for Teacher

Research Project Title: Secondary Science Teachers' Responses to a Competency-Based Curriculum

Researcher: Mohamed Mbarouk Suleiman

This informed consent consists two parts;

- Research Information Sheet (Describing the nature of the study)
- Participant Consent form (for signing if you decide to participate)

Part 1: Information Sheet

Introduction

I am Mohamed Mbarouk Suleiman, a Ph.D. student at the University of Leeds in the UK. I am researching the competency-based curriculum and its implementation at Tanzanian secondary education. This study will focus on teachers of physics, chemistry or biology at the Ordinary secondary level of education in Tanzania.

The purpose of this form is to request your consent to take part in this research. The research will be carried out in your own school setting. Please take a little time to read the following information as it is important that you understand the aim of this research and what will be involved before signing the consent form. If you have any questions, please feel free to contact me using the contact details at the end of this form.

What is the purpose of the Study?

This research aims to investigate secondary science teachers' responses to a competency-based curriculum in Tanzania. This will cover two aspects. The first area of interest is teacher's views, perceptions and their thinking on the curriculum itself as a policy document (teachers' reflections). The second area focuses on how teachers put the curriculum into practice (teachers' practice) through the daily teaching and learning process and the reasons for their approach.

This study will be conducted through a mixed method approach where qualitative and quantitative approaches will be applied sequentially. In this approach, the study will be distributed in two separate phases. The participants of this study will be teachers who are teaching science from 60 selected secondary schools equally distributed between Tanzania Mainland and Tanzania Zanzibar. Six (06) science teachers will be selected from each of the 60 schools giving a total of 360 teachers. The selection will be based on their teaching experience and teaching specialization.

In Phase 1, the study will involve 18 secondary science teachers in Tanzania consisting of nine teachers from Tanzania Mainland and 9 from Tanzania Zanzibar. The teachers involved in this Phase will be selected purposefully in equal proportion from Tanzania Mainland and Tanzania Zanzibar. The data in Phase 1 will be collected through face-to face interviews and classroom observation. The interview will be carried out over three separate visits to every

teacher in order to gain in-depth information about teacher's views, thinking, perceptions and their practices in delivering a competency-based curriculum. One observation will be conducted for every teacher involved in order to get a real picture on how a competency-based curriculum is implemented in a classroom setting. The classroom observations will be used to validate what the teachers say during the face to face interview session. The classroom observation will aid understanding of how science teachers translate a competency-based curriculum into classroom practice.

Phase 2 of this study, a questionnaire, will be administered to the three hundred and sixty (360) secondary science teachers to enable them to provide a response to the implementation of a competency-based curriculum. The survey questionnaire will be used to gain a comprehensive picture of the responses of teachers to a competency-based curriculum in science at secondary school level in Tanzania. The questionnaire for this phase will be mainly based on what has been found in Phase 1 so as to cross-check the responses of qualitative study to a large population of teachers. This will help the researcher to make predictions to a wider population in the context of the study. Teachers will be able to respond to the questionnaire at their own convenience. I will ensure that completed questionnaires are collected at an agreed time that is convenient for teachers.

Why you have been selected?

You have been selected to be invited to take part in this study because you have the appropriate profile and experience of the competency-based science curriculum at the secondary level in Tanzania. Your knowledge, experience and daily interaction with the science curriculum will enable me to gain an insight into teachers' views, perceptions and thinking of a competency-based curriculum.

Do you have to give consent?

Participation is voluntary. Hence you have the right to decide whether or not to agree to participate in this study. If do you choose to give permission, you will be given a copy of this research information sheet as your reference and asked to sign a consent form to show your willingness to participate. However, you will have the right to withdraw at any time without reason, at which point your data will be deleted.

What will happen if you give your consent?

If you do give your consent, you might be asked to take part in the first phase of the research which will involve face-to-face interviews, or you might be asked to take part on the second phase of the study by completing the survey questionnaire depending on a process of random selection. If you are selected for the first phase, you will be involved in three face-to-face interviews and one classroom observation. The interview will be audio recorded in order to make our conversation flow quick but also to help me during data analysis process. The interview will last about 30 to 45min. I will not videotape the classroom observation but instead, I will record it in my field note for future analysis. All information obtained will be treated confidentially, and your name will be anonymized. Once the content of the tapes has been transcribed, they will be deleted.

What type of information will be sought and why is the collection of this information relevant to achieving the research objectives?

The information for this study will be collected through three different methods; interview, observation and questionnaire. The interview will seek data about your reflections and practice in more detail. The interview will be used to let you speak freely on your professional beliefs

and teaching experience how you are implementing the curriculum at your school and classroom level and why you are implementing the curriculum in the way you are doing.

Classroom observation will be conducted to see how you put the curriculum into practice during your science teaching. I will be interested to see how you interpret the science curriculum and put it into practice through different teaching and learning approaches.

The survey questionnaire is used to gain a comprehensive picture of your responses to a competency-based curriculum in science at secondary school level in Tanzania. The questionnaire for this phase will be mainly be based on what has been found in the first phase so as to cross-check the responses of qualitative study to a larger population of teachers. This will help the researcher to make prediction of the responses of teachers from a wider population in the context of the study.

It is expected that receiving data from the three methods will provide a full understanding of the responses of science teachers toward a competency-based science curriculum. The information gained through this study may assist in improving the science curriculum at the secondary level in Tanzania.

Contact for further information

For any further information or any question during and after data collection do not hesitate to contact the researcher using the following contact;

Mohamed Suleiman
PHD Students
Hilary Place
School of Education
University of Leeds
Leeds LS2 9JT
Email: edmmms@leeds.ac.uk
Mobile: +447404362490

Supervisor:
Prof. Jim Ryder
Hilary Place
School of Education
University of Leeds
Email: j.Ryder@education.leeds.ac.uk
Phone: 01133434589

Appendix F : Participant consent form

Participant Consent Form

Research Topic: Secondary Science Teachers' Response to Competency-Based Curriculum in Tanzania

	Add your initial next to the statements you are agree with
I confirm that I have read and understand the research information sheet dated 24/09/2016. I had the opportunity to ask questions about the research and that I have received contact information for the research.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. If I do not wish to answer any particular question or questions I am free to declare.	
I understand that my responses will be kept confidential, I give permission for the researcher to have access to my anonymized responses and to directly quote me. I understand that my name as well as the name of my school will not be identified or identifiable in the report, publication or in any conference presentation that result from the research.	
I agree the data collected from me to be used in the future research	
I agree to take part in the above research project	

**Name of Participant
Signature**

email

Date

**Name of researcher
Signature**

Email

Date

Appendix H Research permit- Zanzibar

REVOLUTIONARY GOVERNMENT OF ZANZIBAR

SECRETARY
ZANZIBAR RESEARCH COMMITTEE
P. O Box 239
Tel: 2230806
FAX: 2233788



RESEARCH/FILMING PERMIT

(This Permit is only Applicable in Zanzibar for a duration specified)



SECTION

Name: MOHAMMED M. SULEIMAN
Date and Place of Birth: 17/09/1973
Nationality: TANZANIA
Passport Number: AB 667526
Date and Place of Issue: 21/01/2015 ZANZIBAR
Date of arrival in Zanzibar: 21/07/2017
Expected date of departure: 20/12/2017
Duration of stay: 5 MONTH
Research Tittles: (" SECONDARY SCIENCE TEACHER'S RESPONSES TO A COMPEENCY - BASED CURRICULUM:").

Full address of Sponsor: -

This is to endorse that I have received and duly considered applicant's request I am satisfied with the descriptions outlined above.

Name of the authorizing officer: MWANAISHA A. KHAMIS
Signature and seal: 
Institution: Office of Chief Government Statistician
Address: P. O Box 2321
Zanzibar.
Date: 03/08/2017

Appendix I Ministry of Education of Zanzibar research permit



SERIKALI YA MAPINDUZI YA ZANZIBAR
WIZARA YA ELIMU NA MAFUNZO YA AMALI

S.L.P 394
ZANZIBAR-TANZANIA
Tovuti: www.moez.go.tz

Tel: +255-24-2232827
Fax: +255-24-2233306
Barua Pepe: info@moez.go.tz

Kumbukumbu Na: P33/18/1/VOL.II/71

Tarehe: 09 Agosti, 2017

Walimu Wakuu,
Skuli za Sekondari,
Zanzibar.

KUH: KUFANYA UTAFITI ND. MOHAMED M. SULEIMAN

Tafadhali naomba uhusike na mada iliyopo hapo juu.
Mtajwa hapo juu ni mwanafunzi wa Shahada ya Uzamivu katika Chuo Kikuu cha Leeds nchini Uingereza anafanya utafiti katika mada inayohusiana na "**Secondary Science Teachers' Responses to a Competency-Based Curriculum**". Ndugu Mohamed amekamilisha taratibu zote za ruhusa ya kufanya utafiti na ruhusa yake imeanza tarehe 04/08/2017 na itamalizika tarehe 04/04/2018. Aidha, utafiti wake utafanyika katika skuli mbali mbali za Sekondari za Zanzibar ambapo orodha ya skuli imeambatanishwa.

Hivyo, unaombwa umpokee na umpe kila aina ya ushirikiano unaohitajika ili aweze kufanikisha utafiti wake.

Tunategemea kupata mashirikiano yako.

Ahsante

(Khalid M. Wazir)
K.n.y. Katibu Mkuu,
Wizara ya Elimu na Mafunzo ya Amali,
Zanzibar.

Nakla: Nd. Mohamed M. Suleiman

Appendix J : COSTECH receipt letter

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY (COSTECH)

Telegrams: COSTECH

Telephones: (255 - 51) 75155 - 6, 700745-6

Director General: (255 - 51) 700750 & 75315

Fax: (255 - 51) 75313

Telex: 41177 UTAFITI

E-M: Rclearance@costech.or.tz



Ali Hassan Mwinyi Road

P.O. Box 4302

Dar es Salaam

Tanzania

In reply please quote: CST/RCA 2017/274

02/10/2017

Mohamed Suleiman,

RE: ACKNOWLEDGEMENT OF APPLICATION FOR RESEARCH CLEARANCE

This is to acknowledge receipt of your application for clearance to do research in Tanzania titled "*Curriculum reform and implementation: Secondary Science Teachers Responses to competency-based curriculum in Tanzania*"

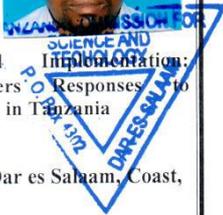
Your application will be reviewed and you will be notified of the outcome in due course.

Email is the preferred mode of communication. Quotation of our reference is essential (RCA 2017/274).

Yours sincerely,

Mashuhuri M
for: **DIRECTOR GENERAL**

Appendix K : Research permit- COSTECH

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY (COSTECH)	
	
Telephones: (255 - 022) 2775155 - 6, 2700745/6	Ali Hassan Mwinyi Road P.O. Box 4302
Director General: (255 - 022) 2700750&2775315	Dar es Salaam
Fax: (255 - 022) 2775313	Tanzania
Email: relearance@costech.or.tz	
RESEARCH PERMIT	
No. 2017-318-NA-2017-274	25 th October 2017
1. Name : Mohamed Mbarouk Suleiman	
2. Nationality : Tanzanian	
3. Title : Curriculum Reform and Implementation: Secondary Science Teachers' Responses to Competency-based Curriculum in Tanzania	
4. Research shall be confined to the following region(s): Dar es Salaam, Coast, Iringa	
5. Permit validity from: 25 th October 2017 to 24 th October 2018	
6. Researcher is required to submit progress report on quarterly basis and submit all Publications made after research. Last but not least	
 M. Mushi for: DIRECTOR GENERAL	

Appendix L Dar es Salaam Regional educational officer research permit

THE UNITED REPUBLIC OF TANZANIA
President's Office
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

DAR ES SALAAM REGION
Phone Number: 2203158
Fax number: 2203158
email: ras@dsm.go.tz
website: www.dsm.go.tz



REGIONAL COMMISSIONER'S OFFICE,
3 RASHID KAWAWA ROAD,
P.O. BOX 5429,
12880 DAR ES SALAAM

In reply please quote:
Ref. No.

13/10/2017

District Administrative Secretary,
KINONDONI

P. O. Box

DAR ES SALAAM.

RE: RESEARCH PERMIT

Prof./Dr./Mrs./Ms/Miss MOHAMED SULEMAN is
student/Research from UNIVERSITY OF LEEDS has been
permitted to undertake research on CURRICULUM REFORM AND
IMPLEMENTATION: SECONDARY SCIENCE TEACHERS'
RESPONSES TO A COMPETENCY-BASED CURRICULUM
IN TANZANIA

From 16/10/2017 to 20/11/2017.

I Kindly request your good assistance to enable her/his research.

F. Froence

For; REGIONAL ADMINISTRATION SECRETARY
DAR ES SALAAM

Copy: Municipal Director,
KINONDONI

DAR ES SALAAM.

Principal/Vice Chancellor
UNIVERSITY OF LEEDS

THE UNITED REPUBLIC OF TANZANIA
President's Office
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

DAR ES SALAAM REGION
Phone Number: 2203158
Fax number: 2203158
email: ras@dsm.go.tz
website: www.dsm.go.tz



REGIONAL COMMISSIONER'S OFFICE,
3 RASHID KAWAWA ROAD,
P.O. BOX 5429,
12880 DAR ES SALAAM

In reply please quote:
Ref. No.

13/10/2017

District Administrative Secretary,

TEMEKE

P. O. Box

DAR ES SALAAM.

RE: RESEARCH PERMIT

Prof/Dr/Mrs./Ms/Miss MOHAMED SULEIMAN is student/Research from UNIVERSITY OF LEEDS has been permitted to undertake research on CURRICULUM REFORM AND IMPLEMENTATION: SECONDARY SCIENCE TEACHERS' RESPONSES TO A COMPETENCY-BASED CURRICULUM IN TANZANIA

From 16/10/2017 to 20/11/2017.

I Kindly request your good assistance to enable her/his research.

F. Froence

For; REGIONAL ADMINISTRATION SECRETARY
DAR ES SALAAM

Copy: Municipal Director,
TEMEKE
DAR ES SALAAM.

Principal/Vice Chancellor
UNIVERSITY OF LEEDS

Received
13/10/2017
Hassim

The United Republic of Tanzania

Prime Ministers' Office

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

ILALA DISTRICT
Phone Address:
Phone No: 2203185/2203182



DISTRICT COMMISSIONER'S OFFICE
ILALA DISTRICT
P. O. Box 15486,
DAR ES SALAAM

In reply quote: Ref. No: AB.60/87/01/

Date:201.....

Municipal Director,
P. O. Box 20950,
Ilala,
DAR ES SALAAM.

RE: RESEARCH PERMIT

Prof./Dr./Mr./Mrs./MS./Miss: MOHAMED SULETMAN.....
from The UNIVERSITY OF LEEDS....., she/he has been
permitted to undertake a field work research on "CURRICULUM REFORM
AND IMPLEMENTATION: SECONDARY SCIENCE TEACHERS' RESPONSES
TO A COMPETENCY-BASED CURRICULUM IN TANZANIA".
The case study at Ilala District from 15/10/2017 to 20/11/2017.....

Therefore, you are asked to give the said researchers necessary assistance
and Cooperation.


District Administrative Secretary
ILALA

Copy:

Principal/Vice Chancellor,
UNIVERSITY OF LEEDS ✓
.....

Appendix M : Kinondoni district education officer research permit

KINONDONI MUNICIPAL COUNCIL

ALL CORRESPONDENCES TO BE ADDRESSED TO THE MUNICIPAL DIRECTOR

Tel: 2170173
Fax: 2172606



**MUNICIPAL DIRECTOR
KINONDONI MUNICIPAL COUNCIL
P. O. BOX 31902
2 BARABARA YA MOROGORO
14883 DAR ES SALAAM**

In reply please quote:

Ref. KMC/ED/SS/R.18/1/15

Date 17/10/2017

Headmistress/Headmaster/WEO,

.....,

REF: RESEARCH PERMIT

Refer the heading above.

Mr. **Mohamed Suleiman**, is a student from **University of Leeds, Leeds LS2 9 JT**, is conducting a Research at your school.

She has been permitted to undertake a Research for **(CURRICULUM REFORM AND IMPLEMENTATION: SECONDARY SCIENCE TEACHER RESPONSES TO A COMPETENCY-BASED CURRICULUM IN TANZANIA.)** in your school.

By this letter you are asked to give her the required assistance to the said research.

Wishing you all the best of luck.

Shemwelekwa

.....
Rogers J. Shemwelekwa
MUNICIPAL SECONDARY EDUCATION OFFICER
KINONDONI MUNICIPAL COUNCIL

.....
MUNICIPAL DIRECTOR
KINONDONI MUNICIPAL COUNCIL
14883 DAR ES SALAAM

Appendix N : Temeke district educational officer research permit

TEMEKE MUNICIPAL COUNCIL

[All letters should be addressed to the Municipal Director]

Tell: +255 22-2851054
Fax: +255 22-2850640
E- mail: temekemanispaa@tmc.go.tz
website: www.tmc.go.tz



Ref. No. TMC/MD/ U.21/30

P.O.Box: 46343,
Mandela Road
DAR ES SALAAM,
TANZANIA.

Date: 16/10/2017

HEAD TEACHERS
SECONDARY SCHOOLS
TEMEKE MUNICIPAL

RE: RESEARCH PERMIT TO MOHAMED SULEIMAN

Please refer to the heading above

This is to inform you that, permission is granted to the above mentioned student/Researcher from UNIVERSITY OF LEEDS to conduct research on CURRICULUM REFORM AND IMPLEMENTATION

case study of SECONDARY SCHOOLS IN TEMEKE MUNICIPAL, DAR-ES-SALAAM
This permit will effect from the date of this letter.

Please give with necessary assistance.


HABEL J. ULEDI
For: MUNICIPAL DIRECTOR
TEMEKE
For: MUNICIPAL DIRECTOR
TEMEKE

Copy to: - Researcher... MOHAMED SULEIMAN
From UNIVERSITY OF LEEDS, UK.

Appendix O :Ilala district educational officer research

HALMASHAURI YA MANISPAA YA ILALA

BARUA ZOTE ZIPELEKWE KWA MKURUGENZI WA MANISPAA

P.O. BOX 20950
PHONE NO: 2128800
2128805
FAX NO. 2121486



Ofisi ya Mkurugenzi
Wa Manispaa Ilala
1 Mission Street
11883 – Dar es salaam

Kumb. Na. IMC/LR.6/11/51

16/10/2017

Mkuu wa Shule
Shule za Sekondari Pugu ,M/chai, B.W.Mkapa,
Jamhuri, Jangwani, Zanki, Azania,
Pugu station, Ilala na Juhudi,
DAR ES SALAAM.

YAH: KUMTAMBULISHA NDUGU MOHAMED SULEIMAN

Husika na kichwa cha habari hapo juu.

Halmashauri ya Manispaa Ilala imemruhusu mtajwa hapo juu ambaye ni mwanachuo wa **Chuo Kikuu cha LEEDS** kufanya utafiti katika Shule yako.

Utafiti juu ya **Curriculum reform and Implementation.**

Utafiti utafanyika kuanzia tarehe **16/10/2017** hadi **20/11/2017**. Tafadhali mpe ushirikiano.

Nakutakia kazi njema.

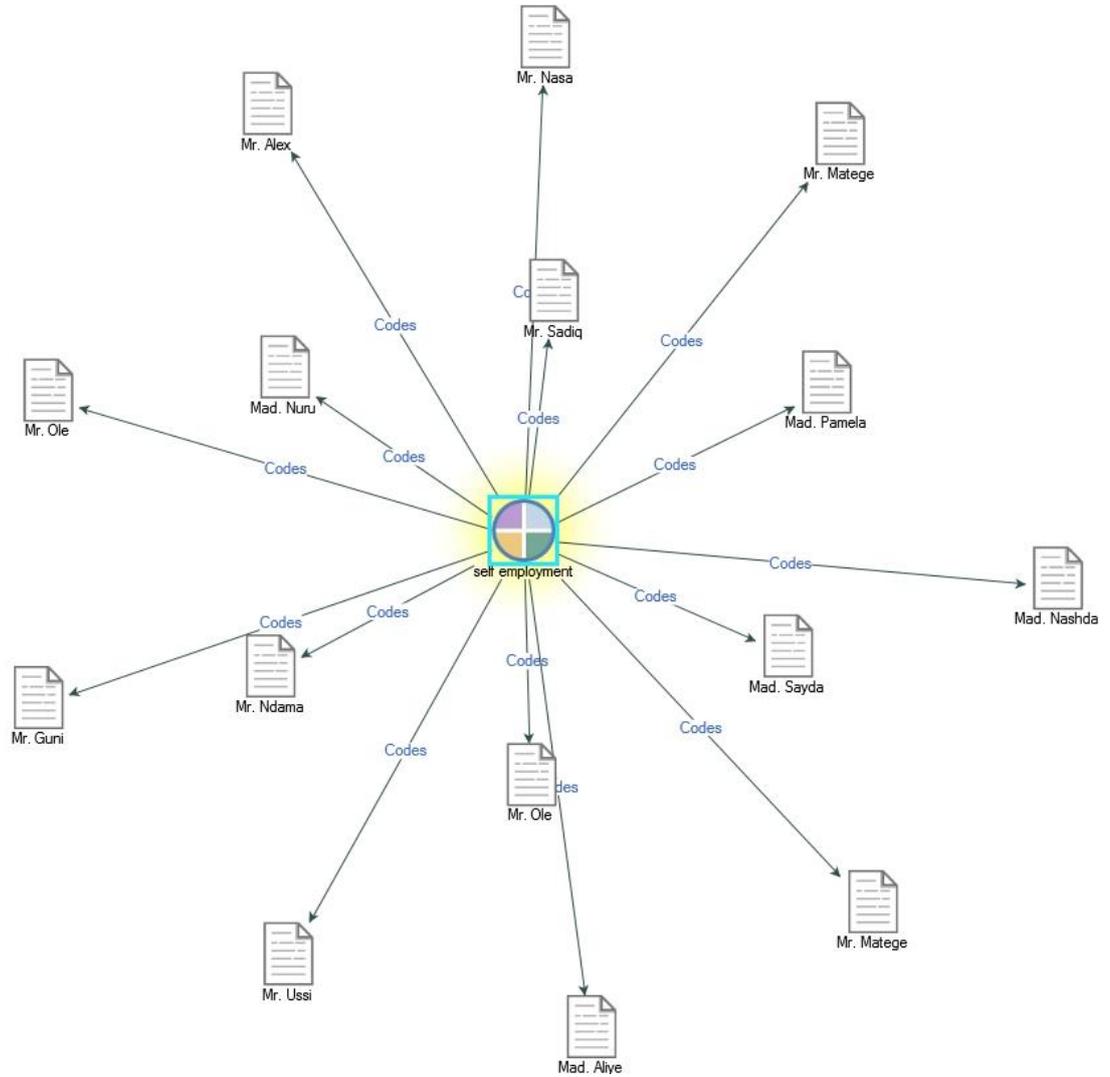
Eliza M. Ngonyani Kny: MKURUGENZI
HALMASHAURI YA MANISPAA YA ILALA

**KNY: MKURUGENZI WA MANISPAA
HALMASHAURI YA MANISPAA YA ILALA**

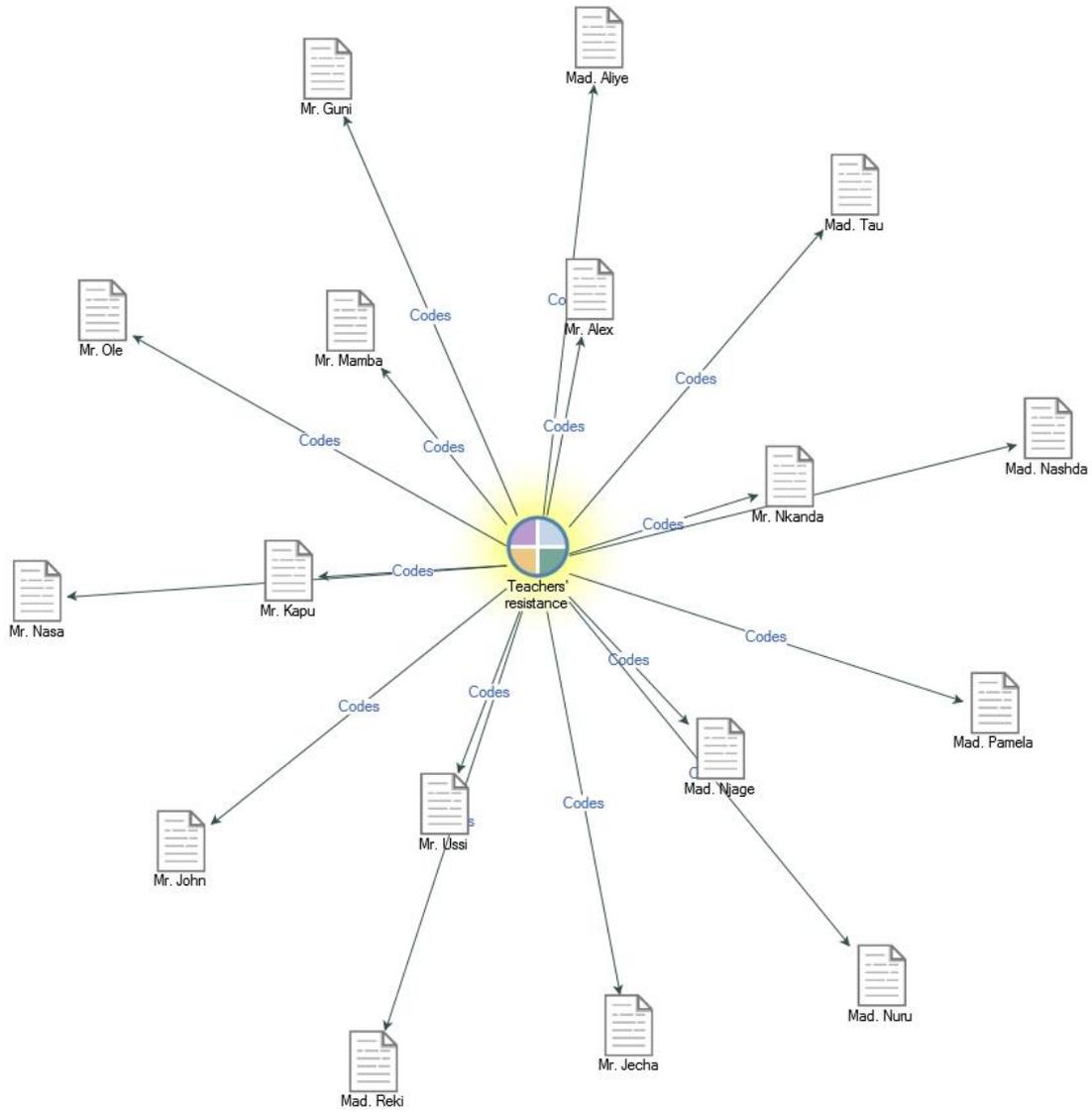
Nakala: Mkurugenzi wa Manispaa,
Halmashauri ya Manispaa ya Ilala (aione kwenye jalada)

Appendix P NVivo Extracts

Self-employment



Teachers' Resistance



Tension in planning stage

