2012-07-23

Teachers' professional development in a challenging educational context - a study of actual practice in rural western Kenya

Onguko, Brown

UNIVERSITY OF CALGARY

Teachers' Professional Development in a Challenging Educational Context – A Study of Actual Practice in Rural Western Kenya

by

Brown Bully Ndale Onguko

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF DOCTOR OF PHILOSOPHY

GRADUATE DIVISION OF EDUCATIONAL RESEARCH

CALGARY, ALBERTA

July, 2012

Abstract

This research adopted a design research approach, utilizing a mixture of methods including narratives, ethnographic observations, qualitative interviews and documentation of design artifacts. It was implemented in a challenging context in Western Kenya. The first research question for this study was: How might professional development (PD), offered through a blended learning approach and delivered by appropriate technologies, inform potential change to teaching practice in a challenging context in Kenya? Research question two sought to understand the implications of the professional development implemented in this study for teachers and professional development teachers (PDTs). Question three sought to understand the sustainability and scalability of the professional development approach

The theoretical framework informing this research is based on activity theory- a needs-driven and goal directed process through tool mediation, and entails division of labor and isolation of partial tasks in a community of relationships (Vygotsky, 1978; Leont'ev, 1978; Engestrom, 1987; 1999; 2000; 2008). Key features of activity theory are active engagement and social interaction, which enabled teachers to collaboratively work with each other, studying through appropriate technologies to inform their teaching practices.

Based on a review of literature, interviews with teachers and observation of teachers during face-to-face meetings in professional development and in their classroom practice, this study suggests that teachers in a challenging context can inform potential change to their teaching as a result of participation in locally developed content, delivered through

blended learning on appropriate technologies. This study observes that through self-directed study on tablets, and occasional face-to-face interaction, teachers can transform into a community of learners that support each other in planning for their lessons. Content development involving local experts is critical to such interventions in challenging contexts, while drawing from global web content, harnessing open educational resources and being sensitive to local culture. Reflective conversations, professional dialogues and technology stewardship were all critical in improving teachers' practice.

Acknowledgements

First and foremost I sincerely thank my Supervisor, Dr. Susan Crichton who guided me through doctoral studies culminating in this thesis. Her foresight, humble, and caring character; and very critical stance helped me shape this study to my satisfaction. Secondly, I sincerely thank the dissertation committee members: Dr. Gail Kopp and Dr. Richard Heyman. Their support was highly valued. Thanks to the jiFUNzeni crew of Ian, Bashkar, Mark, Dr. Halliday and Ganeesh. Their support was so valuable especially Ian for the technical backup. I am also grateful to both the Faculties of Education at the University of Calgary and the University of British Columbia, Okanagan Campus for the scholarly environment and opportunity to interact with scholars at both sites.

I thank my employer and sponsor for my doctoral studies, the Aga Khan University, Institute for Educational Development in East Africa. Without the scholarship I would definitely not have pursued doctoral studies. Special thanks to Chris and Phyllis Robb. Their concern for me and support was highly appreciated. My thanks go to Janet Okoko my colleague through the doctoral studies who has been on a similar journey since we met during our undergraduate studies.

I sincerely thank all my siblings for their support – Alice, Ingati, Rebecca, Nganyi, Mary and Sarah – for you understand where we are coming from. Thanks to Ingati for laying for me the foundation that enabled me to get this far in my academic pursuit. My very sincere appreciation goes to Rev. Julius Otunga who took care of home while I was away.

Finally, very special thanks go to my wife Lucy Chepchumba, and our son John Junior Onguko. I am a husband and father who became a professional student immediately after you two came into my life. I am hopeful that the professional part has come to an end, but I do not promise that the studentship ends at this stage. For your patience, understanding and support; I thank you so much.

Dedication

For my late parents

John and Rosemary Onguko

The embers you lit were not in vain.

And

To Kate, her generation, and future generations

Of children in rural Kenya

You deserve better.

Table of Contents

List of Tables

List of Figures and Illustrations

List of Symbols, Abbreviations and Nomenclature

Symbol	Definition
AKU	Aga Khan University
AVU	African Virtual University
CAL	Computer Assisted Learning
CD	Compact Disk
CEMASTEA	Center for Mathematics, Science and Technology Education in Africa
COL	Commonwealth of Learning
DBR	Design-Based Research
DfID	Department for International Development
EFA	Education For All
FPE	Free Primary Education
HTML	HyperText Markup Language
ICT	Information Communication Technology
ID	Instructional Design
KCSE	Kenya Certificate of Secondary Education
MDGs	Millennium Development Goals
m4Lit	mobile phones for Literacy
m-Learning	mobile Learning
OERs	Open Educational Resources
OLPC	One Laptop Per Child

PD	Professional Development
PDF	Portable Document Format
PDTs	Professional Development Teachers
PRISM	Primary School Management
PV	Photovoltaic
SbTD	School-based Teacher Development
SEMA	School Education Management Application
SEP	School Empowerment Program
SIAC	Statistics In Applied Climatology
SMASE	Strengthening of Mathematics and Science Education
SMASSE	Strengthening of Mathematics and Science in Secondary Education
SMC	School Management Committee
SMS	Short Message Service
SPRED	Strengthening of Primary Education
TAC	Teachers Advisory Center
TESSA	Teacher Education in Sub-Saharan Africa
TSC	Teachers Service Commission
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTs	Untrained Teachers

CHAPTER 1: INTRODUCTION

> The sum of human knowledge and the complexity of human problems are perpetually increasing; therefore every generation must overhaul its educational methods if time is to be found for what is new.
>
> Bertrand Russell, Education and the Good Life.

Background

Teachers are generally inadequately prepared for their teaching responsibilities in developing countries, and this is true of sub-Saharan Africa as well (UNESCO, 2010a; Wanzare, 2007). Davis and Bloom (1998) observed that even the best teacher training programs do not fully prepare new professionals for the daunting responsibilities of a full-time teaching position, and this appears to remain true today. Inadequately trained teachers, who are not supported through professional development (PD), may not be expected to be effective in their teaching practice. It has been observed that in many developing countries, initial teacher training is not good enough, and in-service training, which is vital to build on initial skills, is also poorly developed (UNESCO, 2010a). However, despite these concerns, developing countries are expected to deliver quality education for their citizens and also meet the Millennium Development Goals (MDGs) and Education for All (EFA) goals.

Concern for the state of global education came into sharp focus over the last decade. In the year 2000, the International Community of UNESCO member countries adopted the Education for All Goals in Dakar, Senegal (UNESCO, 2000). The six goals are:

- Expand early childhood care and education
- Provide free and compulsory primary education for all

- Promote learning and life skills for young people and adults
- Increase adult literacy by 50 per cent
- Achieve gender parity by 2005, and gender equality by 2015
- Improve the quality of education.

The International Community of 193 United Nations member states, as well adopted eight Millennium Development Goals (MDGs). Among the eight MDGs, two are directly related to education. These are：

- Goal 2: Achieve Universal Primary Education (UPE) - completion of full primary schooling by all children by 2015; and
- Goal 3: Promote gender equality and empower women - eliminate gender disparity preferably by 2005 and no later than 2015 (United Nations, 2000).

The EFA initiatives started when the nations of the world came together in Jomtien, Thailand from 5th to 9th March 1990 and recalled that more than 40 years earlier they had spoken through the Universal Declaration of Human Rights that everyone has a right to education (UNESCO, 1990). They therefore declared the World Education for All at Jomtien. However, after a global assessment ten years later, it was realized that there was need for accelerated progress towards Education for All. Thus, at the Dakar Conference held from April 26 to 28th 2000, the countries of the world came up with the Dakar Framework as a collective commitment to action to achievement of Education for All goals (UNESCO, 2000).

During the United Nations Millennium Summit from 6th to 8th September 2000, the countries of the world also came up with a comprehensive Millennium Declaration to improve the lives of hundreds of millions of people around the world (United Nations, 2000). The MDGs represent human needs and basic rights that every individual around the world should be able to enjoy (United Nations, 2010). These needs and basic rights include

- freedom from extreme poverty and hunger;
- quality education, productive and decent employment;
- good health and shelter;
- the right of women to give birth without risking their lives; and
- a world where environmental sustainability is a priority, and women and men live in equality.

Both EFA and MDGs' initiatives continue to be important drivers of investments in human development. In particular, the EFA goals and the two MDGs related to education are the standard upon which most countries of the world, especially developing countries, have shaped educational provision over the last 12 years.

The global monitoring report for EFA for the year 2005 focused on quality education, defining quality as a process which includes competent teachers using active pedagogies (UNESCO, 2004). In the same report, it was observed that in twenty-six sub-Saharan African countries, to qualify as a primary school teacher, an individual was only required

to have twelve years of formal education (typically, high school completion). However, in some of these countries, UNESCO observed that these qualification requirements are often not met, suggesting that teachers who fail to meet the qualifications are not qualified within recognized, global standards. In actual practice, this means that in some developing countries, teachers move from grade twelve to teaching positions without any pre-service training. These teachers are referred to as untrained teachers (UTs) in Kenya.

In the endeavour to honor her global commitments and obligations to her citizens, the Government of Kenya introduced the Free Primary Education (FPE) policy in 2003. The introduction of FPE resulted in increased numbers of children in schools and subsequently overstretched and crowded learning facilities, leading to high pupil/teacher ratio (Ministry of Education, 2012). Recently, the Ministry of Education, based on a task force report recognized the need for teachers' professional development and recommended the establishment of "a program for teacher development through regular retraining and in-servicing to improve teacher competence in curriculum delivery" (Ministry of Education, 2012, p. 78). The current policy on education, training and research in Kenya, for example, articulates the need to improve quality of education through continuous skills upgrading for teachers.

> Continuous improvement in the quality of education services should also entail continuous skills upgrading for teachers. However, this has not been the case as lack of adequate opportunities for in-service training has denied most practicing teachers the chance to enhance their skills beyond those acquired during their pre-service basic training. The current situation calls for an urgent development of a comprehensive in-service training program to empower teachers to deliver the changes that have been made in the existing school curricula (Ministry of Education, 2005, p. 75).

While the Ministry of Education articulated an urgent need for development of a comprehensive in-service training program to empower teachers, it should be noted that there has been no major recognizable change in practice. The noticeable change is that the Ministry of Education introduced an annual one-week teachers' proficiency course for selected primary school teachers (Teachers Service Commission, 2004). The one week course, which is coordinated by the Education Ministry's Directorate of Quality Assurance and Standards is used as a means to promotion to higher grades, and it appears even the Teachers Service Commission (TSC), the employer of teachers, is not very confident that the promotion course empowers teachers enough. The TSC Chief Executive Officer suggested that promotion of teachers on merit from one grade to another does not improve academic qualification and should not be a basis for admission to universities (Muindi, 2009). However, a good national in-service program should provide for accreditation for progression both professionally and academically, while empowering teachers for improved performance of their work. Furthermore, the purpose of the course is promotion of teachers to higher grades, which results in more pay and not really for improving their performance in their teaching practice.

While Kenya has teachers' advisory centers in place for providing professional development for primary school teachers, the Teachers' Advisory Center Tutors (TAC Tutors) who are in charge of these centers do not necessarily have the support they require. According to Odini (1998), DfID (1999) and Ministry of Education (2008) the TAC Tutors

- are required to cover large areas comprised of 15 to 20 primary schools yet they have no financial resources to enable them to function;
- do not have the skills to provide professional development;
- have poor or no learning resources; and
- have no access to Internet resources.

Despite some attempts to change teachers' practice, the problem of adequate professional development for teachers still persists. I set out in this research, to understand if there might be a better way to address the problem. The statement of the problem I addressed in this study, and the research questions are articulated in the following section.

Statement of the Problem

The existing TAC tutor structure for teachers' professional development in Kenya is not working. The Kenya Education Management Capacity Assessment Survey by the Ministry of Education (2008) confirmed there is a serious deficiency of skills for TAC tutors leading to a weak support system for teachers and schools. The teachers are required to deliver quality teaching consistent with the Ministry of Education's aspiration for quality of education as stated in its current educational policy. In the policy on education, training and research, it is stated: "In order to meet the demands for the 21st century, our education and training programs must be of the highest quality to compete favourably with the international standards" (Ministry of Education, 2005, p. 27).

With no professional development for teachers to enable them to change their practice, teachers typically resort to teaching the way they were taught (Kaufman, 2003). Kaufman

observed that many times when teachers are confronted with situations in which they are not sure what to do; they usually do with their learners what had been done with them. The expectations for quality education by the Ministry of Education cannot be met unless the government of Kenya invests in teachers' professional development (Ministry of Education, 2012,).

In addition to the problem of teacher training, which is inadequate, there is a lack of Information Communication Technology (ICT) infrastructure and equipment across the country that could provide options for online professional development as happens in developed contexts. My interest in this study was to establish whether a professional development course developed with the input of local experts, delivered through blended learning on appropriate technologies, could potentially change teachers' practice in rural Kenya. The study explored the following research questions:

1. How might professional development, offered through a blended learning approach and delivered by appropriate technologies, inform potential change to teaching practice in a challenging context in Kenya?

    1.1 How might we design a course using a blended learning approach?

    1.2 How might appropriate technologies assist in the delivery of professional development via blended learning?

    1.3 What support do teachers require for blended learning on appropriate technologies?

    1.4 How appropriate is blended learning for teachers in a rural setting?

2. What are the implications of the blended learning approach supported by appropriate technologies for professional development for: teachers and professional development teachers (PDTs)?

3. What is the potential for sustainability and scalability of the professional development approach?

The Research Context

The research site was a rural setting in the western part of Kenya - one of the countries in East Africa. Kenya lies across the Equator on the coast of the Indian Ocean. Kenya borders Ethiopia and Sudan to the North, Uganda to the West, Tanzania to the South and Somalia to the East. The education sector in Kenya is centralized; hence planning and provision of services originate from the central government.

This research was implemented in one school in Lugari district. Lugari district is a rural agricultural district mainly served by earth roads. Most schools in the district do not have permanent buildings. The school infrastructure and learning materials such as text books are very minimal or non-existent in such rural schools. The schools tend to have large classes of more than 83 students with some students sitting on the floor for lack of desks (Glennerster, Kremer, Mbiti & Takavarasha, 2011). Most teachers will normally have had pre-service teacher training, consisting of two years in a teacher training college. For the purposes of this research I will describe such schools as being in challenging contexts.

My Interest in this Research

In doing research, often there is a background that influences the researcher's decisions concerning the topic and the location of the research. My personal background is important in understanding why I decided to do this study and why I did it in rural western Kenya. I started my primary school education in the mid-1970s in rural western Kenya (a different location from the one for this study). Having advanced on in my academic life to a higher level, I was influenced by my personal background to try to make a difference for teachers in a rural context, who in my view operate in even more challenging circumstances than the teachers who taught me many years ago. It is my belief that through research focusing on teachers' professional development, I could in a small way contribute towards improving the situation. The choice to do research in a rural setting in Kenya was further strengthened by the recognition that among other challenges facing primary school education is inadequate in-service training for teachers which affects rural areas even more than the urban areas (Ministry of Education, 2005).

Having worked as National Coordinator for Education for All at the Ministry of Education in Kenya from 2005 to 2006, I was exposed to and developed an interest in the global initiatives of EFA and MDGs. This exposure and interest has continued to guide my educational thought and practice leading to this study.

My background in educational technology and interest in the use of appropriate technology had a major bearing on the decisions to do this research as well. First of all, my having studied for my master's degree in educational technology at the University of

Twente, in the Netherlands, introduced me to the broad area of educational technology. Secondly, my previous work experience in innovative practice at the Aga Khan University (AKU) also influenced my interest to conduct this research on use of appropriate technology. In 2008 at AKU, I led in design and implementation of a teachers' professional development program that incorporated mobile learning through use of short message service (SMS) on mobile phones.

When I first met Dr. Susan Crichton who eventually became my doctoral supervisor, I was implementing the mobile learning program at AKU. Our continued interactions helped in shaping my research ideas focusing on use of appropriate technologies in teachers' professional development. While I had just implemented a mobile learning project on SMS, Dr. Crichton was initiating the thinking about appropriate technologies for educators who are "off the electricity grid" and lack Internet access. Consequently our ideas converged, culminating in the jiFUNzeni learning approach, which I have been part of since 2008.

Through this study, I implemented the jiFUNzeni learning process, a theoretical proposition that emphasizes both instructional and pedagogical orientations that honor context, especially involvement of local experts in developing contextually relevant content that is needs-based, with careful selection of appropriate technologies.

Jifunzeni is a Kiswahili[1] word for inviting all to learn.

Finally, the doctoral courses I enrolled in at the University of Calgary enabled me to further shape my potential research focus, which was on use of appropriate technology for providing professional development for teachers located in a challenging context.

Overview of the Chapters

In Chapter Two, I present the literature review. Embedded in the literature is elaboration of activity theory, the theoretical framework underpinning this study. The literature reviewed in the chapter includes a focus on three broad areas of: professional development, education and educational contexts, and blended learning.

In Chapter Three, I present the methodology for this study. I expound on design research and also explain the mixture of methods, including documentation of design artifacts, narratives, ethnographic observations and qualitative interviews used in this study and explain the data analysis procedures. Finally, I present the ethical considerations taken in this study.

In Chapter Four, I present the findings arising from the data for this study. Data is presented in the themes which emerged from the literature and during the data analysis process. The data is presented in a way that honors the participants' voices. The participants' narratives are quoted extensively, in addition to the use of illustrations in the

[1] Kiswahili is the language commonly and widely spoken in East Africa. It is the national language in

form of artifacts and pictures gathered during instructional design and research implementation stages.

In Chapter Five, discussion of the findings is presented. In this chapter, I use the discussion of data in answering question one of this study. The discussion of findings continues in Chapter Six by providing answers for questions two and three. Thus, the implications of this study for teachers and PDTs, and the conclusion and recommendations are presented in Chapter Six. In this dissertation, I have largely presented the information in first person voice in recognition of the researcher role as participant observer especially as the instructional design and technology expert in the research.

Chapter Summary

In this Chapter, I briefly introduced this study. I first provided a background of global initiatives; specifically Education for All and Millennium Development Goals as commitments taken by the countries of the world to improve the human condition. I then presented a background to the Kenyan government's ambition to provide quality education and the challenges faced in this endeavor. Following the background on inadequacy of teachers' professional development in Kenya, I presented the statement of the problem and the research questions for this study. Finally, I briefly presented the research context and my interest that led me to this research. In Chapter two, I present the literature reviewed in this study, including the theoretical framework.

Kenya.

CHAPTER 2: LITERATURE REVIEW

The more technologically advanced we become, the more our world is characterized by change.

George David Miller, Editorial Forward, Whitehead and Philosophy of Education.

Introduction

In this chapter, I review literature relating to the broad research topic of professional development while touching on the other key aspects in this research, including the activity theory, educational contexts, and blended learning. The literature reviewed in this chapter serves a number of purposes including

- to present an overview of the research topic;
- to identify gaps in existing research;
- to ground the study in existing literature;
- to build on existing knowledge in the area of professional development; and
- to define the boundaries for this study (Gereluk, 2012).

This study is grounded in literature categorized under three broad headings: professional development; education and educational contexts; and blended learning. Under professional development (Moore, 2006; Guskey, 2002; Sparks, 2002), there are sections on the activity theory, which was introduced in the 1920s by Vygotsky (1978), developed further by Leont'ev (1978), and expanded by Engestrom (1987; 2000; 1999; 2008) and others. Other sections in this broad heading include: Situated learning theory (Lave & Wenger, 1991; Barab & Duffy, 2012), adult learning (Merriam, 2001; Collis, 2006; Selinger, 2006), self-directed study (Garrison 1997; Lai, 2011; Song & Hill, 2007), and

reflective practice and reflective conversations (Dewey, 1933; Schon, 1983; Taylor, 2008; Otienoh, 2009; 2011).

The second literature review heading is education and educational contexts (UNESCO, 1948; 2010b; Ministry of Education, 2005). This review category includes sections on professional development as a way to change teaching practice (Fullan, 1985; Joyce, 2004; Showers, 1983; Akyeampong, Pryor, Westbrook & Lussier, 2011), a definition of challenging educational contexts (Harris, 2002; Chapman & Harris, 2004; Crichton & Onguko, in press), the status of primary teacher preparation in Kenya (Ministry of Education, 2005; Kisirkoi, 2012), inadequacy of professional development in Kenya (DfID, 1998; Wanzare, 2002; Bunyi, Wangia, Magoma, Limboro & Akyeampong, 2011), teaching practices in Kenyan primary education (Amutabi, 2011; Kabaji, 2012; Pontefract & Hardman, 2005), and teachers' professional development in Kenya (Waudo, Juma, Herriot & Mwirotsi, 2002; Hardman, Abd-Kadir, Agg, Migwi, Ndambuki & Smith, 2009; Waititu & Orado, 2009; Wanzare, 2002; Otienoh, 2010);

Finally, the third heading is blended learning (Bersin, 2004; Garrison & Vaughan, 2008; Gunga & Ricketts, 2007). This section reviews the literature on appropriate technology (Schumacher,1973; Batteau, 2010; Januszeswski & Molenda, 2008) with specific focus on tablets and computers (Mock, 2004; Boyinbode & Akinyede, 2008; Willis & Miertschin, 2004), mobile learning within Africa (Brown, 2003; Vosloo, 2010; Traxler & Leach 2006; Onguko, Ngatia & Crichton, 2011), and Open Educational Resources (OERs) (Siemens & Tittenberger, 2009; Daniel; 2010; Gakindi, 2010). The final section

under literature review on blended learning is technology stewardship (Mumtaz, 2000; Wenger, White & Smith, 2009).

Professional Development

Moore (2006) observed that in the 1970s, UNESCO vigorously promoted the notion of life-long learning as a strategy for managing the pace of change, using the term continuing education. Moore argued that it was Gardner (1978) who proposed continuing professional development as a term with a wider application in education. According to Moore continuing professional development would include both the development of the individual's persona and the advancement of the individual's professional career. The term professional development (PD) is used in this study to include what is commonly referred to as continuing professional development or in-service training.

According to Guskey (2002), professional development is the systematic effort to bring about change in the classroom practices of teachers, in their attitudes and beliefs, and in the learning outcomes of students. Guskey argues high quality professional development is central in nearly every modern proposal for improving education. Further, the envisaged end in any professional development effort is improvement in student learning. Guskey, a professor in the College of Education at the University of Kentucky has done substantial research on professional development, specifically focusing on evaluating effectiveness of professional development. Thus Guskey's definition of professional development as a systematic effort to bring about change in the practices of teachers in their attitudes and beliefs and the learning outcomes of students is adopted for this study. This systematic change can be achieved through provision of opportunities for teachers to

experience a variety of situations that would enable the change in attitudes and beliefs. Thus professional development activities are designed to initiate change in teachers' attitudes, beliefs and perceptions (Guskey, 2002).

Sparks (2002) emphasized the need for a different approach to high-quality professional development. Sparks, writing from the United States National Staff Development Council, argued professional development as it was experienced by most teachers and principals had been unfocused, insufficient, and irrelevant to the day-to-day problems faced by educators. He then pitched for high-quality professional development suggesting it

- deepens teachers' content knowledge and pedagogical skills;
- provides opportunities for practice, research, and reflection;
- is embedded in educators' work and takes place during the school day;
- can be sustained over time; and
- is founded on a sense of collegiality and collaboration among teachers and

between teachers and principals in solving problems related to teaching and learning.

Sparks' view on high quality professional development is illuminating in that he wrote from the perspective of the United States situation in 2002. He sought to correct a situation which was prevalent for the state of teachers' professional development in the United States. However, at least he sought to improve the quality of professional development, a practice which was already recognized as being important for making a difference in student learning. The situation is very different, for example in Kenya,

where teachers' professional development is not valued as part of the continuous professional learning (Bunyi, et al. 2011). Spark's recommendations for high-quality professional development could be valuable in informing the design of PD for Kenyan teachers.

Perhaps it is important to revisit the view that teachers' training programs do not fully prepare new professionals for the daunting responsibilities before them (Davis & Bloom, 1998). Wanzare (2007), who conducted a literature study from a global perspective, concurs arguing that several researchers and writers believe that pre-service training does not prepare teachers adequately for teaching. Therefore it is critical to maintain sustained professional development programs for teachers as pre-service training institutions only act as a starting point for the development of teaching skills and abilities for intending teachers (Wanzare, 2007).

For developing countries such as Kenya, teachers are typically not adequately trained due to a number of factors related to low funding of teacher education programs especially at primary level (Ministry of Education, 2012). As such professional development is required even more for Kenyan primary school teachers who generally begin their careers having inadequate preparation (Wanzare, 2002; Otienoh, 2010). Wanzare and Otienoh, who are both Kenyan scholars, have conducted studies on aspects of teachers' initial preparation and their professional support while on the job, researching aspects such as how teachers can be prepared to handle large classes. Detailed literature on teacher

preparation and professional development in Kenya is reviewed in other sections ahead in this chapter.

In the following section, I elaborate on activity theory. This is the theoretical framework that guided this study. This research suggests PD informed by activity theory is appropriate for practicing teachers as it engages them in relevant, meaningful activities situated within their work contexts.

Activity theory

Activity theory has been used over the years by many scholars especially in western countries and Russia as a guiding theoretical framework to understand human practice as developmental processes where both individual action and social interaction are interlinked. From Vygotsky's (1978) perspective, human activity entails social interaction with others mediated through cultural tools in the learning process that help internalize the experience. Further, activity theory maintains that knowing is achieved through action, and is manifested through practical social activity settings mediated by tools, language and social and cultural circumstances (DeVane & Squire, 2012; Daniels, 2004).

Leont'ev (1978), who took up and expanded on activity theory after Vygotsky's early death, asserted that in order to prompt an activity, there should always be a need. This suggests an activity is a response to one need or another. Commonly human activity is driven by a need to be satisfied through tool mediation and social interaction. Leont'ev pointed to some of the features of human activity as goal directed processes that entail

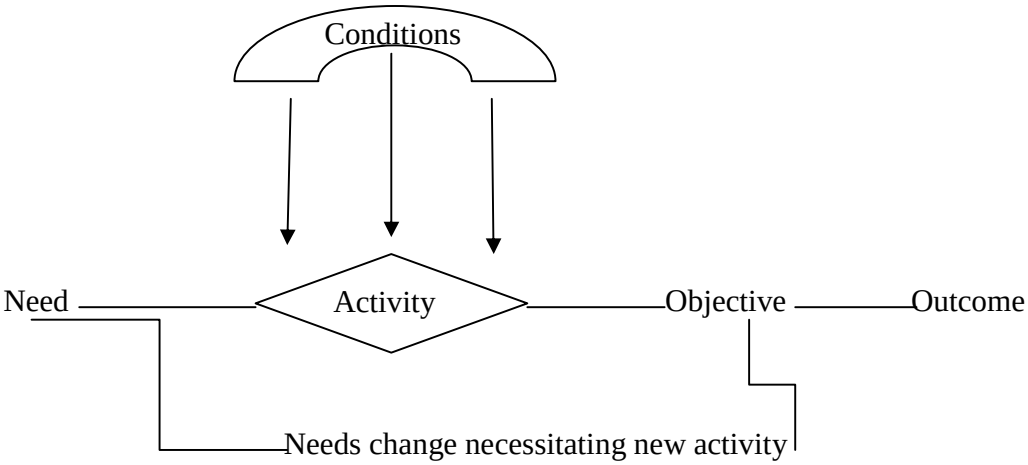
division of labor and isolation of partial tasks. A collection of partial tasks are achieved by people working on a collective activity in a social relationship to achieve a larger goal. Leont'ev's perspective advanced activity theory as his efforts together with others such as Luria are popularly referred to as the second-generation of activity theory (Roth & Lee, 2007).

Taking up and expanding activity theory further, Engestrom (1987; 1999; 2000) asserted that activity is a collective, systemic formation that has a complex mediation structure with multiple mediations. Engestrom (2000) pointed to the mediation role of tools in goal-oriented activities. Engestrom (2011) asserted that human learning takes place within and between complex, continuously changing activity systems. He emphasized a key implication of the activity system is that the interventions need to be embedded and contextualized in the participants' meaningful life activity. In other words, an activity intervention should focus on addressing the motives or needs of the participants; implying involvement of participants in identification of their needs or motives.

Engestrom (2008) identified an interplay between the subject and the object, or the actor and the task domain, which is mediated by tools. The tools include not only machines such as computers, but also symbols such as language and representations of various kinds including artifacts. Engestrom and his colleagues (including Lompscher and Ruckriem) particularly helped to ground tool mediation as an important part of activity theory through their work at the Center for Activity Theory and Work Research at the University of Finland, Helsinki (Roth & Lee, 2007).

Activity theory, considered from the earlier Vygotskian thought, is typically seen as a system of relationships between a need, activity and objective supported by conditions that enable action (Botha et al., 2007). Implied in the system of activity relationships are: identification of a need, which is then addressed through efforts that involve interaction and collaboration through a series of activities to address the objective. There have to be conditions that favor the achievement of the objectives, including mediation by tools leading to a desired outcome. As the objectives are met, human needs change necessitating new ways to address activities that might be even more complex. These relationships in an activity system for this study are depicted in Figure 2.1., which was adapted from Engestrom's (1999) triangle of relationships in activity system.

Figure 2.1: Activity System of Relationships



In the activity system of relationships, the need is addressed through activities guided by set objectives within social and cultural conditions to achieve intended and sometimes unintended outcomes. The conditions as depicted in Figure 2.1 entail the social and

cultural circumstances (including tools and languages) that enable humans to interact and act within the activity system.

In an activity system, people take the commitment to grappling with the different aspects of everyday activity to realize successful outcomes (Nardi, 1992). Engestrom (2000) explained the processes in an activity system, suggesting the process begins with actions of questioning the existing standard practice, then proceeds to actions of analyzing the contradictions in the system and modeling an intervention, then to actions of examining and implementing the new model in practice. In implementing the new model, the actors are often confronted with varying conditions that include personality characteristics and contextual conditions that eventually influence the direction of the activity. Success in an activity system therefore depends on how the people navigate through both their relationships and the contextual conditions prevailing at the time.

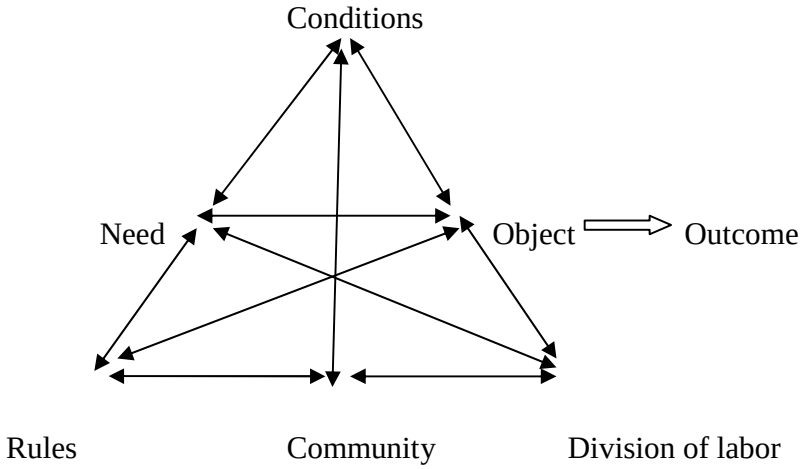
The activity system of relationships in Figure 2.2 is an expanded version of Engestrom's triangle of relationships in an activity system, to accommodate the social and material conditions necessary in an activity system (Engestrom, 1987; 1999; Roth & Lee, 2007). This expansion has been referred to as the third generation of the activity theory (Roth & Lee, 2007; Botha, et al. 2007). Among the supportive conditions necessary for the activity to be achieved are

- social interactions by a community of members;
- conventions or rules guiding the interaction;
- shared roles through division of labor among members; and

- cultural conditions, including tools that mediate human interaction in the activity system.

The expanded activity system depicted in Figure 2.2 is adapted from Engestrom (1999). To recap the relationships in an activity system, a need is first identified through analysis of the context and steps taken to address the need. Among the actions taken are: mediation by tools and symbols such as language, and participants' interaction in a community. The participants are guided by agreed conventions and rules. The participants in an activity system act through shared responsibilities, leading to division of labor with each participant playing their part towards achieving a desired outcome.

Figure 2.2: Expanded Activity System of Relationships



Key features of the activity theory, which are critical to this study, are active engagement and social interaction. According to Roth and Lee (2007), an activity is realized through concrete actions directed towards goals framed by individuals. Through their deliberate actions to satisfy specific needs, human beings not only consciously engage in social

interaction to achieve the goals, but also actively engage in the task at hand to accomplish or satisfy their needs. To achieve a given task, human beings engage actively with others and/or with the materials or tools, aided by communication processes such as gestures, verbal explanations and finally leading to articulate explanation of the task or activity processes

Working with teachers who, by the nature of their work actively engage with colleagues and their students in a learning system, the two features of social interaction and active engagement cannot be over-emphasized. The key features of a learning system are the ability to relate with others and engage with them in achievement of the task at hand. Learning itself is a social endeavour that entails acting with others to achieve common goals. For example, teachers could benefit from learning in community with others, by coming together to deepen their understanding of the subject content they teach and how to best teach that content, as their common goals (Barab & Duffy, 2012). Professional development provides opportunities for such active engagement and social interaction as teachers focus on addressing their common needs guided by identified objectives concerning their professional practice.

Elaborating on activity theory, Botha, et al. (2007) asserted that human activity is attributed to the specific needs that human beings have to accomplish based on specific objectives. Botha, et al. further stated that activity is then mediated by one or more tools and is reflected through people's actions as they interact with the environment. Botha, et al. specifically focused on expanding activity theory to incorporate mobile technology as

a partner in learning. Writing from South Africa, these researchers might have been influenced by the fact that mobile phones are the most wide-spread technologies in Africa and hence their fairly wide adoption as the tool of choice not only in education, but also in other sectors such as banking, commerce and health.

In view of the attributes of activity theory identified by scholars (for example, Engestrom, 2001, 2008; Both, et al. 2007; DeVane & Squire, 2012), activity theory appears to be a relevant theoretical framework for this study whose focus is on deployment of appropriate technologies for teachers' PD in a complex setting. The relevance of activity theory for this study is also informed by Jonassen and Rohrer-Murphy's (1999) view that activity theory provides an appropriate framework for analyzing needs, tasks and outcomes for designing constructivist learning environments. Activity theory according to these researchers seems to provide the richest framework for studies of context in its comprehensiveness and engagement with different issues of consciousness, intentionality and history.

Botha, et al.'s work, which entailed a literature study from an African setting that elaborated on expansion of the activity theory to accommodate mobile technologies, was significant, as not much has been written on activity theory from an African setting. Recent developments from an African context, however, indicate that the activity theory is beginning to take root as an important theory for understanding learning as transformation rather than transmission (Hardman, 2005a). It has been documented that teaching and learning in most of sub-Saharan Africa and specifically in Kenya has

previously been construed as transmission of facts from the teacher to the learners (Pontefract & Hardman, 2005). Since activity theory entails active engagement and social interaction, its use as a guiding framework can be helpful in addressing learning as transformation rather than transmission.

Some researchers in Africa, particularly from South Africa, have used activity theory to guide their research activities such as Hardman, (2005a; 2005b), and Botha et al., (2007). From Kenya, Chogi (2007) has referred to the activity theory in his work on medium and small enterprises. The use of activity theory to understand human engagements in African settings will hopefully continue to expand with expansion in research activities and access to modern technologies. This theoretical perspective is particularly relevant in an African setting because there are many learning needs and people generally speak about their needs, at times with a lot of frustration and other times with a lot of enthusiasm. Thus, if needs can be identified and articulated, they can be addressed through the activity mediation system, as needs often have inherent goals to enable achievement of outcomes.

Hardman (2005a) utilized activity theory as a framework for technology research in an unequal terrain - post-apartheid South Africa. Hardman, a professor at the University of Cape Town, investigated how the activity theory could be used to understand the process of transformation occurring when computers are introduced as teaching/learning tools and how the different systems interact with, and transform each other over time in a postgraduate course (Hardman, 2005a). Through interviews and observation of 20

Bachelor of Education students in a course entitled “Learning and Cognition”, Hardman found introducing a computer as a teaching tool led to a shift in the classroom, transforming traditional behaviours and changes in the learning system. There were more actors in the community, for example, as the laboratory technician and software designer became part of the community in addition to the lecturer and students. Thus new contradictions, rules and division of labour, emerged as a result of the shift. There were new social interactions, new rules and an expanded community, as opposed to the previous situation where only the lecturer and the students formed the community.

In another study, Hardman (2005b) utilized activity theory to understand how teachers use technology to mediate the teaching and learning of mathematics in four case studies in four primary schools (two rural and two urban) in Western Cape, South Africa. Four mathematics teachers were the subjects in the study, and the study was located within four grade six classrooms. The data in the study were collected over a period of one year through observations and interviews although most of the data reported in the paper, were based on interviews after teachers taught two lessons each; one traditional math lesson and one computer-aided math lesson (Hardman, 2005b). The findings indicated teachers viewed the object of the computer lessons as acquisition of lower order cognitive skills such as technical, computer skills, drill and practice and students’ motivation as opposed to higher order conceptual development expected of such technology (Hardman, 2005b). This outcome was generally consistent with the process by which computers are initially introduced to teaching of specific subjects, especially with the long time required to

master their use; thus teachers initially focus on technical and computer skills as well as drill and practice.

Botha, et al.'s (2007) assertion that mobile technologies as tools interact with the user and hence they become an active partner with the user provides new impetus to the conceptualization of activity theory in view of the recent developments in technology tending towards small and mobile tools. In this study mobile technologies, namely tablets and mobile phones, were utilized to mediate learning with the potential for personalization of learning experiences through such portable technologies. Thus personalization of learning experiences makes a case for concurrence with the view that mobile technologies can indeed be active partners in learning, enabling a personal relationship between the user and the technology as Botha et al. would have it. Indeed a general observation of current use of mobile tools points to an inherent personal relationship between the user and the tool.

Activity theory was used by Chogi (2007) as the guiding framework in studying the impact of mobile phone technologies on medium and small enterprises in Kenya. Through a survey study, Chogi, who was based at the University of Nairobi's School of Computing and Informatics, sought to understand the role of mobile phones in changing the micro-enterprises and the opportunities available to entrepreneurs as a result of proliferation of mobile phones in Kenya. The study was guided by the activity theory to reflect people's actions as they interact with mobile phones to perform business transactions and social networking. Of the 43 respondents, 88.4% felt that mobile phones

had a high positive impact on their enterprises over time, and thus the tool (mobile phone) transformed the objectives of the entrepreneurs leading to tangible benefits such as mobile money banking accounts, mobile money payments and access to agricultural commodity process.

The four studies reviewed, conducted in South Africa and Kenya which used activity theory as the guiding framework, are important for this study for a number of reasons. These studies focused on technology tools such as computers (Hardman, 2005a; 2005b) and mobile phones (Botha et al, 2007 and Chogi, 2007) in enabling human engagement in addressing the varied needs. The studies also provide an important foundation for this study, paving the way for use of the activity theory as a relevant theoretical framework in an African context, especially knowing that for a long time the activity theory has been utilized in the Russian and Western contexts.

While Hardman's (2005a; 2005b) studies involved observation of actual use of computers as tools in teaching in university and primary school classrooms in South Africa respectively, my study focused on deployment of tablets as tools to enable teachers' engagement in professional development in a rural Kenyan setting. On the other hand, Botha, et al. (2007) and Chogi's (2007) studies did not involve observation of actual deployment of mobile technologies as tools, but rather were literature and survey studies respectively. Chogi's study, which was done in Kenya, was particularly focused on small and medium enterprises and not on teacher learning. These studies therefore leave a gap for my study, which is unique in that it utilizes a variety of appropriate

technologies including tablets, mobile phones, and solar energy as well as open source software such as open educational resources to enable access to relevant professional development for teachers in a Kenyan context.

In this study, the activity, (professional development), was undertaken by teachers motivated towards achieving the objective (teaching large classes) and working through prevailing conditions (in a school in a challenging context and mediated by tablets) in collaboration with others (community of fellow teachers). The activity, (professional development) was enacted within a cultural environment with conventions (such as communal and professional commitments – rules) and social strata (division of labor – teachers and instructors engaging in various tasks as individuals or in group action as a community) to address the need (teaching large classes) and achieve the outcome (changed teaching practice). Coupled with the use of activity theory in this study, is situated learning theory, which is important in studying activities in context (Nardi, 1992) as reviewed in the following section.

Situated learning theory

Situated learning theory posits that learning activity takes place in specific circumstances (Lave & Wenger, 1991). According to situated learning, the important aspect of peoples' engagement in activity acting in context is the focus on the unfolding of real activity in a real setting (Nardi, 1992). These authors therefore imply that meaningful learning can be made specific to the situation at hand. Thus learning occurs in the lives of persons who are embedded in the culture that enables learning to occur.

Situated learning theory presents learning as a meaning making practice that is not separate from the context in which it is situated (Barab & Duffy, 2012). In this understanding, experiencing learning embedded within the work context enables the people learning to participate in authentic practice (Land, Hannafin & Oliver, 2012). According to Land, et al. (2012) learning within practices, situations and processes of a community frame how knowledge is meaningfully used. In other words, the best way to acquire and utilize new learning is to locate the learning experience within a community of actors and in the context where the knowledge and skills are required.

Situated learning, according to Barab and Duffy (2012), guides peoples' interactions, the practices they engage in, the reasons for their engagement in particular practices, the resources they use, and the constraints of the particular task at hand. These are important factors in determining the activities people engage in when learning and the contextual realities that influence their actions. For example, contextual analysis is critical in determining the contextual realities before implementing a learning program. Contextual analysis would among other factors contribute towards understanding and determining the participants' needs, their capabilities and inadequacies, contextual constraints, potential activities and learning approaches.

Situated learning theory guided the development of content and implementation of professional development in this study, particularly in terms of embedding the learning experiences within the work context in school and classrooms. Situated learning theory is particularly important for adult learners who have specific and immediate needs for their

daily engagements. Adult learners also have unique characteristics including busy lives and may require personalized attention in their learning, including appreciation of their previous experiences as reviewed in the following section on adult learning.

Adult learning

This study focused on teachers' learning through professional development, hence an adult learning process. As such, a review of adult learning theory is critical in locating this study within its rightful perspective. It has been argued that the adult learner, the learning process and the context of learning form the corner-stone of the field of adult education (Merriam, 2001; Holton, Swanson & Naquin, 2001). There is no single explanation or theory of adult learning because adult learning is far too complex, too personal and at the same time, too context-bound for one theory (Merriam, 2001). Instead of one theory of adult learning, Merriam suggests there has been an ever-changing mosaic, where old pieces are rearranged and new pieces are added. It is, however, important to understand the different pieces of adult learning theory in order to continue improving the individual adults' experience (Holton, et al. 2001).

Adult learning theory may be understood as the answer to the basic question: How do adults learn? This is a basic question because, to answer it one needs to address several aspects concerning adult learning, including adult learner characteristics, the various contexts where adult learning takes place and the process of adult learning itself (Merriam, 2001; Hansman, 2001).

There are two foundational adult learning theories namely, andragogy and self-directed learning (Merriam, 2001). These two theories, according to Merriam, resulted out of the first two attempts by adult educators to define adult education as a unique field of practice. Andragogy and self-directed learning both present adult learners as independent, internally-motivated, problem-centered and interested in immediate application of knowledge (Merriam, 2001; MacKeracher, 2004). Merriam (2001) asserts that since adults manage other aspects of their lives, they are capable of directing, or at least assisting in planning their own learning.

While agreeing with Merriam (2001), King and Gura (2007) observed that efforts to address teachers' professional development should be related to the teacher's level of application and need. These authors emphasized that teacher-created content is immensely valuable. To only present professional development materials created by professional development providers cannot always meet the need (King & Gura, 2007). Consistent with the view that adults are capable of directing or assisting in planning their learning, teachers may be able to contribute towards the creation of professional development content arising from their involvement in needs assessment and sharing of their contextual experiences. Involving teachers in content creation is likely to provide a valuable authentication from which to be heard and also upon which to build future opportunities for learning (King & Gura, 2007; Williams, 2010; Selinger, 2006). Working with teachers from the context where there is a professional development need, providers can have huge and positive implications in terms of authentication of such

intervention especially with regard to relevance and appropriateness of the activities and the approaches used.

Teachers' PD may entail work-based learning activities designed to fit into the normal school routine, with opportunity for collaboration or support by peers within the school. Indeed, Collis (2006) recommended that work-based learning activities must be directly relevant and valuable in the work place. Work-based blended learning activities would keep teachers in classrooms while undergoing professional development, so that school attendance targets are maintained, and also allow teachers to put new ideas into practice, thereby directly integrating theory and practice (Selinger, 2006). For example, two teachers can be guided on planning and implementing a peer support relationship for their teaching. This process would involve preparing for lessons together, assembling the relevant resources, observing each other's lessons and finally providing feedback to one another. The teachers would then be required to document this peer support process as evidence or proof of the authenticity of their learning and as part of the assessment process.

The authors whose work has been reviewed here (i.e. Collis, 2006; Selinger, 2006; & Williams, 2010) have a western, developed countries' orientation and their ideas have been applied and tested in those educational systems for a long time. For the Kenyan context, where there are inadequately prepared teachers who teach large classes, and work a longer instructional day, providing professional development embedded within the work environment may have huge benefits. The benefits may include immediate

application of what is learned in practice and also avoiding interference with the learning process through withdrawal of teachers from classrooms for extended periods. Incorporation of work-based learning experiences in PD may be guided by the self-directed learning theory of adult learning.

Self-directed study

Self-directed study has for long been identified as a central concept in the study and practice of adult education (Garrison, 1997; Merriam, 2001). Realizing self-directed study had for long been limited only to focus on autonomy of adults in their learning; Garrison (1997) redefined self-directed study to incorporate aspects of contextual control and cognitive responsibility. He defined self-directed study as "an approach where learners are motivated to assume personal responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing and confirming meaningful and worthwhile learning outcomes" (Garrison, 1997, p.18).

In a study that sought to establish the self-directed learning readiness of 283 Taiwanese civil servants, Lai (2011), using Self Directed Learning Readiness Scale (SDLRS) developed by Guglielmino, found that the civil servants valued the importance of being self-directed learners in an online learning environment. Lai linked the high levels of self-directed study readiness to the requirement by policy, since 2007, for Taiwanese civil servants to take online training courses. In the study, Lai apparently attributed self-directed study readiness of the Taiwanese civil servants directly to online learning and Internet use. Indeed Lai (2011) suggested that self-instruction was the best method of learning Internet usage for adult students. However, it is important to note that self-

directed study is much more than independent study online or while using the Internet. Self-directed study may be motivated by more factors including the contextual circumstances, personal drive and self-motivation. The expanding availability of appropriate and mobile technologies, however, will make self-directed study more common and increasingly relevant for developing countries like Kenya, and the readiness for self-directed study will be a key factor.

Song and Hill (2007) have emphasized the importance of context in self-directed study. They particularly singled out the anytime, anywhere nature of asynchronous online learning that places the learner in control of when, where, and how they learn. For those who cannot as yet access online learning due to contextual circumstances such as infrastructural limitations, availing asynchronous learning experiences through offline anytime, anywhere modalities with content on mobile technologies such as tablets still provide learners with control over when, where and how to study.

Self-directed study entails adults taking control over their learning process. In self-directed study the adult determines when, where and how to engage in study; thus pacing their study while balancing their time and competing responsibilities. Such control of their learning may call for some time for interaction with others through conversations and collaboration to enable active engagement in the learning process. One way to enhance active engagement, collaboration and social interaction is through reflective practice and conversations, which is reviewed in the following section.

Reflective practice and reflective conversations

Reflective practice has been identified as a concept with substantial history and base of knowledge (York-Barr, Sommers, Ghere & Montie, 2001). Dewey (1933), being one of the proponents of reflective practice, was concerned about people's ability to think as this is the distinguishing power between human beings and lower animals. This concern with the way human beings think led Dewey to consider the values of reflective thought. Dewey argued that reflective thought emancipates human beings from merely impulsive and merely routine activity. Dewey thus emphasized reflective practice as a means that would enable humans to direct their activities with foresight, plan according to an end in view or plan with awareness of purpose.

Schon (1983) has also added to the understanding of reflective practice. Schon particularly added to the reflective practice discourse the two views of reflection-in-action and reflection-on-action. By reflection-in-action, Schon meant human observation and thinking on current actions as they occurred with a view to making necessary adjustments at the moment of action. On reflection-on-action, Schon meant the human capacity to look back on what had transpired and learn from the experience with a view to improving on future action (York-Barr, et al. 2001). These views by Schon have particularly been emphasized for the teaching profession where teachers are encouraged to reflect-on-action and in-action.

Focusing on reflective practice as a part of teaching practice, Otienoh (2009) observed that professional development plays an important role in changing teaching practice.

Otienoh, who is a lecturer and my colleague, referred to our institution, the Aga Khan University's Institute for Educational Development in East Africa, as an institution that conducts professional development programs for practicing teachers in Kenya. The PD programs at this institution include a major component of reflective practice with the aim of empowering teachers to take ownership of their professional development and change their classroom practices (Otienoh, 2009). While Otienoh did not explain how the teachers would change their classroom practice through reflective practice, it is understood that reflective practice entails consistent push of oneself to think of alternative ways of handling issues as they arise in the daily teaching experiences and challenges (Onguko, 2005). Through consistently thinking of alternative ways to handle situations, teachers may potentially change their teaching practices. It is worth noting that each time a teacher interacts with a learner, there emerge new challenges with new expectations and outcomes. As these interactions progress, they lead to new learning experience, as the teacher handles the varied situations.

The School-based Teacher Development (SbTD) program introduced the reflective model of teacher education in Kenya (Bunyi, et al. 2011). In this program, teachers were expected to keep a record in a daily diary of critical incidents happening in their teaching. While some teachers in the program made attempts to keep descriptive records of the critical incidents, from my personal experience in implementation of SbTD, most teachers were hampered by the oral tradition and hence did not make good progress in logging-in critical incidents in their reflective diaries. Consistently keeping reflective

journals has generally been found to be difficult, even in the western world where writing and recording has been part of the culture (Taylor, 2008).

An explanation for lack of consistent reflective practice can be linked to learning preferences where, instead of the use of reflective journaling, some learners have been found to prefer talking about issues rather than writing them in journals (Taylor, 2008). Taylor stated that some learners do not see it necessary to write their thoughts and therefore, do not see a need for keeping reflective journals. This situation is prevalent in cultures that have an oral rather than a writing tradition, who prefer speaking out issues rather than documenting them. Use of reflective conversations is an important alternative way to engage teachers from such oral traditions in reflecting on their practice. Such oral cultures are common in Africa, where writing was not part of the traditional practices.

Reflective conversations enable participants to make their thinking public through open dialogue, thus extending and elaborating each other's thoughts, and collaboratively constructing understanding amongst themselves (DeBruin-Parecki & Henning, 2002). Reflective journaling which entails documenting one's reflections is an important way of monitoring professional growth over time. However, unlike reflective journaling which tends to be personal and isolated for one's own consumption or for the instructors to read and provide feedback on growth in learning (O'Connell & Dyment, 2011), in reflective conversations participants openly share their reflections with colleagues. "The conversations are enriched by multiple perspectives and issues can be explored through a variety of lenses" (DeBruin-Parecki & Henning, 2002, p. 19).

In a small-scale study done in Tanzania to establish why teachers find reflective journaling challenging, Otienoh (2009) found that there are no structures in schools to support reflective journaling. The three teachers' who were interviewed by the researcher pointed to their heavy workloads and the lack of tangible benefits of reflective journaling, as two of the reasons why they do not continue with reflective practice after their training. The teachers also felt that the feedback given by instructors during training after reading their reflections is normally discouraging. Otienoh's study was an important step in establishing reasons why teachers find it difficult to continue keeping reflective journals after their training. The study provides a basis for rethinking both the way reflective practice is introduced and how reflective practice could be enacted in an oral cultural tradition like Kenya.

In another study, an alternative approach that would empower teachers to participate in deciding how to structure their reflective practice was suggested by Otienoh (2010). In the study Otienoh interviewed 12 participants including eight teachers and four instructors, who all participated in courses that introduced reflective practice for teachers. While the teachers were not comfortable with the written feedback provided by instructors after reading their journals, the instructors thought written feedback was important for developing reflective practice skills (Otienoh, 2010). Otienoh suggested that teachers should have a chance to choose the format of their reflective practice so that they do not see it as a prescribed, examination-like approach with a preferable response. Alternative approaches may include reflective conversations, which formed a major part

of the face-to-face sessions to get teachers talking about their experiences in this study. Otienoh's study was done in Dar es Salaam, Tanzania, at the Aga Khan University. The same institution offers professional development to teachers in Kenya, in which reflective practice is emphasized and some of the instructors interviewed were also involved in delivery of programs in Kenya. The findings in Otienoh's study can be helpful in thinking about the appropriate way to use reflective practice in the Kenyan context.

By styling reflective practice as reflective conversations in this study, it was deemed easier to get teachers' views in face-to-face sessions leading to richer sharing of experiences, because teachers in Kenya tend to be more expressive in oral reflections rather than written reflective journaling (Otienoh, 2010). Maathai (2009) writing on the challenge for Africa confirmed that Africa has had an oral culture rather than a culture of writing. Kenyan teachers being part of this oral tradition are deemed to be more comfortable sharing ideas and experiences in the oral mode. To bring the Kenyan teachers and the educational context in which they operate into perspective, a review of literature relating to Kenyan educational context and teacher preparation is presented in the following section.

Education and Educational Contexts

Education is not only recognized as a fundamental human right, through Article 26 of the Universal Declaration of Human Rights (UNESCO, 1948), but is also considered critical to the exercise of all other human rights (UNESCO, 2010b). Education is a powerful tool by which economically and socially marginalized adults and children can uplift themselves from poverty; realize better, more productive lives and participate in human

endeavours fully as citizens (UNESCO, 2010b; Glennerster, et al. 2011). It is with this understanding of education as a human right that the global efforts have been stepped up over the last decade through Education for All (EFA) and the Millennium Development Goals (MDGs).

Kenya embraced the global goals for both EFA and MDGs and committed to work towards achievement of these goals for the benefit of her citizens. Through the domestication of these global obligations, the Free Primary Education (FPE) program was initiated in Kenya (Ministry of Education, 2005). The right to education was included in the Kenyan constitution, which contains a comprehensive bill of rights and was promulgated in August 2010 (Government of Kenya, 2010). The importance of education cannot be overemphasized, since it is a part of the Universal Human Rights as well as a constitutional obligation in Kenya. There are, however, still many challenges to educational provision in Kenya, so that the right to education is far from being realized. Kenya has many marginalized communities, including the teachers in rural areas, like the ones who participated in the intervention in this study. Such teachers are marginalized because they do not get opportunities for professional development and generally work in appalling conditions.

A report on review of progress, challenges and potential solutions in education prepared for the Kenyan Prime Minister's Office highlights some of the challenges faced by the Kenyan government in the endeavour to provide education as a right for Kenyan children (Glennerster, et al. 2011). The data for the report were from a review of quantitative

research studies done on education in Kenya over the years. Following a nationwide survey of 100, 000 students between the age of 3 and 16 in over 2000 schools, which was done by Uwezo (2010), it was found that only 33% of children at grade two could read a paragraph at that grade level. The survey also found that 25% of the students at grade five could not read a paragraph of grade two work (Uwezo, 2010). These are glaring learning problems in the educational system, which are contributed to in part by large classes and poor teaching approaches such as use of rote learning. One possibility of the solutions provided in the Glennerster, et al. report is change of teaching methods. The authors of the report did not recommend the preferred teaching methods, but instead recommended that more research be done to determine the most effective teaching methods given the large number of students of mixed abilities. The report identified that at the beginning of 2005 in some areas of Western Province, where the school in this research is located; there were 83 students in most of the classes, while in 28% of the classes there were over 100 students. The Education Ministry's recommended class size in Kenya is 40 students.

The findings and recommendations in the report provide important information on gaps for research such as the one done in this study on teaching strategies for large classes with students of mixed ability in a challenging educational context. With teachers who are inadequately prepared and who use traditional teacher-dominated teaching approaches (Ministry of Education, 2005), one way to address the situation is to provide access to professional development to enhance their teaching. There is a perceived correlation between professional development and potential change in teaching practices as reviewed in the following section.

Professional development and change in teaching practice

Professional development provides teachers with opportunities to reach beyond their current professional repertoire (Joyce, 2004). According to Joyce, teachers are wonderful learners who, when given just a few days of high quality professional development, can enhance their performance and make huge differences for their students. Joyce suggested that teachers need some help to make changes in their practice in curriculum, instruction and assessing student learning. The help envisioned by Joyce focused on professional development providers availing themselves as working colleagues to inquire with teams of teachers, becoming part of, rather than professional development 'presenters' (Joyce, 2004).

Fullan (1985) identified eight common variables of effective schools. Among the variables is professional development. In effective schools, teachers as individuals play their role through delivery of instruction. Indeed, Fullan pointed to change at the individual level as a process where individuals alter their ways of thinking and doing (implying teaching). Fullan further pointed to school factors conducive to professional development including teachers talking to each other, planning for teaching together and observing each other as they teach. These school factors identified by Fullan are generally lacking in Kenya as teachers plan individually, have full teaching loads with no time to observe each other and generally operate in their schools and classrooms in isolation.

Changed teaching practice in this study means mastery of new teaching approaches which help teachers to think and work differently, by organizing instruction in fresh ways, and helping students adapt to new approaches to learning (Showers, 1983). changed teaching practice entails recognition that it is not only the teacher as the purveyor of knowledge and the student as the recipient (Howland, Jonassen & Marra, 2012), but rather teaching and learning is more about social interaction, conversation and active engagement. Thus, changed teaching practice involves both the teacher and the students having opportunities to contribute to learning through classroom talk and engaging in learning activities.

The Kenyan education authorities recognize the importance of professional development as a potential contributor to change in teaching practice. The Kenyan Ministry of Education identified in-service education for primary teachers as an important component of the comprehensive investment program in education for the period 2005 – 2010 (Akyeampong, et al. 2011). However, it was noted that although Kenya has an elaborate professional development infrastructure, not much has been done to institutionalize professional development (Akyeampong, et al., 2011). Instead provision of teachers' professional development in Kenya consists of "small usually one shot projects by a variety of NGOs [Non-Governmental Organizations] whose focus is usually dictated by the area of interest to the particular NGO" (Akyeampong, et al. 2011, p. 52). The country's educational aspirations cannot be realized, including the need to change teachers' professional practice, with such unstructured and uncoordinated implementation of PD. Research on potential ways to address provision of PD in the challenging contexts

of Kenya could perhaps help the country towards institutionalization of PD. An explanation of the meaning of challenging context is presented through literature reviewed in the following section.

Challenging educational contexts

It is suggested in this dissertation that there is a range of contextual circumstances inherent in educational contexts like the one in this study that would be characterized as challenging educational contexts. While it is acknowledged that there does not appear to be a commonly held definition of the term challenging contexts, there seems to be some consensus that they are associated with contexts with high poverty levels (Chapman & Harris, 2004).

Harris (2002) writing on school leadership in schools that might be characterized as challenging contexts, interchangeably used the terms: schools in difficult circumstances, schools in difficult and challenging contexts, schools facing difficult circumstances, and difficult school contexts. The mixture of terms describing schools in similar situations can be very confusing. Harris (2002) pointed to the United Kingdom's Department for Education and Skills (DfES) designation of 'schools facing challenging circumstances' as those in which, among other circumstances, 35% of the students receive free meals, those schools with falling enrolment numbers and those serving inner city communities. The characteristics enumerated in the DfES categorization imply links to high poverty as a condition for designation of 'schools facing challenging circumstances'.

Challenging educational contexts can be defined as environmental, social, and infrastructural impacts that prevent individuals from reaching their potential and participating in both formal and informal learning (Crichton & Onguko, in press). The environmental, social and infrastructural constraints that characterize challenging contexts referred to in this dissertation are

- lack of universal access to formal learning;
- threats to access to learning activities due to cultural or religious reasons;
- lack of access to electricity;
- lack of clean water and sanitation services;
- lack of access to reliable, unfiltered or censored Internet; and
- other access limitations linked directly to poverty (health, fees, low wages, inappropriate clothing, etc.).

The list of constraints above is not exhaustive, although it suggests the types of challenges faced by learners and educators, including the participants in this study. The conditions enumerated above are common in many developing countries, thus calling for interventions that recognize the need to address the constraints through deployment of appropriate technologies that take into account the contextual realities. An intervention guided by the activity theory can enable alleviation of some of the challenges since teachers are able to articulate their needs; motivated to address the needs through active engagement, social interaction and collaborative effort. A review of primary teachers' preparation in Kenya is imperative in understanding some of the impacts of the constraints in challenging contexts as this study is situated in a primary school.

Primary teachers preparation in Kenya

Primary school teachers in Kenya are prepared through two-year full-time study in teacher training colleges. There are 20 public teacher training colleges and 85 private teacher training colleges[2] spread across the country (Ministry of Education, 2012). The Kenyan Education policy presented though Sessional Paper No. 1 of 2005, pointed out that teacher education programs aim at developing communication skills, professional attitudes and values that equip a teacher with the knowledge and ability to identify and develop the educational needs of the child (Ministry of Education, 2005). The same policy recognized the discrepancy in teaching approaches in primary schools which were dominated by transmission forms of teaching in which students were passive and were expected to recall facts (Ministry of Education, 2005).

Transmission form of teaching, which is widespread in the country, results from inadequacy in teacher preparation, as recognized by the Ministry of Education through its' policy in the sessional paper. The Ministry acknowledged through the policy that the content of teacher training curricular was too wide for teacher trainees to cover while also acquiring the requisite pedagogical skills (Ministry of Education, 2005). The admission by the ministry that the teacher training curricular is too wide to enable acquisition of both content knowledge and pedagogical skills reflects the inadequacy of initial teacher preparation in Kenya.

[2] Public teacher colleges are owned by the government and operated on tax payers' funding, while private colleges are owned by individual investors or religious-based organizations.

According to Kisirkoi (2011), initial primary teacher preparation in Kenya takes two years of residential training leading to a teaching certificate, where teacher trainees study 10 subjects and participate in teaching practicum. The 10 subjects offered in the first year according to Kisirkoi are: Mathematics, English, Kiswahili, Science, Religious Education, Social Studies, Professional Studies (Education), Creative Arts, Physical Education and Information Communication Technology (ICT). In the second year, Kisirkoi asserts that the trainee teachers take nine subjects (five core subjects and four optional subjects either in the sciences or arts) and teaching practicum. The core subjects are English, Kiswahili, Professional Studies, Physical Education and ICT. The Science-option subjects are Mathematics, Science, Home Science and Agriculture; while the Art-option subjects are Music, Art and Craft, Social Studies and Religious Education. While this subject offering arrangement might look like specialization in the second year, in reality, teachers are expected to teach any of the subjects offered in schools once they graduate. In Kenya, teachers trained for primary schools cannot teach in secondary schools because the preparation is quite different and specific to each level.

Initial teacher preparation for teachers of secondary schools takes four years leading to a Bachelor's degree offered in universities. Trainee teachers at this level study for two teaching subjects either in art-based subjects or science subjects, and Education (Ministry of Education, 2005). There is another category of teachers who are trained through a three-year initial training leading to a teaching diploma, in the two diploma colleges in Kenya (Ministry of Education, 2012). The diploma holders qualify as teachers of

secondary schools and study two teaching subjects in addition to physical education and professional studies (Education), which are compulsory (Ministry of Education, 2005).

The primary school teachers' preparation program is a two-year residential training. Because of the many subjects they have to study, they cannot really be specialists in any subject or grasp mastery of teaching approaches. They therefore leave teacher training ill-prepared for their professional practice as pointed out in the education policy in the Sessional Paper (Ministry of Education, 2005). Thus some scholars have pointed to the inadequacy of primary school teachers' preparation in Kenya as reviewed in the following subsection.

Inadequacy of primary teacher preparation in Kenya

From a historical perspective, Kenyan primary education sector has had problems related to teachers' adequate preparation for handling their teaching roles. The evaluation report for the Strengthening of Primary Education (SPRED) project revealed that in the mid-1980s, the number of untrained teachers in Kenyan primary schools was at 35% (DfID, 1998). This means that 35% of the teachers entered the teaching force after grade 12, before attending initial teacher training. According to the report, teachers lacked training and schools lacked teaching resources for the new subjects introduced with the 8-4-4[3] system in1985. It was also felt, according to the report, that the 8-4-4 curriculum was too full to be completed in the allotted schooling time.

[3] Kenya's education system entails eight years of primary, four years of secondary and four years of university education. Before 1985, the education system was 7-4-2-3 meaning seven years of primary, four years of secondary, two years of high school, and three years of university education.

Dissatisfaction of some Kenyans with the 8-4-4 education system since its introduction has continuously been debated with consistent calls by a section of Kenyans for change of the education system. Indeed by the time of this study, a report by a task force to review and align the education sector to the new constitution of Kenya was awaiting stakeholder debate (Ministry of Education, 2012). Also at the time of this study, there were untrained teachers still serving in the Kenyan primary schools, including in the research school of this dissertation.

Wanzare (2002) pointed to three major factors associated with low teacher quality in Kenya. These were deficiencies in teachers' pre-service training programs; persistence of unqualified and under-qualified teachers; and, inadequacies in in-service teacher training programs. Among the problems associated with low teacher quality identified by Wanzare were:

- Inadequate training period and overloaded curriculum that do not enable the trainees to master the essential academic knowledge and pedagogical skills;
- A majority of students admitted to the pre-service teacher training programs do not choose education at all, but take teaching as the last and only available option and, consequently, they have no interest in teaching;
- General low entry requirements for pre-service training as a result of regional disparities;

- The Kenyan government's endeavor to provide free primary education and the introduction of the 8-4-4 system of education made the existence of untrained teachers a permanent feature of the education system; and
- The Ministry of Education has not put in place a comprehensive teacher in-service program to prepare serving teachers to cope with the changes and challenges in teaching.

The problems identified above suggest that, generally, Kenyan primary school teachers are ill prepared for the challenging daily encounters in the classrooms. Additionally, there is neither a clear policy nor a structure in place to empower the teachers through continuous professional development once they are hired to take up teaching responsibilities. "There seems to be a theoretical recognition of the importance of CPD [continuous professional development], however, little has been done to institutionalize and improve the quality of CPD programs in Kenya" (Bunyi, et al. 2011, p. x). Those teachers hired before initial teacher training are in double jeopardy in that they have neither pedagogical skills nor opportunities for on-the-job preparation, for example, through an apprenticeship arrangement.

Kisirkoi (2011) alluded to the low levels of preparedness of primary school teachers in Kenya associated with the pre-service training entry grades. She stated that the teaching profession admits teacher trainees with low grades of 'C' and 'D' of the Kenya Certificate of Secondary Education (KCSE), the national examinations done at grade 12. With 'A' as the highest grade at KCSE, the requirement for admission to teacher training

at grades ‘C’ and ‘D’ according to Kisirkoi does not augur well for the quality of teaching and learning. This means that the quality of teaching at the primary level is consistently inadequate as the teaching profession in Kenya generally attracts low achievers with lower grades at entry into teacher training, coupled with the inadequate initial teacher training referred to by Wanzare (2002) and DfID (1998).

In a study that focused on selected teachers’ training colleges and primary schools in Kenya, it was found that the primary teacher education curriculum is overloaded leaving little room for focus on development of knowledge, understanding and skills that trainee teachers need for their teaching tasks (Bunyi, et al. 2011). The researchers also found that the primary teacher education curriculum lays more emphasis on subject content and acquisition of theoretical knowledge about teaching reading and mathematics rather than on understandings and skills for teaching. They as well found that the trainee teachers mistake the theoretical knowledge acquired about teaching for teaching competence and leave colleges confident about their ability to teach reading and mathematics.

The study by Bunyi et al. was done in four teacher training colleges and 33 schools drawn from Coast and Central provinces of Kenya. For data collection, these researchers conducted a critical analysis of teacher education policy documents to establish the competencies relevant to the teaching of reading and mathematics for teacher trainees. They, as well, got quantitative and qualitative data through interviews and classroom observations of teacher trainers and teachers in the colleges and schools respectively. The study confirmed findings by earlier studies reviewed in this section on the inadequate

training provided to Kenyan primary teachers that leads to consistent traditional teaching practices, with more emphasis on the teacher as the sole provider of knowledge through rote learning, while students remain passive in learning. With the inadequacy identified in initial teacher training, there are inevitably problems in teaching practices in Kenya as reviewed in the following subsection.

Teaching practices in Kenyan primary education

It is generally agreed by various researchers and the Kenyan Ministry of Education that teaching practice in Kenyan primary schools is inadequate and mainly dominated by teacher talk and rote learning, and it does not give students an opportunity to actively engage in their learning (Ministry of Education, 2005; Hardman et al. 2009; Pontefract & Hardman, 2005; Kisirkoi, 2012; Amutabi, 2011; Kabaji, 2012). The Ministry of Education (2005) acknowledged that the primary education sub-sector has problems in the quality of learning as teachers are not adequately trained to teach all the seven subjects offered. The Ministry further affirmed that the two-year teacher training does not enable teachers to acquire mastery in subject content and pedagogical skills in all the seven subjects, thus compromising the quality of teaching.

Amutabi (2011) and Kabaji (2012), both reacting to the Kenyan national primary school examination results for 2011, identified rote learning as the undesirable, yet common learning approach in Kenyan primary schools. “The [Kenyan education] system breeds rote-learning in which memorizing has replaced inquiry and independent thinking” (Amutabi, 2011, para. 4). “Rote-learning is promoted as the best approach to success. That is why pupils without the capacity to memorize things are doomed to fail” (Kabaji,

2012, para. 9). Kabaji further asserted: “An education system of this nature does not encourage independent thinking nor does it empower the learner with analytical skills” (2012, para. 12). Both Amutabi and Kabaji are university professors in Kenya and recognized authorities in this area. I value their critiques as they are well versed and have also interacted with education systems in other parts of the world.

Pontefract and Hardman (2005), who were consultants in the School-based Teacher Development (SbTD), a teachers professional development program, observed 27 teachers (18 women and 9 men) teaching in nine schools: five urban schools in the city of Nairobi and four rural schools based in Kajiado district of Kenya. They observed ten English lessons, nine mathematics lessons and eight science lessons, thus each teacher was observed once. They analyzed the discourse styles while teachers taught these subjects in primary school grades 1 – 7. Their findings revealed:

> All the lessons observed used teacher-led recitation in which the teacher often used a textbook and/or chalkboard to transmit recipe knowledge for rote learning (i.e. imparting information and testing recall). Because of the dominance of whole class teaching, tasks were usually undifferentiated in respect of ability and the teacher monitored mostly from the front (Pontefract & Hardman, 2005, p. 99).

Apart from Pontefract and Hardman’s findings, recent research by Kisirokoi (2012), also established that classroom practice encouraged memorization of facts and not construction of knowledge; a practice already alluded to by Amutabi (2011) and Kabaji (2012). Kisirkoi, in her study, in which she reported on lessons she observed in Nairobi city, found that teaching was dominated by lecture method at 80%; while other strategies took the remaining time: question - answer sessions 12%, group work 4%, individual

work 2% and others including discussion and role play 2% (Kisirkoi, 2012). The features of primary school teaching practice identified in this section generally prevail across the country in both urban and rural schools.

The teaching practices in Kenyan primary schools fit the characterization by Brown (1992) of the traditional classroom, where students are seen as relatively passive receivers of wisdom dispensed from teachers, textbooks, or other media. With the mainly teacher-centered teaching practices reviewed in this section, it is important to understand what efforts have been taken over the years in addressing teachers' professional development in Kenya, which is reviewed in the following subsection.

Teachers' professional development in Kenya

There have been some efforts to provide professional development programs in Kenya in the past. These efforts included the large scale one-off projects such as the Primary School Management (PRISM) project implemented in 1996 to 1998 (Waudo, et al. 2002) and the School-based Teacher Development program (SbTD) which was a component of the Strengthening of Primary Education project (SPRED) from1997 to 2004 (Hardman, et al. 2009; Onguko, 2005). SbTD was the first major national in-service training for teachers. About fifty thousand teachers were trained through SbTD against the more than 200,000 teachers in public primary schools nationwide. The other effort was the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project from 1998 to 2008 (Waititu & Orado, 2009).

These professional development projects and programs were based on externally driven funding, design, and implementation. While the first two, (PRISM and SbTD) were funded by the British government, SMASSE was funded by the Japanese government. Such programs where external consultants design and lead implementation normally end up in problems of sustainability as happened for both PRISM and SbTD. Indeed, the Department for International Development (DfID) of the United Kingdom, in its project evaluation, confirmed that an earlier SPRED project phase from 1991 to 1996 did not sufficiently involve Kenyan educational personnel and beneficiaries in project design. The lack of sufficient involvement of local experts led to over-dependence on British expertise and under-utilization of local capacity (DfID, 1999), which made it difficult to sustain such initiatives.

SMASSE specifically aimed at training mathematics and science teachers at the secondary school level. SMASSE project had a better transition than PRISM and SbTD because it has since been mainstreamed as a Ministry of Education program and institutionalized at the Center for Mathematics, Science and Technology Education in Africa (CEMASTEA) (Ministry of Education, 2009; Japan International Cooperation Agency, 2009). While institutionalization of SMASSE programs through CEMASTEA is a positive step towards sustainability, it is worrying though, that a national professional development institution has been set-up for a section of subjects of the curricula, while disregarding other subjects such as the languages and humanities[4]. Furthermore,

[4] Humanities subjects in the Kenyan education system include Geography, History, and Religious Studies.

CEMASTEA is no longer focused on programs for Kenyan teachers, but the whole of Africa.

SMASSE was originally designed for secondary school teachers and has now been extended to primary school teachers. The training for primary school teachers through SMASE[5] started in 2010 with teachers of grade 6 Mathematics and Science (Bunyi, at al. 2011). While a few teachers are set to benefit from the introduction of SMASE for primary schools, it is still too early to tell how much opportunity will be availed for professional development through this initiative.

The change of the Kenyan system of education to 8-4-4 in 1984 coupled with the introduction of the Free Primary Education (FPE) in 2003 created new demands for teachers (Wanzare, 2002; Otienoh, 2010). These new demands on teachers included handling of large classes that they were not accustomed to (Otienoh, 2010). Large classes have led to recruitment of unqualified teachers in many schools (Wanzare, 2002).

While the problems identified above could have been addressed through professional development so that teachers could be empowered to deal with the new challenges, Wanzare observed that current centralized teachers' professional development programs are highly inadequate because of lack of resources and connection to the actual

[5] SMASE stands for Strengthening of Mathematics and Science Education. One S that represented secondary was dropped to accommodate the expansion to cover primary school teachers.

conditions in which Kenyan teachers work. Otienoh (2010) concurs that teachers encounter a number of challenges that impact negatively on the quality of teaching and there has been no provision of professional support. In spite of the lack of consistent professional development for teachers in Kenya, Wanzare (2007) observed that learning to teach is a life-long process that involves new learning as one comes in contact with each new student and shares ideas, problems, and solutions with colleagues. In other words, Wanzare implied that every situation encountered is a learning experience and hence teachers' professional development should be an ongoing on-the-job process throughout a teacher's career life.

There is a state of uncertainty in the provision of professional development in Kenya, which Otienoh (2010), alluded to, by arguing that those with responsibility for teachers professional development recognize what is happening, but choose not to notice it, hoping that the problems will go away. Teachers have to keep learning to teach and this will happen through sustained professional development. According to Bunyi, et al. the government of Kenya through policy documents, such as the Sessional Paper No. 1 of 2005 underlined the importance of teachers' professional development. However, in the same policy document, the government acknowledged that few teachers have had opportunities to participate in professional development. Teachers, therefore, continuously engage in routine traditional teaching, where the teacher is at the center as the provider of knowledge, because they have not had opportunities to upgrade their pedagogical skills and content knowledge to potentially change their teaching practice.

This research suggests that teachers can access professional development through blended learning approaches as reviewed in the following section.

Blended Learning

Blended learning is generally regarded as a combination of different training media including technologies, activities and types of events, to create an optimum training program for a specific audience (Bersin, 2004). Bersin further viewed blended learning as traditional instructor-led training being supplemented with other electronic formats or vice versa. Bersin's view of blended learning is broader and leaves room for new media as opposed to views by authors such as Neumeier (2005) who saw blended learning as a combination of face-to-face (F2F) and computer assisted learning (CAL) in a single teaching and learning environment, or Howard, Remenyi and Pap (2006) who viewed blended learning as engaging in activities in synchronous or asynchronous modes. Neumeier and Howard, et al.'s definitions are limited in scope and would not, for example, accommodate new media such as the miniature and portable devices that have become common place and the variety of possible blends.

There is no one, generally accepted definition of blended learning (Picciano, 2009). Picciano stated that there are many forms of blended learning but a generally accepted taxonomy does not exist. Picciano identified a variety of terms used synonymously to describe related learning approaches including blended, hybrid or mixed mode. Picciano, however, went further and identified blended learning broadly as "some nebulous combination of online and face-to-face instruction" (2009, p.8).

Garrison and Vaughan (2008) suggest blended learning has no consistent recommendation concerning the balance of types of instruction being blended. They define blended learning as the thoughtful fusion of face-to-face and online learning experiences. They asserted both face-to-face oral communication and online written communication are optimally integrated by blending the strengths of both into a unique learning experience to create a harmonized context with the intended purpose. The two authors presented key assumptions of blended learning design as:

- Thoughtful integration of face-to-face and online learning
- Fundamental rethinking of the course design to optimize student engagement
- Restructuring and replacement of traditional class contact hours.

The definition of blended learning by Picciano (2009) seems to be non-committal, and yet it also tends to be limited by focusing on online experiences thus potentially locks out other forms of blended learning possible in challenging contexts. For example, in challenging contexts, the online experience might not always be possible due to lack of Internet and other infrastructural requirements, such as electricity. On the other hand, while Garrison and Vaughan's definition is more persuasive and clearer than Picciano's, it still points to the fact that blended learning is not a set formula of specific components that can be easily recognized. Garrison and Vaughan emphasized online experience, which was definitely influenced by the Western context where they live and work. Perhaps blended learning should therefore be defined with consideration of the contextual realities as well, so that the available technology options for each context are considered in rolling out a blended learning experience such as the setting for this research.

Consideration of forms of blended learning in Kenya would help elaborate on the concept from a contextual perspective for this study.

Blended learning in Kenya

Blended learning of various "blends" has been utilized in Kenya. For example, demand for flexible delivery of university education caused Moi University through the Department of Technology Education to establish degree level, distance learning programs for teachers who could study during the school vacation (Simiyu & Macharia, 2008). In their literature study, these researchers suggested that the blend in the programs consisted of face-to-face instruction to teachers, combined with online access to course content via communication tools such as email or discussion forums. It seems from these researchers' views that the university set out to improve on delivery of a distance learning program by incorporating other modes of contact through online access on email and discussion forums. This has been the process most institutions have gone through in incorporating new technologies in learning, leading to what we call today blended learning.

For example, the course of Statistics in Applied Climatology (SIAC) was offered to meteorological staff in Kenya using a 'blended' approach where students learned through the Moodle virtual learning environment as well as on compact disk (Janssens-Bervernage & Stern, 2006). This training program was implemented in Kenya and aimed at enabling producers of climatic data to develop skills in analysis of historical records. In the blended learning approach, it was assumed that the participants who did not have access to the Internet, but had access to a computer, could feasibly study offline with

content on compact disk and go online at Internet cafés to participate in discussions and submit assignments (Janssens-Bervernage & Stern, 2006).

The blended learning approach in SIAC was limited to those with access to computers for offline study and who could also access cyber cafés for online communication. Such a program was viable in the urban and peri-urban locations in Kenya. The SIAC program was, however, relevant to this study because of its implementation in challenging contexts, and like this study, the blend incorporated offline content and face-to-face sessions. SIAC entailed provision of professional development for participants spread in cities and small towns (some in challenging contexts) in Kenya, and utilized the Moodle virtual learning environment, compact disk for offline content, text-based materials and a face-to-face workshop. In the challenging contexts referred to by these authors as places with difficult circumstances, “offering the same units on CD [compact disk] enables participants with low bandwidth or irregular Internet access to engage in learning without dealing with potentially frustrating technology” (Janssens-Bervernage & Stern, 2006, p. 11). The high levels of participation for the program, which according to the authors, exceeded their expectations and was an important indicator that it was possible to provide blended learning for those located in challenging contexts.

The African Virtual University (AVU), which presents yet another approach to blended learning, started by offering external internationally accredited programs from North America and Australia via video link and Internet to Africa, through a network of learning centers and partner institutions. At the end of two years several challenges

emerged, among them: the approach was costly; there were difficulties in scaling up the program to a wider audience; it was economically unviable; and did not lead to significant skills transfer (Gunga & Ricketts, 2007).

On realizing the shortcomings identified above, the AVU center at Kenyatta University in Kenya was redesigned so that students present themselves at the center to take the courses (Gunga & Ricketts, 2007). Rather than using only the virtual means of learning delivery, they decided to blend with the residential face-to-face mode. This redesign was important as the earlier approach was not viable in a challenging context with inadequate Internet connectivity and poor ICT infrastructure. This scenario best demonstrates the need to utilize appropriate technology solutions, such as those used in this research, in challenging contexts such as rural Kenya. The views by these authors also show the importance of blended learning as a viable option for improving delivery of education in a challenging context.

Blended learning in this study is defined as a deliberate combination of self-directed study of offline content deployed on tablets, with the occasional face-to-face meetings, moderated through instructor-led sessions. This definition takes into consideration access to offline PD content on tablets, with teachers' face-to-face interactions with their peers and instructors for reflective conversations, aimed at both sharing success and finding solutions for challenges encountered during self-directed study.

This research was grounded within the emerging jiFUNzeni learning process (Crichton & Onguko, 2010). The jiFUNzeni learning process, which is a work in progress, is a simple way to digitally *tell*, *watch* a pamphlet, *read* information, and *build* instructional capacity through the thoughtful development and delivery of relevant content, enabled by appropriate technologies.

The jiFUNzeni approach emphasizes involvement of local expertise to develop context specific content. The jiFUNzeni process also emphasizes careful selection of appropriate hardware and software deployed as technology tools based on the contextual realities and conditions. JiFUNzeni learning process rests in activity theory, situated learning theory and self-directed learning. Thus the emphasis is on careful selection of tools, to enable learning in a highly social, interactive and collaborative setting within the context of work, with immediate application and relevance to the situation (Leonard, 2002). Further elaboration of the jiFUNzeni process is shared in Chapter Three and Four. Appropriate technology, an important component of the jiFUNzeni learning process, is the focus of the following section.

Appropriate technology

Appropriate technology was coined and extensively used by Schumacher (1973) in his book entitled, “Small is Beautiful”. Schumacher identified the characteristics of appropriate technology as (a) simple, (b) small scale, (c) low cost, and (d) non-violent. The United States Office of Technology Assessment further refined the definition of appropriate technology as: (a) small scale, (b) energy efficient, (c) environmentally sound, (d) labor intensive, (e) controlled by the local community, and (f) sustained at the

local level (Wicklein, 2005). Sustainability at the local level has been qualified by Batteau as: “Appropriate technologies are ‘appropriatable’ technologies – devices and implements with which users can establish up-close and familiar relationships, so that mastering them no longer seems to be an insurmountable feat” (2010, p. 132).

Appropriate technology in this dissertation refers to those technologies which are simple, small scale, easily connect with the local users and cultures, are sustainable within the local economic circumstances, and inexpensive (Wicklein, 2005; Januszewski & Molenda, 2008). From a general perspective, Batteau asserted that examples of appropriate technologies may include bicycle-driven water pumps for arid regions lacking reliable electric supply or hand-cranked radios that never need to have their batteries replaced. They also include minimally featured cell phones that are more reliable than landline telephones in many challenging contexts (Batteau, 2010). In this dissertation, examples of appropriate technologies include inexpensive tablets, solar energy, mobile phones and open educational resources (OERs).

Tablets and computers

Tablets started off as small notebook computers with the ability to produce digital ink by handwritten text with a stylus when they were first released in 2002 (Mock, 2004; Boyinbode & Akinyede, 2008). By 2004, tablets were in their second or third generation and contained enough computing power that put them at par with relatively powerful desktop computers (Mock, 2004). A tablet is a portable personal computing device equipped with a touch screen as the primary input device and is designed to be operated as a personal device. Tablets are extensions of laptops with multimodal input options

including pen, voice or keyboard; however, in reality tablets are hybrids of not only handheld devices and laptops, but all the other tools information workers use, such as day planners, spiral notebooks and sticky notes (Willis & Miertschin, 2004).

Unlike the desktop computers or laptop computers, tablets are easier to use as they have fewer functions and simple software applications. Tablets have been designed to utilize quick applications popularly known as apps, rather than programs; and virtual keyboards or functions that allow one to simply click on and swipe a finger to use. According to Sigal (2011), a tablet is " mobile, lightweight, simple to use, connected, has a long battery life and is a digital machine for running native apps, web browsing, playing all kinds of media, enabling game playing, taking photos and communicating" (Sigal, 2011, para. 8).

Willis and Miertschin (2004) argued that tablets were designed to be easy to use, just like we do not have to think of how to use a chair as a tool that enables sitting. They credited Jiang Wang, one of the people who initially designed the tablet, with the assertion that the tablet would be a device that people never have to think about how to use, but rather just pick it up and use in a natural way. This view on the ease of use of tablets is important because the tablets have the potential to enable activities such as professional development for teachers who have no familiarity with the technology and have long and full work days that would not allow them to take weeks of learning.

While desktop and laptop computers will remain important input tools for developing content, tablets will increasingly be used for content consumption. The content is easily

accessed on tablet platforms, which are becoming more robust and portable and enable mobility with learning content thereby personalizing the learning experience.

Mobile learning within the African context

There are many documented initiatives on learning in Africa with appropriate technologies, the majority of which utilize mobile phone platforms. A review of some of the initiatives is important in explaining the contextual reality and educational circumstances in Africa. For example, Brown (2003), following implementation of mobile learning (m-Learning) at the Faculty of Education of the University of Pretoria, suggested premises for mobile learning in Africa:

- m-Learning is a supportive mode of education and not a primary mode of education
- m-Learning provides flexibilities for various learning styles
- The most appropriate mobile device for learners in Africa is a mobile phone
- Possibilities and latest developments in mobile technologies must be tested against practicality, usability and cost-effectiveness
- The use of multimedia on mobile phones must be tested against the envisaged learning outcomes
- The major focus of m-learning should be more on communication and interaction than on content.

Mobile learning defined on the basis of a cell phone platform validates many of the premises suggested by Brown. However, with changes and improvements in mobile devices led by the iPad and the increasingly sophisticated Android tablets, the premises

become less valid. This is because tablets are increasing becoming powerful devices with more capabilities and options for variety of media formats and holding capacity for more content, coupled with larger screens.

Focusing on the e-readers that have been noted to bring digital books to the masses, Vosloo (2010) argues the 'masses' are high-end consumers in the developed world, some of whom may be reading for leisure and pleasure. Vosloo therefore launched the mobile phones for Literacy (m4Lit) project in 2009 to capitalize on South Africa's 'book-poor, phone-rich' environment, to establish if teenagers would read stories on their cell phones. There was no cost for the actual stories though users paid their mobile network providers for mobile data traffic. The charges were typically between 5 – 9 cents per chapter. The initiative by Vosloo was a classic case of making content available to the people hence empowering them, using simple, inexpensive and easily accessible technologies such as the "e-reader" applications on mobile phones. However, e-reader applications such as the one on tablets present advantages due to the larger screen sizes and memory options over the affordances of mobile phone applications and would enable access to more resources.

Traxler and Leach (2006) reported on two projects implemented in Kenya and South Africa respectively. These two projects addressed the challenge of in-service teacher training. They observed that common to such training is EFA as a mechanism for delivering on the MDGs. Consistent with the concerns of my research, Traxler and Leach mentioned the problem of untrained or under-trained teaching force with only a limited

repertoire of pedagogies coupled with inadequate materials for both teachers and students.

The mobile learning initiative reported by Traxler was intended as SMS component of the School Empowerment Program (SEP) for communicating study guides, hints, tips, outlines, summaries, reminders, cancellations and changes; to the teachers during in-service training. This was an initiative of the DfID with a team of consultants from the University of Wolverhampton in the United Kingdom. Failure to find any evidence of successful implementation of the School Education Management Application (SEMA) project inspired the initiation of the SMS mobile learning support in teachers' professional development programs at the Aga Khan University in East Africa , which I was associated with. The SMS support provides students at the Aga Khan University's Institute for Educational development in East Africa with an opportunity to interact with their instructors as they implement action research projects in their schools (Onguko, 2010; Onguko, Ngatia & Crichton, 2011). The experiences, successes and challenges in the SMS mobile learning initiative further inspired my doctoral research focusing on professional development for teachers in challenging contexts.

Most of the learning initiatives on appropriate and mobile technologies in Africa utilize SMS capability on mobile phones. This research presented an opportunity for utilizing various apps on tablets for content delivery and mobile phones for communication in teachers' PD in a challenging context, powered by solar energy. Further, this study

provided opportunities for practical implementation of other appropriate technologies such as open educational resources, whose literature is reviewed next.

Open educational resources

Open educational resources are teaching, learning and research resources available in the public domain that have been released under an intellectual property licence that permits their free use or repurposing (Atkins, Brown & Hammond, 2007). According to West and Victor (2011) OERs are digitized educational resources that can be shared freely over the Internet and can be edited or customized, combined with other resources and new versions created. Such resources "include full courses, course materials, modules, textbooks, streaming videos, texts, software, and any other tools, materials or techniques used to support access to knowledge" (Atkins et al. 2007, p. 4).

The initial semblance of what later emerged as the open educational resources movement was the investment in the OpenCourseWare Project (OCW) by the Massachusetts Institute of Technology (MIT). By the time of writing the report by Atkins et al. (2007), over 16 million visits had been made to the MIT open content. The mix of materials through the MIT OpenCourseWare include syllabus, course calendar, lecture notes, assignments, exams, problem and solution sets, labs and projects, hyper-textbooks, simulations, tools and tutorials, and video lectures (Atkins et al. 2007).

The term Open Educational Resources (OER) first emerged at a meeting convened in 2002 by UNESCO on the impact of Open Courseware for higher education in developing countries (Johnstone, 2005). According to Johnstone, at the forum there was

representation of MIT's OCW, other projects from United States universities and individuals from universities in developing nations. Later on, at another UNESCO meeting in 2004 during the Second Global Forum on International Quality Assurance, Accreditation, and the Recognition of Qualifications in Higher Education, OER was defined. OER was defined at this forum to include learning resources such as courseware, content modules, learning objects, learner-support and assessment tools, online learning communities (Johnstone, 2005). OER also included resources to support teachers to enable them to create, adapt, and use training materials and other teaching tools. From its humble beginning, the OER initiative has grown as Internet use has grown worldwide.

The OER initiative is an important addition to educational practice especially for developing contexts such as Africa. According to OER Africa initiative, there are too few learning resources for learners and lecturers in African universities, while those available are very expensive to purchase (West & Victor 2011). For primary schools, the situation of provision of educational resources is even grimmer; thus, initiatives such as the open educational resources from Teacher Education in Sub Saharan Africa (TESSA) is very handy for teachers working in resource challenged environments (Wolfenden, Umar, Aguti & Gafar, 2010). For those who can access the Internet and download for their own use, both for teaching and their professional development, such OERs enable teachers to enact a culturally responsive pedagogy (Wolfenden, et al. 2010). However, OERs still have to be repurposed for contextual relevance as the African continent has differences such as region-specific cultures including languages and accents.

According to Atkins, et al. (2007) the OER movement has nurtured a culture of sharing, not only between individuals, but also within major institutions of higher education. Further, the movement has been invested in internationally and continues to build capacity for engagement based on mutual benefit between people and institutions, between and within developed and developing regions (Atkins, et al. 2007). The popularity of the OERs can be captured in the statistics that indicate by 2008, there were over 3000 courses available as OERs in more than 300 universities around the world (Ramirez, 2011). For the TESSA OERs, the statistics show that by early 2010, there were 19 programs utilizing TESSA materials; 690 teachers were familiar with TESSA materials, while 303,300 teachers enrolled in programs which used TESSA OER in 9 African countries (Wolfenden, et al. 2010).

While the OER initiatives are of great relevance for challenging contexts, they might not make the necessary contribution unless there is more access to Internet in such contexts for users to download the resources. Considering that Africa has 55 countries, 9 countries utilizing TESSA OER content is only a small fraction of the potential users. Use of such resources as offline materials after downloading will continue to be important for challenging contexts without consistent Internet access. To enable access to and use of OERs and other appropriate technologies, users in challenging contexts may require services for technology support through technology stewardship, which is reviewed in the following section.

Technology stewardship

Technology support is critical in implementation of technology use in whatever setting. As different technologies become available to users, there has to be not only learning about their use, but also support on how to make them work better or troubleshoot when there are technical problems. Mumtaz (2000), in a literature review and critique study of more than 100 studies on factors affecting teachers' use of ICT, found that successful intervention in use of technology in schools required changes to be undertaken in schools for effective computer integration in classrooms. Among the changes required included classroom assistance by trainers who were successful technology integrators, and working alongside teachers to observe, support, evaluate and model computer integration (Mumtaz, 2000).

Specific reference to technology support is gaining new focus with the emergence of the term technology stewardship, a fairly recent term that has been coined by Wenger, White and Smith (2009). Technology stewardship in these authors' view, entails selecting and configuring technology, as well as supporting its use in practice by members of a community. The technology steward's role includes understanding the community, awareness of technology, selection and installation of technology, support in adoption and transition and in everyday use. This term was adopted for this study to elaborate on the key role to enable teachers to remain on course through consistent support in utilization of appropriate technology including tablets, solar energy and generally navigating through the PD content artifacts. Being a relatively new concept, technology

stewardship has not been explored much. This study and the subsequent dissemination of findings should help entrench this concept within the academic discourse.

Research Questions

A review of the literature concerning key components underpinning this study, suggest there is a need to formalize the availability of professional development for teachers in Kenya. Also research is needed concerning alternative ways of delivering professional development in a challenging context in view of the current global initiatives on the state of education, specifically EFA and MDGs. This study can make a contribution by providing research on a way that professional development might be designed and delivered in such contexts.

The research questions for this study include:

1. How might professional development, offered through a blended learning approach and delivered by appropriate technologies, inform potential change to teaching practice in a challenging context in Kenya?

    1.1 How might we design a course using a blended learning approach?

    1.2 How might appropriate technologies assist in the delivery of professional development via blended learning?

    1.3 What support do teachers require for blended learning on appropriate technologies?

    1.4 How appropriate is blended learning for teachers in a rural setting?

2. What are the implications of the blended learning approach supported by appropriate technologies for professional development for teachers and professional development teachers (PDTs)?

3. What is the potential for sustainability and scalability of the professional development approach?

Chapter Summary

In this chapter, I have reviewed the literature relating to the broader topic of teachers' professional development provided through blended learning using appropriate technologies. I also reviewed activity theory, the overarching theoretical framework that guided this study. Under professional development, I reviewed literature on situated learning, adult learning, self-directed study, and reflective practice. On education and educational contexts, I reviewed literature on professional development and change in teaching practice, challenging educational contexts, primary teacher preparation, and inadequate professional development in Kenya. Under blended learning, I reviewed literature on blended learning in Kenya, appropriate technology, and technology stewardship. Finally, I presented the research questions following the literature review. In the following chapter, the methodology of this study is presented.

CHAPTER 3: METHODOLOGY

> Another key way in which DBR [design-based research] differs from both conventional design and traditional research is its emphasis on adapting a design to its local context, a vital attribute for scaling up an innovation successful in one place to many other venues with dissimilar characteristics.
>
> Chris Dede, Why design-based research is both important and difficult.

Introduction

In this chapter I present the research methodology for this study. First, I present a brief explanation of the research design including the research methods, followed by the research process, including a description of the participants and how they were identified. Finally, I explain the data collection and analysis procedures, as well as the ethical considerations I took in the study.

Research Design

This study adopted a design-based research (DBR) methodology, commonly referred to as design research (van den Akker, Gravemeijer, McKenney & Nieveen, 2006; Confrey, 2006; Design-based research collective, 2003; Middleton, Corard, Taylor & Bannan-Ritland, 2008). I used a mixture of methods (Creswell, 2009; Brown, 1992) to design a blended learning environment for teachers' professional development, and studied its implementation with teachers in a challenging context. Design research is explained in the following section.

Design research

According to Barab and Squire (2004), design research "is not so much an approach as it is a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic

settings" (p. 2). Cobb and Gravemeijer (2008) suggest that design research is a family of methodological approaches in which instructional design and research are interdependent.

Design research is a method of conducting educational research that focuses on systematic and multifaceted development and evaluation of interventions in actual educational settings (van den Akker, et al. 2006). van den Akker, et al. point to five characteristics of design research. First, it is interventionist by aiming at designing an intervention in the real world. Second it is iterative; thus, design research incorporates a cyclical approach of design, evaluation and revision. Third, it is process oriented meaning the focus of design research is to understand and improve interventions. Fourth, it is utility oriented; hence the merit of design research is measured in part, by the practicality for users in real contexts. Fifth, it is theory oriented; thus, the design is based on theoretical propositions, and field testing of design contributes to theory building.

Linking design research to pragmatism, Confrey (2006) argued that design research is based on pragmatic thinking that does not place theory on a shelf, to be useful only as a guide to pristine experimentalism. He asserted that pragmatism instead places theory into the world of action and experience while engaging with complexity rather than striving to artificially reduce it. Therefore, design research is grounded within the pragmatic tradition backed up by learning theories such as experiential learning developed by Dewey (Confrey, 2006).

Dewey's emphasis on action in the real world is captured in his own writing on the topic of society and education. He asserts that

> Personalities which became effective in action were bred and tested in the medium of action. Again we cannot overlook the importance for educational purposes of the close and intimate acquaintance got with nature at first hand, with real things and materials, with the actual processes of their manipulation, and the knowledge of their societal necessities and uses. In all this there was continual training in observation, of ingenuity, constructive imagination, of logical thought, and of the sense of reality acquired through first-hand contact with actualities (1964, p. 298).

These views by Dewey resonate with design research approaches by locating experiences of designed environments for educational practice and researching the actions within the actual world. The emphasis by Dewey on intimate acquaintance with real things and materials, training in observation, actual processes of manipulation, and experiencing the sense of reality acquired through first-hand contact with actualities relate very closely with the process of design research.

Walker (2006) argues that in design research, a researcher's rigorous analysis of a learning problem leads to specific ideas for intervention. "Designers then build systems that use information technology to build specific teaching and learning materials and methods designed to realize learning gains predicted by theory and research (Walker, 2006, p. 11). Walker suggested that if the theoretical analysis is right then these interventions ought to give markedly more effective results. Thus, literature on design research is unanimous that the goal is useful innovation with particular emphasis on investigating the possibilities for educational improvement by bringing about new forms of learning in order to study them (Schwartz, Chang & Martin, 2008).

Design researchers are interventionist-observers who draw upon existing and emerging models of learning and affordances of new technologies to perturb learning and teaching as they document, measure and theorize on the way the participants in the learning environment respond (Kelly, Lesh & Baek, 2008). The interventionist nature of design research aims to inform practice (Brown, 1992), while design research involves a partnership between practitioners and researchers (Rohse & Anderson, 2006).

Brown (1992), who has been credited with popularizing design research alluded to use of mixed methods approaches in design research. She asserts that

> Increasingly, I find that in the interest of converging operations, and because of the multifaceted nature of my data base, I prefer a mixed approach, suiting the method to the particular data. I mix and match qualitative and quantitative methodologies in order to describe the phenomena, a mixture that is becoming commonplace in the journals (p. 156).

Writing a commentary on the growing utilization of design research, Dede as well emphasized the mixed methods nature, of design research approach, stating that

> Design-based research takes a more nuanced, mixed-methods view of quantitative and qualitative analytics. Many DBR studies utilize a form of "interventionist ethnography," in which research studies perturb a range of typical learning settings by introducing evocative, theory-influenced designs, then use both qualitative and quantitative analytics to draw out implications for new theories of teaching, learning, and schooling (2005b, p. 346).

For this study, the mixture of methods used included: narrative research (Sandelowski, 1991; Andrews, Sclater, Squire & Tamboukou, 2007; Lewis, 2010 ; Sherman & Rokne, 2010; Mor, 2010), ethnographic observations (Goetz & LeCompte, 1984; Walsh, 2004;

Delamont, 2007; Bryman, Teevan & Bell, 2009), qualitative interviews (Byrne, 2004; Rapley, 2007;Creswell, 2009), and documentation of design artifacts (Prior, 2007; Kelly, Baek, Lesh, & Bannan-Ritland, 2008; Bannan-Ritland & Baek, 2008). These research methods are briefly explained in the following sections.

Narrative research

Narrative research relies on stories told by people, recognizing we are "all, nonetheless, active and effective storytellers" (Andrews et al. 2008, p. 104). Narrative is a deeply human activity; according to Lewis (2010), because as human beings we have a symbiotic relationship with story in that we are both informed by story and formed by story. According to Sandelowski (1991), narrative research entails stories that include a temporal ordering of events and an effort to make something out of those events: to render, or to signify, the experiences of persons-in-flux in a personally and culturally coherent, plausible manner.

Narrative research is a way by which we understand experience. Simply stated, narrative inquiry is stories of experiences lived and told (Sherman & Rokne, 2010; Clandinin & Huber, 2002). For example, Sherman and Rokne engaged with a group of pre-service teachers on a reflective journey to share the story of their professional and personal growth eventually documenting a story of the growth of a professional community of beginning teachers. Teacher stories shared with colleagues in a reflective journey through a research process are likely to open up new ways of understanding teaching practice. Narratives therefore presented opportunity for teachers to interact and share experiences in this study.

In this study, teachers from a school in rural Kenya shared narratives of their experiences during one-on-one interviews with me, and also when they met as a group during the PD face-to-face sessions. In getting teachers to narrate their stories of experience, trust was a critical factor. The teachers needed to trust my intentions, which were elaborated in the consent form they signed off and my explanation to them on the objectives of my research (Apendix D: Teacher Script and F: Consent Form). I also had to trust that what they shared was the truth about their teaching practice experiences. As Ryen suggested, "trust is the traditional magic key to building good field relations" (2007, p. 222). According to Ryen, trust is associated with fidelity, which she defined as the obligation for truth telling.

The teachers narrated their teaching practice experiences as their peers contributed to their shared stories in the face-to-face sessions. The professional development teachers (PDTs) who were the PD instructors, on the other hand, shared their narratives in offering PD and their experiences during instructional design process in this study. The narratives by PDTs on their instructional design experiences fit with Mor's assertion, "I see narrative as essential for describing design experiences and processes, as an initial step towards their [design] systematization. I also see narrative as playing a role in communicating design knowledge to broad audiences" (2010, p. 15). Finally, when narratives are recorded for further analysis, they offer an account of the history and evolution of a design process, including the research context, the tools and activities designed, and the results of users' interactions with the designed artifacts (Mor, 2010).

Ethnographic observations

Ethnographic observation entails "spending long periods watching people, coupled with talking to them about what they are doing, thinking and saying, to see how they understand their world" (Delamont, 2007, p. 206). As Walsh (2004) stated ethnography is based on researcher observation; thus, the researcher as an observer essentially becomes a primary research instrument. In doing ethnography, a researcher is normally immersed in a group of people and participates in the people's daily lives for extended periods, observing behaviour, listening to what is said in conversations and asking questions (Bryman et al. 2009).

According to Bryman et al. ethnographic observers must jot down fairly detailed summaries of their observations because of the frailties of human memory, while Walsh (2004) added that audio recording of interviews and visual recording of observations can be additional and valuable aids. Ethnographers also have to make decisions about what to observe, whom to talk to, and what to record and how (Walsh, 2004). Educational ethnographic work includes studies of change and innovation in school systems (Goetz & LeCompte, 1984). In this study, I observed different aspects of design and implementation of PD (including teachers implementation of teaching strategies in classrooms and discussions during face-to-face meetings), which are explained in the section on research activities and data collection procedures in this Chapter.

As the researcher, I speak the three languages (English, Kiswahili and Luhya), which are dominantly used in the research site of this study. The teachers who participated in this

study all spoke these languages though the instructional language, and the language used in this study, was English. As such, I could easily understand teachers' stories, in whichever of the three languages used, I could notice any tensions conveyed through language, and I was generally easily accepted in the school. Being a migrant of slightly over ten years to the community by the time of this study, it was a first opportunity for me to interact with the school community through this study. These aspects made it possible for me to conduct ethnographic observations within the time available for my research as I could more easily embed myself in the context and understand the environment, workplace and social interactions.

Qualitative interviews

Qualitative interviews are a form of communication as a means of extracting different forms of information from individuals and groups (Byrne, 2004). According to Byrne, "The interactive nature of their practice means that interviewing is a highly flexible but also somewhat unpredictable form of social research" (2004, p. 180). Rapley (2007) stated that human beings are part of an interview society, in which interviews are central to making sense of our lives. Rapley further argued that "the interview – seen in various forms of news interviews, talk shows and documentaries, alongside research interviews – *pervades and produces our contemporary cultural experiences and knowledges of authentic personal, private selves*" (2007, p. 15) (emphasis in original).

From an epistemological point of view, Byrne (2004) argued that interview data presents one of many possible representations of the world from an idealist account. Thus the interview is seen as a process of data generation rather than data collection (Mason,

1996). Interview is a data generation process because, as a qualitative researcher according to Mason, you do not simply work out how to collect data which already exists in a collectable state, but rather you work out how best you can generate data from your chosen sources. In this view of the interview as data generation, for example, the interviewer speaks to the interviewee who thinks through answers that best address the question and which the interviewee may never have thought of before. Likewise the interviewer poses questions, some of which arise as a result of the previous answer by the interviewee.

According to Byrne, many different variables affect the outcome of interviews. As a researcher there is need to be aware of such factors including "who is doing the interviewing, who is being interviewed, the location in which the interview takes place and the form of questioning" (p. 180). If for example, the researcher relies on interviews done by a research assistant, there are bound to be discrepancies between the understanding of the researcher and the actual interviewing process. On the other hand, an interview done in a location where either the interviewer or the interviewee does not feel comfortable or safe, can affect the outcome of the interview.

In doing qualitative interviews, the researcher may conduct face-to-face interviews with participants, interview participants by telephone, or engage in focus group interviews with a group of six to eight interviewees (Creswell, 2009). "These interviews involve unstructured and generally open-ended questions that are few in number and intended to

elicit views and opinions from the participants" (Creswell, 2009, p. 181). In this study, I conducted one-on-one interviews with all the 12 research participants, as explained in the section on research activities and data collection procedures in this Chapter.

Documentation of design artifacts

Design research entails aspects of designing learning artifacts or a learning environment and research processes. It has been argued by some scholars (Kelly et al. 2008; Bannan-Ritland & Baek, 2008) that, in most cases, the product design process is not reported as part of design research, with many design researchers simply reporting the ready-made structures. "Documentation is the archiving and indexing of the design research process that serves as a way of gathering evidence of the effects of design changes, and serves to inform re-design if changes to a prototype prove ineffective" (Kelly et al. 2008, p. 12).

Bannan-Ritland and Baek (2008, citing Lawson, 2004) suggested that "the process of design research subsumes many of the characteristics and processes representative of the nature of design including locating relevant information, structuring the problem, exercising creative insight, proposing a solution and evaluating the solution" (p. 300). The design researchers quoted in this section point to a need to report on the design process, which is referred to in this study as documentation of design artifacts.

Documentation of design artifacts is suggested as a means of providing insights into the 'making of' the design (Kelly, et al. 2008). The process of documentation of design artifacts as described by Kelly, et al. "involves not simply sharing the designed artifact, but providing rich descriptions of the context, guiding and emerging theory, design

features of the intervention and the impact of these features on participation and learning" (2008, p. 13). Indeed Prior (2007) suggests the study of the process of document production and consumption (or use) to provide two sturdy pillars around which interesting and essential research programs can be built and developed. Finally, according to Anderson and Shattuck (2012), design researchers document the time, commitment, and contingencies that are involved in the creation and implementation of the intervention to enable their readers judge for themselves the possibility of achieving similar or better results using the same intervention. Detailed description of the design processes for the artifacts and the implementation of the intervention in this research are presented as part of the data in Chapter Four.

Researcher Role

My background is important at this stage in explaining my role as the researcher. I was born in a rural part of western Kenya and had my primary and secondary education in Western Province. I am therefore fairly well-versed with the local culture of Western province of Kenya. I speak the three dominant languages spoken in the province and generally understand the various dialects of the Luhya language spoken in the province.

I went through my primary education in a school similar to the one in this study. I also went through my secondary education and high school in western province. I therefore have a lot of concern and interest to contribute towards making a positive impact on the quality of education delivered in rural places, having grown up there.

My experiences as a teacher trainer in a teachers' college in my early career life, my work as an education management trainer and later at the Ministry of Education, where I worked at the Education for All (EFA) desk as national coordinator for close to two years, helped me develop an interest in educational practice especially for rural teachers. Awareness of teachers' struggles with numerous challenges provoked my interest in conducting this research, for I am a product of my rural primary school.

Further exposure to educational technology through higher education, understanding of the global initiatives of EFA and MDGs, and my work at the Aga Khan University, Institute for Educational Development in East Africa, further grounded me in my current research interest. Being aware that both EFA and MDGs emphasize the need for quality in provision of education and that they recommend among other aspects utilization of technologies in enhancing quality (UNESCO, 2005), and the opportunity provided by the Aga Khan University to work with both urban and rural teachers in East Africa in addressing their professional development needs, have all greatly encouraged my research interest for teachers in challenging contexts.

As the researcher in this study, I inevitably became a participant observer because "design research inherently involves the act of design" (Bannan-Ritland & Baek, 2008, p.300). It was my responsibility to lead the design aspects of this study while working with the PDTs as content experts. Although I was a participant observer, I had to strike a balance between how much I could do to guide the design process, while at the same time collecting data for this study. I participated in design by leading the more technical and

innovation aspects of design while letting the PDTs lead on the content and pedagogical aspects. During instructional design, I had complete participation in the situation (Walsh, 2004) providing guidance to most of the design decisions taken (by the PDTs and me).

Participant observer role entails an obtrusive data collection method, as it requires the researcher to undertake roles that involve establishing and maintaining ongoing relationships with research participants in field settings (Grinnell & Unrau, 2008). Grinnell and Unrau asserted that participant observation is an excellent method to gather data for understanding how other people see or interpret their experiences.

During the implementation of PD, I still retained my participant observer position, initially leading the first face-to-face session to introduce the research process and the two groups of participants (teachers and PDTs), as they had never met before. I retained the technology and innovation role during implementation of PD, while taking on a more observer role in data collection. The PDTs as professional development providers were the instructors.

During implementation of PD, I took the pose of marginality by retaining a strangeness that avoids over-rapport and a familiarity that grasps the perspectives of the participants (Walsh, 2004). For example, when I visited the school to observe lessons, I avoided interfering with teachers' limited sitting space in their staffroom. I ensured to appear in school at the scheduled time for lesson observation to avoid interference with the school programs. I took tea and lunch with teachers on a few occasions and avoided many more

invitations for lunches and teas. This was in keeping with the cultural expectation that ‘if you cook for two, a third person can always eat part of that ready meal’. I had to strike a balance between not keeping off completely, and yet keeping a safe distance and remaining focused on my objectives of implementing the study and collecting data.

Research Participants

To identify the teachers who participated in this study, I first sought permission from the gatekeepers (Creswell, 2009); including the Ministry of Higher Education, Science and Technology in Nairobi, Kenya and the Lugari District Education Officer (Appendices A and B). From the initial plan, I intended to involve ten teachers in this study; hence I was ready to work with teachers in one, two or three schools. The choice of ten teachers was determined by the number of tablets available for the research (each tablet to be shared between two teachers), which were the primary technology platform for mediating self-directed study content. I intended to visit any of the three public primary schools in the neighborhood of where I lived using a convenience sampling to identify the school(s) in which the teachers to participate in this study would be selected (Palys, 1992).

After getting permission of the District Education Officer, which allowed me to conduct research in schools in the district, I went to my first school. After discussing with the head teacher about my research interests and focus (Appendix C: Head teacher script), the head teacher immediately assured me that I would be able to get all the ten teachers I needed from Lumbwa School (Pseudonym for research school). The head teacher then immediately convened a meeting of all the teachers (18 teachers attended the meeting), where I spoke about my research (Appendix D: Teacher script). After explaining the

details of my research, teachers readily volunteered to be participants. More than ten teachers were willing to participate, so I got the names of the first ten teachers by requesting them to write their names on a piece of paper with only ten places available. I invited the ten teachers to read and sign the consent forms in duplicate to signify that they understood their rights in participation in the study (Appendix E: Research Ethics Certificate and F: Consent Form).

To identify the two Professional development teachers (PDTs) who participated in this study, I as well sought entry through the gatekeeper; who was the chairperson of the association of professional development teachers. PDTs are practicing teachers, who offer professional development programs for other teachers. Teachers are designated as PDTs on graduation from Aga Khan University with a Master's degree in education in the specialization of either teacher education or educational leadership. As part of their commitment to serve as teacher leaders and agents of change, they are initially contracted for six months after graduation, by the university to provide PD to other teachers in East Africa (Kenya, Tanzania and Uganda). They have formed an association of professional development providers in which membership is determined by one's status as an alumnus of the Aga Khan University, Institute for Educational Development – Eastern Africa. Through their association of professional development teachers, they are also contracted by individual schools to provide PD to teachers.

Based on the findings from the teachers' needs analysis (which is described in Chapter Four), I consulted with the chairperson of the association to purposefully select

(Creswell, 2009) two PDTs with the necessary skills. The two PDTs specialized in teacher education with emphasis on social studies. I explained the objectives of the study to the PDTs and invited them to complete the consent forms as well.

Design processes

Design research processes entail aspects of designing learning curriculum, artifacts or environments. Thus researchers embrace, in some form, the traditional instructional design ADDIE tradition (Analysis, Design, Development, Implementation, and Evaluation) (Kelly, et al. 2008). In this research, design of the learning content followed the ADDIE process because of its systematic approach through the design stages. ADDIE process involved detailed analysis of the teachers and the school context. This was followed by design and development of study content based on careful and systematic articulation of the instructional objectives, and implementation of PD with teachers making use of the study content to plan and implement their teaching. Evaluation was an ongoing process - with freedom to go back to any of the earlier stages (Norton & Wiburg, 2003).

The ADDIE framework as an Instructional Systems Design (ISD) process emerged out of the post-World War II research in the United States military that aimed to find a more effective way to create training programs (Allen, 2006). This instructional design framework continues to be an important model as it provides guidelines upon which instructional design processes are based (Allen, 2006; Molenda, 2003). In other words, as an original instructional design model, other models have been developed based on the ADDIE model. As Malachowski (2012) asserted, ADDIE was one of the first

instructional design models that is liked for its simplicity, ease of application and cyclic nature.

The instructional design process was a critical part of content development for this study. Instructional design has been defined as “a systematic process that is employed to develop education and training programs in a consistent and reliable fashion” (Reiser & Dempsey, 2007, p. 11). This process entails consideration of a variety of aspects including the learners and their contexts, the content and the learning materials, the objectives, and expected outcomes based on evaluation procedures. Crichton (2007) observed that while instructional design is a process of identifying and solving instructional problems, one needs to be mindful of the local context, especially in a challenging setting such as the one for this research as described in Chapter Four. Contextual analysis is important in helping identify factors such as the physical environment, which included the working environments in the classrooms, and the social and cultural environment that entailed individuals in the community such as teachers in this study (Kopp, 2005)

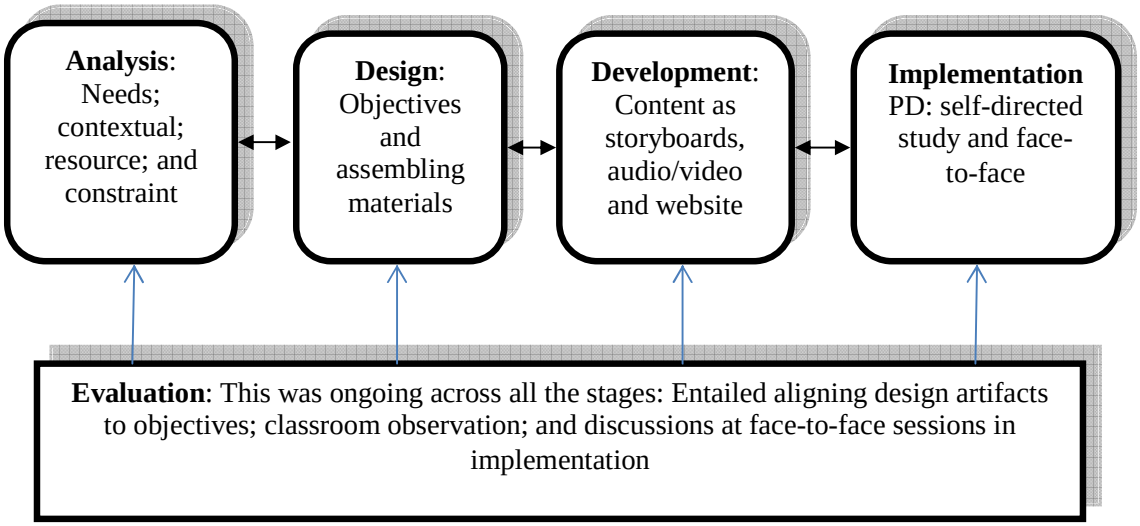
I worked with the PDTs; them being local practitioners who brought on board their content expertise while I, as the researcher, brought on board both research expertise and expertise in ICT innovations, to design the PD content and the implementation process. The first step was a detailed analysis that included needs assessment conducted through one-on-one interviews with the teachers to identify who they were, what they already knew, what their learning characteristics were and what they needed to learn (Norton &

Wiburg, 2003). After analysing the data, we (PDTs and me) agreed on the topic for PD: Strategies for teaching a large class of mixed ability students.

In designing content for this study, we already had teachers needs gathered through my interviews with them. Working with the PDTs, and guided by activity theory, situated learning and adult learning theories, we identified the PD objectives, assembled learning materials including artifacts, authored the PD content, compiled it as a website, and implemented PD. Evaluation of the efficacy of the material was an ongoing function across all the stages of the instructional design process as depicted in Figure 3.1, which was adapted from Molenda, 2003. We developed multimedia content including web based content, video and audio clips and photographs. Development of both video and audio clips entailed the PDTs writing storyboards of relevant scenarios for learning. Two audio clips were recorded in the form of role-plays involving the PDTs acting in lesson preparation for teaching two topics in math (perimeter and area), while modeling the key elements and structures of cooperative learning.

During the instructional design process there was opportunity for the iterative process of design, test and redesign (Middleton, et al. 2008). In the iterative instructional design process, we (the PDTs and me) were able to interact with the content and instructional materials by consistently aligning our design prototypes to the aims and objectives derived from the identified PD needs. The instructional design process hence involved iterative cycles of test and revision of the prototyping phases.

Figure 3.1: ADDIE Process Model



Instructional design involved identification and preparation of the different resources including readings (electronic documents), videos, audio recordings and authoring of content in HyperText Markup Language (HTML) format. Because the tablet used in this PD intervention had limited specifications for the media formats that could be displayed on it, the instructional design process entailed working within the specifications of the device to host the relevant content and resources to fit with the specifications. The tablet supported a number of digital media formats including photographs, HTML files, e-book reader, Portable Document Format (PDF) content, dictionaries, video and audio files (JiFUNzeni, 2010), and these formats were incorporated into the course. Further details of design artifacts are presented in the following section under documentation of design artifacts as data.

Research Activities and Data Collection Procedures

There were a variety of roles and tasks in the research process. I (as the researcher, as well as instructional designer and ICT expert), the PDTs (as practitioners and instructors of PD), and the teachers (as the PD participants) engaged in various aspects in implementation of the PD intervention. The different tasks are highlighted in the following subsections accompanied by the data collection procedures.

Documentation of design artifacts as data

Documentation of the design process is important as it is research data and also informs future design (Hjalmarson & Lesh, 2008). Documentation of usability is also critical as a source of data on usability of the design product (Hjalmarson & Lesh, 2008). Documentation of design artifacts in this study entailed keeping records of both the process of artifact production and utilization either as still pictures, written text or as videos and audio records. As suggested by Hjalmarson and Lesh (2008), as the product is developed, the design process is documented. As Prior clarified, “Documentation is not coterminous with text, of course, not all documents involve written traces” (2007, p. 345). Prior asserted that documents take many forms such as architectural drawings, books, paintings, gravestone inscriptions, films, World Wide Web pages, bus tickets and shopping lists.

As explained in the previous section, during instructional design I worked with the PDTs to develop self-directed study content in which a number of artifacts were created in the form of instructional design drafts, storyboards, still pictures, audio and video clips. All

these artifacts fall in the category of documents as products in this study. However, there was also documentation of the production of artifacts as process.

The artifacts as documents stood in a dual relationship to episodes of human interactions. The artifacts contained content and also entered the stream of interaction as agents with functions (Prior, 2007). For example, the readings were a source of content for PD participants, and yet the documents also acted as the links between this study and their sources that included organizations such as Teacher Education in Sub Saharan Africa (TESSA) and Latika Roy Foundation of India (details of these are explained in Chapter Four). While the artifacts were critical in enabling teachers' self-directed study, the process of artifact production which I documented as part of data collection process was equally critical.

Documentation of design artifacts entailed keeping records of video and audio clips of the process of instructional design, taking photographs during instructional design process, documentation of procedures such as the records of email communication between the Executive Director Latika Roy Foundation of India and me, seeking permission to use their content on activity-based learning; and screenshots of video downloads of global web content from YouTube.

Documentation of artifacts was iterative in the sense that the earlier versions of the artifacts were saved and subsequently improved on as part of the process. For example, I saved the various prototypes of the storyboards for the audio and video role- plays we

recorded as well as the prototypes of the actual audio and videos. It was easier to later listen to and watch the clips to pick on the best recorded version of videos and audios. The documentation of design artifacts provided data to account for the design part of this study, as presented in Chapter Four.

Entry and exit interviews

I conducted initial interviews with teachers and the PDTs to establish their entry levels. For the teachers, I conducted one-on-one interviews to establish their personal profiles, their current knowledge and skills in active and interactive teaching approaches, and their professional needs based on their struggles in teaching (Appendix G: Teachers' entry interview guide). The next task was to analyze the data from the interviews and then share the findings of PD needs with the two PDTs whom I had identified as the instructors I would work with in the instructional design process and implementation of the PD. The timeline of research activities is presented in Table 3.1.

Table 3.1: Timeline of Research Activities

Activity	**Duration**	**Dates**
Pilot study instructional design	Five months	January – May 2010
Pilot Study implementation	One month	June 2010
Analysis (needs, contextual, constraint)	Two weeks	Feb 7th – 19th 2011
Entry data analysis and initial planning	Two weeks	Feb 21st – March 5th 2011

Assemblying solar chargers	Two months	March 1st – April 30th 2011
Instructional design	One month	April 4th – 29th 2011
PD implementation	One month	May 7th – June 4th 2011
Exit Interviews	Two weeks	June 6th – 18th 2012
Data Analysis and Writing	Eight months	Sep 2011 - April 2012

For the PDTs, I conducted one-on-one interviews to establish their personal professional profiles, their knowledge and skills in providing PD as well as their experience in offering professional development (Appendix H: PDTs' entry interview guide). The criteria for identifying the PDTs was their qualifications as holders of Master's degree in teacher education and their practice in offering professional development for teachers in the areas of teaching and learning. For example, the interview schedule included questions on how many PD activities they had engaged in, the latest PD activity held and the approaches they used in delivery of PD. The entry interviews with PDTs were important in identifying what they could do as instructors of PD and whatever they expected to learn in the process of their participation in this study.

At the end of the PD intervention, I conducted another round of one-on-one interviews with all the teachers. These were exit interviews to establish teachers' views on the PD intervention. The objective was to establish whether the intervention enabled teachers to change their teaching and what their future plans on professional development were (Appendix I: Teachers' exit interview guide).

I also conducted one-on-one interviews with the two PDTs at the end of the PD intervention. These interviews aimed to establish the PDTs' views on their participation in the intervention especially concerning their own learning through the instructional design process and their facilitation of the blended learning approach (Appendix J: PDT exit interview guide).

Open-ended and flexible interview questions were used to better get access to participants' views, interpretations, understandings, experiences and opinions (Byrne, 2004). The semi-structured interview approach presents an ontological perspective which considers the knowledge, values and experiences of the participants as critical (Byrne, 2004) and hence contributed to meaning for this research as presented in the data in Chapter Four.

During the interviews, I used both audio recording and short-hand note taking to record interview data. I used the Livescribe pen – a digital pen - to record the interviews thus recording the interview data as both written text and in audio format. This allowed me to

view and review the interviews without having to transcribe the data (Crichton, 2011) and retain the integrity of the primary sources of data.

Self-directed study and observation of classroom practice

At the PD implementation stage, teachers got an opportunity to determine when and where they would engage in their study of PD content, as it was delivered on a tablet. While there was general guidance on the three-hour duration for studying each content unit, the teachers paced their own study with regard to their other responsibilities such as teaching and household tasks. The self-directed study content developed during the instructional design process was pre-loaded on the tablets before they were given to the participants. The two teachers sharing each tablet were encouraged to plan how to collaboratively use the device and determine when each might have the device for independent self-directed study. The teachers were also encouraged to develop their individual self-directed study schedules based on guidance provided on the number of study hours per week over the four-week PD period.

I observed each teacher once over the four weeks of this study, as they implemented the teaching strategies from the PD content in their teaching. In the content, we required the teachers to plan some lessons each week in which they incorporated the four teaching strategies in the self-directed study content. These were: cooperative learning; activity-based learning; inquiry learning; and use of community and local environment as resources for learning. The classroom observation process entailed my attendance during scheduled visits to the participants' classrooms. I collected data in the form of still pictures, videos and written field notes during classroom observation.

Observation of face- to- face meetings

The PD implementation began during the first face-to-face meeting, where with the PDTs; we introduced the teachers to the PD study process that entailed familiarization with the technologies including use of the tablet and the solar charging process. After introduction to use of the tablet, the teachers started an orientation to the self-directed study content, and lastly they were introduced to the solar power charging process (Appendix K: Six steps on familiarization of tablets and content). PDTs led the facilitation in the face-to-face meetings, while I concentrated on data collection, recording the process on video, still pictures and written notes and audio with the digital pen. I also supported the PDTs on the technical aspects such as facilitation of the solar charging process.

In the second and third face-to-face meetings, the PDTs and the teachers got together for reflective conversations to discuss critical incidents, raise concerns, review progress, and to seek for clarifications. These sessions were critical for the research as they were iterative and acted both as face-to-face meetings of the blended learning process and also as evaluation sessions for feedback on the design research process. The discussions were structured to provide opportunity for teachers to share their successes and challenges over the previous study period since the last meeting.

During the second and third face-to-face meetings, I concentrated on collecting data through recording the reflective conversations to capture all the teachers and PDTs said on audio as well as written notes. I recorded some parts of the face-to-face meetings on

video to honor participant voice and support data analysis (Crichton, 2011). I also took still pictures during the second and third face-to-face meetings. The various digital data, particularly the audio, photographs and video were recorded using digital camera and audio recorder as well as the digital pen, which records both audio and written text.

Design and implementation iterations

Design research entails an iterative process that involves a cyclic approach of design, evaluation and revision (van den Akker, et al. 2006). During instructional design there were iterative cycles of design. The design and development of the multimedia study content including readings, pictures, videos, audio and offline website was iterative in the sense that we developed prototypes in progression that culminated in the final artifacts and content which were provided for teachers' study. According to Nieveen (1997), prototypes are products which are designed before the final product is constructed and fully implemented in practice.

Nieveen (1997) suggested that a prototype may be continually refined based on the reflections of the developers on the prototype and formative evaluation results and evolve towards a final deliverable. For this study, in developing audio and video content for example, we first wrote storyboards, which we refined through several iterations to ensure that they were flowing well and aligned to the objectives of PD. Once we were satisfied with the storyboards, we then went through an iterative process in recording and production of the video and audio content. We recorded and edited several versions of both the video and audio content to ensure that we had the clearest version as our final content. In developing content in HTML format and finally exporting as a website, we

also had several iterative stages. This was important because occasionally some of the steps did not work and so we had to take steps back to ensure that we were following the right procedures. For example, when audio or video files could not play, we had to revise the whole process till we finally got it right.

The iterative process during implementation of PD entailed feedback and evaluation sessions during face-to-face meetings. Kelly, et al. (2008) suggested that in design research assessment may be used formatively in order to dynamically determine progress towards mastery of disciplinary knowledge or to guide the design of a prototype and to inform its iterative redesign. However, in this study, there was neither assessment nor redesign of content. The feedback sessions during face-to-face meetings provided the opportunity for determining progress towards mastery of the teaching strategies. Every face-to-face meeting was therefore iteration in this study. Teachers and PDTs got opportunity for feedback and evaluation of the previous fortnight's activities at face-to-face meetings. For example, during face-to-face meeting two, teachers watched three video clips of colleagues recorded during classroom observation and they all decided to revisit the implementation of the first two strategies: cooperative learning and activity-based learning over the following two weeks.

Data Analysis

In analysis of data for this study, I used various forms based on each data collection method. For the needs assessment interview data, I did analysis through simple tallies and frequencies to rank the various aspects such as participants' personal and professional details (e.g. age range, number of lessons per week and years of service), teachers' most

common concerns, and PDT's expectations. I also consistently listened to audio recordings of interviews and read and reread the accompanying written field notes to determine the teachers' PD needs.

For the exit interview data, ethnographic observations and documentation, I had to sift through the comments, field notes and repeatedly listen to and watch audiovisual content (photographs, audio and video clips) to identify emerging patterns of similarity leading to coding by placing like with like (Pink, 2007; Seale, 2004). Seale (2004) has elaborated that coding is the first step towards data analysis, emphasizing that the quality of a coding scheme influences the eventual quality of data analysis since it is in coding schemes that a researcher becomes committed to particular ways of categorizing the world.

Scholars in qualitative research advocate for coding as a process of organizing data into chunks or segments of text before bringing meaning to information (Miles & Huberman, 1994; Creswell, 2009). Miles and Huberman (1994) advise that codes are efficient data labeling and data retrieval devices that empower and speed up analysis. According to Dey (2007), open coding, which is a process of breaking down, examining, comparing, conceptualizing and categorizing data offers opportunity for generating ideas by close and detailed inspection of data.

Initial themes and codes

I had developed an initial theme and coding scheme arising from the research questions, the theoretical framework, and literature. The initial themes and codes are provided in

Table 3.2. The initial themes and codes of analysis changed during data analysis as I dealt with emerging data. Seale (2004) has explained that:

> The initial stage when faced with an interview transcript, or with a set of notes describing observations, or some other qualitative material, is to develop a set of codes that both reflect the initial aims of the research project, and take into account any unexpected issues that have emerged during data collection. That is to say, a coding scheme emerges both deductively from pre-existing concerns, questions and hypotheses, and inductively from the data itself (p. 313).

The changes to the initial coding frame included renaming some of the initial themes and codes as well as removing some that did not emerge from the data while, adding new ones that featured prominently in data. The changes between the initial themes and codes and the final themes and codes can be seen in Tables 3.2 and 3.3. For example, while in the initial frame (Table 3.2) I had PD needs assessment as a theme, in the final frame I changed this theme to PD start point and instead had teachers' needs assessment as a code under this theme (Figure 3.3).

Table 3.2: Initial Frame of Themes, Codes and Literature Sources

Theme	Code	Selected Literature
PD needs assessment	Teacher profiles	-
	PD needs	Moore (2006)
Program design	Decision making	Engestrom (2000)
	Material preparation	Merriam (2001)
	Levels of involvement	Garrison (1997)

PD implementation	PDT interaction with teachers	Otienoh (2010)
	Access to resources	-
	Teacher collaboration	Bonk (2009)
	Teacher turn taking	-
	Division of labor	Engestrom (2000)
Changed teaching practice	Teacher-to-teacher dialogue	Otienoh (2009)
	Teacher-to-student dialogue	Joyce (2004)
	Active learning	Showers (1983)
	Links to classroom practice	Otienoh (2010)
Community	Teacher engagement	Min. of Educ. (2005)
	Rules of engagement	Engestrom (2000)
	Open communication	Otienoh (2010)
	Work schedules issues	Moon (2007)
	Home related issues	-
Instrumentation and technology	Creation of artifacts	Pink (2007)
	Storage of devices	-
	Maintenance of devices	-
	Solar power process	Pilloton (2009)

This study had a major component of ethnographic observation while participants engaged in different aspects (including instructional design, classroom practice, and during face-to-face sessions). As such, the data analysis took the form of analytic memos and fieldwork journals as data emerged during the research process in the field (Walsh, 2004). I endeavoured to derive some preliminary concepts that made analytic sense from what was going on in the social setting as the participants worked through the research activities (Walsh, 2004). I considered these preliminary concepts emerging from data as part of a stable set of categories for the systematic coding, thus, updating my initial frame of themes and codes to get the final frame (Walsh, 2004).This data analysis process is in line with Seale's (2004) view that initial coding consists of reading through material and identifying where themes of a particular interest are illustrated by data. Seale (2004) further explained that coding schemes in qualitative research develop as the research project proceeds.

My data analysis process as well benefited from Creswell's (2009) overview of data analysis that provides steps ranging from listening to audio records, viewing videos and reading through the participants' words and actions, coding the data, getting themes and descriptions, interrelating themes and descriptions and finally interpreting the meaning of themes and descriptions. I further sorted out the digital data by themes and codes as I continuously replayed and reviewed, noting the trends and patterns as they emerged from the data and provided opportunities for me to relive interaction with participants (Crichton & Childs, 2005).

Final themes and codes

To get to the final themes and codes that emerged in this study based on literature and data, I did analytical coding in two stages: The first coding stage, which had numerous and varied codes; and the second stage of focused coding, which was a process of winnowing out less productive and useful codes (Lofland & Lofland, 1995). Both coding stages involved a physical process, using sticky notes to identify and group specific themes and codes, reminiscent of Bryman, Teevan and Bell's (2009) suggestion that coding entails cutting and pasting chunks of data - sometimes in the literal sense of using scissors and paste.

I used sticky notes on an analysis frame on a flip chart, where I sorted out themes and codes, placing like with like and winnowing to isolate those themes and codes that did not fit in at stage two of focused analytical coding. I also followed Stakes' (1995) suggestion that the page is only written by finding, for analysis, the right ambience, the right moment, by reading and rereading the accounts, by deep thinking, then understanding creeps forward. Apart from reading and rereading accounts from my field journal, I also listened to audio clips consistently and repeatedly, and viewed video clips of moments in face-to-face sessions and class observations repeatedly, as I split data into parts for better understanding.

The process of breaking down data into themes, examining, comparing, conceptualizing and categorizing, led to emergence of codes consistent with the research questions and the purpose of this study. Through a process of close inspection of the activities and

processes recorded in observation and interview data; the final themes and related codes that emerged are presented in Table 3.3.

Table 3.3: Final Frame of Themes and Codes

Theme	Code
PD starting point	Teachers' needs assessment
	PDTs' knowledge, skills and expectations
Assembling appropriate technologies	Choice of appropriate technologies
	Local technical capacity for solar energy
Creating learning resources	Content development process
	Local experts
	Global web content for local context
	Open educational resources
Proceedings at face-to-face meetings	Technology familiarization
	Reflective conversations
	Professional dialogues
	Communal and professional commitments
Self-directed study	Peer support, sharing and feedback

	Technology stewarding
Classroom practice	Change in teaching approaches
	Local learning materials
The PD end point	Teachers gain new knowledge and skills
	PDTs gain new knowledge and skills
	Emerging sustainability framework

Reliability and Validity

It has been argued that the quality and credibility of qualitative research has often been questioned (Seale, 2007). According to Seale, credibility refers to the validation of findings while quality refers to the transparency of the whole research process. Further, the issues of quality and credibility relate to "the reliability (of methods) and validity (of data)" (Seale, 2007, p.377). Reliability in qualitative research refers to ensuring that there is accuracy in the processes used to collect data, arising from the consistence of procedures used (Seale, 2004). On the other hand, validity is concerned with the truthfulness of the research data relied on to make interpretations and arrive at conclusions (Seale, 2004).

Another concern that is critical to this study is the view that design research as a methodology has not yet matured as a research approach that can argue methodically for the scientific warrants of its claims (Kelly, 2004). Dede (2004) also raised a number of

concerns for design research. Among other concerns, Dede argued that design researchers do not find out the problems practitioners are facing, but rather, go to the context with what they believe are theoretically promising interventions thus “we refuse to soil our ivory-tower hands” (2004, p. 113). Kelly (2004), seemingly providing a way forward for design research, argues that ultimately design research should be seen as a practical endeavour that produces knowledge artifacts that provide solutions for teachers and learners that are efficient, workable, economical, and that do not entail a significant switching cost from current practice.

Despite concerns raised about the credibility of design research, it has been clarified by Kali (2008) that design research brings together a design focus on assessment of critical design elements and ethnographic research that provide qualitative methods of looking carefully at how a design plays out in practice, and how social and contextual variables interact with cognitive variables. Scholars who have been critical of design research (such as Dede and Kelly) have, however, been clear that the methodology is an important addition to the repertoire of educational research and a useful complement to traditional research strategies. Indeed these scholars have used design research approaches and published their findings as well (examples Kelly, 2003; Kelly, et al. 2008; Dede, 2005a; 2005b); hence, they offer constructive feedback as a way of contributing to enrichment of the design research at its early stages of evolution. Dede (2005b) acknowledged that scholars were publishing a growing body of high quality design research studies that addressed many of the weaknesses of typical scholarship in educational technology.

To ensure quality and credibility, thus reliability and validity in this research, I conducted a pilot study with six PDTs in Nairobi, who went through the research process. The participants in the pilot went through familiarization with the content and appropriate technologies, and self-directed study of content on the topic: formative assessment. As van Teijlingen and Hundley (2001) intimated, pilot studies are a crucial element of a good study design in that they might give an advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are appropriate or too complicated. I conducted interviews during the pilot and also observed the PDTs working through the content during the familiarization session. The pilot study was important for not only confirming that I could implement the study in the Kenyan context and particularly in a challenging rural setting, but also enabling me to identify weaknesses in the interview schedule, which I improved to clarify unclear questions before I used it in the rural setting for this study.

I also ensured that I followed design processes representative of the nature of design as identified earlier in this chapter (Bannan-Ritland & Baek, 2008), and that the process of design was documented as an important part of design research. Thus with the PDTs, we engaged in the design processes that are systematic, creative, dynamic, generative, and directed at solutions to real problems (Kelly, et al. 2008). On the other hand as the researcher, I also followed the research procedures that were rigorous, systematic, rule-governed, and tied to clear standards of evidence (Kelly, et al. 2008). In other words, narrative research, ethnographic observations, and qualitative interviews operate within

certain standards which I adhered to in data collection. I, for example, followed Walsh's (2004) advice as a participant observer and avoided complete participation in activities such as face-to-face meetings (including avoiding making contributions during discussions). In other words I became more of a silent observer rather than a contributing observer, a status that Walsh (2004) referred to as marginal native. Marginality according to Walsh is about finding a balance between a strangeness that avoids over-rapport and familiarity that grasps the perspective of people in the situation.

The other steps I took to ensure quality and credibility included engaging in a continuous process of reflection (Delamont, 2007; Ali, Campbell, Branley & James, 2004); use of methodical triangulation (Stake, 1995); and, avoidance of going native (Delamont, 2007). Reflexivity as "the capacity to reflect on our role in generating research knowledge is crucial" (Ali, et al. 2004). According to Delamont (2007) reflexivity is critical in qualitative research because it is a way of ensuring reliability and validity. In reflecting on my crucial role as the researcher in this study, I ensured that as a participant observer, I partially immersed myself in the school (Delamont, 2007). Partial immersion implies, for example, that the researcher eats, sleeps, and relaxes at home, but spends a large chunk of the day in the school (Delamont, 2007). Participant observers also do not really participate by actually teaching classes or catching fish, rather they watch things being done and occasionally help (Delamont, 2007). I did not, for example, lead in facilitation of face-to-face sessions, although I commented on some of the aspects, especially to follow up on the participants' views so that I could get my data from their conversations.

Going native is the process of getting too familiar in a research field and hence beginning to loose objectivity or immersing oneself into a culture and acting as more of a community member than the research participants who are members of that community. Delamont (2007) states a good principle is that, once the field feels at home it is time to leave. According to Delamont fieldwork is supposed to be uncomfortable, so once it is feeling familiar, it is time to move on. I was cognizant of the possibility of going native while in fieldwork. Going native in respect to this study would, for example, entail acting or behaving like one of the teachers in the research school and getting entangled in the school culture and personal relationships.

To guard against going native, I left the research site during the sixth week after collecting research data, when teachers had just started becoming too comfortable with me as one of their community members. I had started receiving requests to participate in school-projects. For example, I was requested by the head teacher and the deputy head teacher to take photographs of all the teachers and school buildings to support the bidding process for a school project proposal. Once such signs set in, it was time for me to move on to avoid contaminating my data with other unrelated information. Indeed I did not get to take the photographs for the stated project, which on reflection, I think was the right thing to do. My not taking the photographs did not stop the project bidding process because there are commercial photographers in the community.

Methodical triangulation refers to use of multiple methods to study the same phenomenon (Stakes, 1995; Creswell, 2009). According to Stakes, multiple approaches within a single

study are likely to illuminate or nullify some extraneous influences. Creswell states that "If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study" (2009, p. 191). The use of a mixture of methods in this study was helpful in increasing confidence in my interpretation of the data. For example, observing teachers in their classroom practice, listening to them as they engaged in reflective conversations during face-to-face sessions, and exit interviews presented data that illuminated the changes in teaching practice over the study period.

Ethical Considerations

Informed consent

As part of the research ethical considerations in this study, I applied for and received ethics approval from the University of Calgary Conjoint Faculties Research Ethics Board (Appendix E). I also applied for a research permit from the Research Department of the Ministry of Higher Education, Science and Technology of the Government of Kenya in Nairobi (Appendix A). I visited the Lugari District Education Office to seek for entry into the schools and received the District Education Officer's approval as well (Appendix B).

The teachers and PDTs participated in this study through a voluntary process. I spoke to the participants to inform them of the objectives of the study and then requested them to consider their participation in the study. I then invited the two PDTs identified and the first ten teachers who volunteered to read the consent form carefully for understanding of their rights in participation. They signed the consent form in duplicate such that they kept one copy and I kept the other copy (Appendix F). Informed consent was aimed at

protecting the research participants on issues of personal disclosure and personal privacy (Creswell, 2009). Throughout this dissertation, I have neither referred to the actual name of the research school nor of any of the research participants. I have used pseudonyms to identify both the school and the participants. This was in a bid to protect their identity.

Limitations of the Study

Involvement of a small number of participants in this study resulted in narratives which provide detailed descriptions of the research processes. The study also provided rich and in-depth descriptions of the context and the research activities that give the readers an opportunity to interpret the implications and conclusions I arrived at in Chapter Six from their various contexts. Further, the findings in this study reflect my personal background and experiences, insights and interpretations of the data arising from adopting design-based research approach. Further, my participant observer role adds richness to this work that others doing a similar study might not be able to bring. While, my findings may not be generalized to a larger population in a different context, they are my findings and have contributed significantly to the literature on blended learning, using appropriate technologies.

Chapter Summary

In this chapter I have presented the research design for this study, including an explanation of design research. I have also presented the mixture of methods used in this study, which included: documentation of design artifacts, narrative research, ethnographic observations and qualitative interviews. I presented my role as a researcher and also the processes of identifying both the research school and the research

participants. Finally, I presented the data collection procedures, data analysis procedures, issues of validity and reliability in this study as well as the ethical considerations I took.

CHAPTER 4: RESEARCH FINDINGS

From the very beginning of his education, the child should experience the joy of discovery.

Alfred North Whitehead, Essays in Science and Philosophy.

Introduction

In this chapter, I present the findings of this study. The findings are presented through research data based on the research questions. The first part of this chapter presents a description of the research site and the research participants' profiles. After highlighting the school contextual features and participants' profiles, the second part of the chapter presents the data within the themes and codes that emerged from the review of the literature and during the data analysis. The data is presented in the following themes

- starting point;
- assembling appropriate technologies;
- creating learning resources;
- proceedings at face-to-face meetings;
- self-directed study;
- classroom practice; and
- the professional development end point.

The Research Site and Participants' Profiles

Lumbwa (pseudonym) primary school is located in Lugari District of Kakamega County, in rural western Kenya. The school is about 15 km along an earth road off the Nairobi (Kenyan capital) to Tororo (a city in Uganda) highway. At the time of this study, the school had a population of approximately 1000 students and 20 teachers (including the

head teacher and deputy head teacher). Like other schools in Kenya, Lumbwa School had a head teacher, a deputy head teacher and a school management committee (SMC).

The school had a nursery[6] section with 3 teachers; a special needs education unit[7] with 1 teacher and the regular primary school grades: 1 to 8 with 16 teachers. There were 19 classrooms in total with average class size of 53 students. The 10 teachers who volunteered to participate in this study were drawn from all the three sections of the school – nursery, special needs education unit, and mainstream grades 1 - 8. The school had some brick wall buildings and many classrooms had no lockable doors and windows. However, there were a few classrooms made of semi-permanent mud walls, which were not safe learning environments, as the walls were crumbling (See Figure 4.1). Generally the school had limited resources such as desks, chairs and learning materials; students were crowded in most of the classrooms.

---

[6] Nursery school in Kenya refers to pre-school education institutions. Pre-school education is not compulsory; hence attendance in pre-school is not a prerequisite for joining Class 1 - the first grade of primary school (Republic of Kenya, 2006). According to the policy on early childhood development, Pre-school education caters to children between the ages of 3- 6 years (Republic of Kenya, 2006).

[7] Special needs education units are classes set aside in regular schools to cater for students with special needs and disabilities. The classes should not be less than 15 children (Republic of Kenya, 2009). In Lumbwa School special education unit, there were students with autism, mental handicaps, learning disabilities, and speech and language disorders. Students with profound or severe disabilities typically do not attend regular schools.

Figure 4.1: Inside a Lumbwa Classroom

The research school fits the description of a challenging educational context used in this study. The school faced environmental, social and technical constraints characteristic of challenging educational contexts including location in a community where many school age children remained out of the school and formal learning, with many consistently dropping out of school. Many school age children work on farms during the peak seasons of planting, weeding and harvesting of corn and beans. At the time of this study, there was no access to electricity and Internet; and the school is located in Lugari district, which was listed as having 47% of the population living below the poverty line[8] (Kenya Open Data, 2011). While 47% was the official figure provided by the government of Kenya based on the 2005/06 statistics, there were other sources such as the Mars Group

[8] The World Bank used the population living below US$ 1.25 per person per day at the 2005 international prices to indicate poverty level (www.data.worldbank.org/indicator/SI.POV.DDAY). In Kenya, the common perception of poverty line is the population living on less than US$ 1 per day.

Kenya (2011), whose statistics indicated the poverty levels in Lugari district at 63% for 2011.

Teacher profiles

The ten teachers who participated in this study have been assigned pseudonyms to protect their identity. Of the ten teachers, five were female and five were male. As illustrated in Table 4.1, one teacher was in the age range of 50 to 59; five teachers in the age range of 40 to 49; two teachers in the age range of 30 to 39 and two teachers in the age range 20 to 29. All the teachers had at different times gone through initial teacher training, which consisted of two years in teacher training colleges located in different counties of Kenya. All the teachers were expected to teach all seven[9] subjects in the primary school curriculum. None of the teachers had any specific pedagogical training within a specific subject specialization.

Table 4.1: Teachers' Profiles

Teacher	Age range	Experience (yrs)	Lessons/week
Churchill	30 – 39	17	32
Dennis	40 – 49	18	40
Emah	20 – 29	1	35
Emily	40 – 49	15	40
Josh	30 – 39	14	39
Mika	20 – 29	5	39

[9] The subjects taught in primary schools are: Mathematics, English, Kiswahili, Social Studies, Religious Studies and Geography History and Civics (GHC). While English is the language of instruction in Kenyan schools, Kiswahili is taught as a subject in primary schools.

Nita	50 – 59	27	35
Perita	40 – 49	21	40
Rita	40 – 49	27	10
Timo	40 – 49	23	38

The teachers had a range of teaching experience (from 1 – 27 years). The youngest teacher, in the 20 to 29 age range, was in her first year of teaching. Unlike her other colleagues who were employed on permanent and pensionable terms, she was hired on a three year contract (a new policy for hiring teachers in Kenya). In Kenyan primary schools, the lower primary section comprised of grades 1 – 3 has a maximum of 35 lessons per week, while upper primary, comprised of grades 4 – 8 has a maximum of 40 lessons per week. Thus, most of the teachers in this study had heavy teaching loads, ranging from 35 to 40 lessons per week, apart from Rita (nursery section) and Churchill, who was the deputy head teacher. Rita was the only teacher who confirmed that she was satisfied with her work load since she taught the nursery class with two other teachers. The other teachers felt they had heavy teaching loads considering the number of lesson they taught per week.

None of the ten teachers had selected teaching as their first career choice. They had either wanted to be doctors, lawyers, nurses, agricultural officers or journalists. However, they all indicated that the career opportunity that had come up for them was teaching so they

took it up. This meant that either they had not achieved the examination grades to enable them pursue their careers of choice, or they had not known how to follow-up on their admission to their careers of choice. Indeed Dennis' response to why he did not pursue a career in medicine, suggested that there was one disturbing interview question that may have barred him. He said:

> I attended several interviews for entry into the medical profession. During that time, however, there was a disturbing article [question] in the interviews. There was an item asking that: 'Do you have a relative who is currently working in the medical field?' So I believed since I did not have anybody [relative in medical profession], maybe that is why I was not considered. But I received a number of letters inviting me for interviews. I didn't understand why that item was important because it was me who wanted the training (Dennis, entry interview, 4).

To the teachers in this study, teaching as a career was more open to accommodate them than other career options. They seemed to suggest that it became their second career option and the easier one to join. From my experience as a Kenyan, there was the general view in previous years that if one failed to join a first career of choice, there was always a chance to become a teacher.

Having established themselves as career teachers, the teachers enthusiastically volunteered to participate in this study with a view to benefiting professionally from the PD intervention. The teachers explained they were motivated by several factors including:

"Teaching is interesting because at least every day you will observe a new character. For example, today I entered a class and they [students] started singing praising me; that our good teacher has come" (Nita, entry interview, 1).

"What motivates me is that I love working with these children and the hope that I will be employed on permanent and pensionable terms after three years" (Emah, entry interview, 2).

"I feel I have the interest of the child at heart, and want to help them for posterity" (Mika, entry interview, 3).

"I love serving the community, and I believe God gave me the opportunity to serve the people diligently because when I went for Special Needs Education training, I was the only one in the district". (Dennis, entry interview, 4).

"I have appreciated the employment. I just believe that it is a God-given opportunity so I have to perform; and it is also a source of income" (Emily, entry interview, 5).

"I am motivated by my love for teaching and also my interest in helping the children" (Rita, entry interview, 7).

"I am motivated by my natural love for the work." (Timo, entry interview, 10).

Curiously Churchill, Perita and Josh indicated that they are not motivated at all. Churchill suggested that he is not motivated, though he is forced by circumstances to teach because when inspection is done, "Your record speaks for you; it goes to your file" (Entry interview, 6). The other reason for lack of motivation was that the teachers' basic needs are not catered for. Perita said, "At least in other places, people get to school and are given a cup of tea. I leave home without taking a cup of tea" (Entry interview, 7). Josh indicated that he was not motivated at all, but because "these children come from this community; we are duty-bound to help them" (Entry interview, 9).

Although the ten teachers never had teaching as their first career choice, they indicated that they had accepted their being career teachers and were happy and settled in their positions. For example, Timo's response is indicative of his commitment to teaching.

> I love the work. In fact I come [to school] the earliest. I am the earliest bird. I love the work because as I told you in my life I intended to pursue very high [different career]. Things did not work well and I ended where I ended [became a teacher] so I just got motivated to do my work. I have a commitment to the students (Entry interview, 10).

Only one teacher - Mika - was still harboring the ambition to achieve his first career choice. He wanted to be a lawyer. He was in the 20 to 29 years age range and so maybe he still had the opportunity for a career switch. There was nothing to indicate, however, that Mika was not motivated in his teaching career just because he was looking forward to a career change. In fact, he was not among the three teachers who felt they were not motivated at all.

Professional development teachers' profiles

Two professional development teachers (PDTs) participated in this research as practitioners in professional development. The two PDTs were in the age ranges of 40 to 49 and 30 to 39. They both were holders of masters of education degree with the specialization of teacher education.

The PDTs regularly offer face-to-face PD programs for teachers in the areas of teaching, learning and assessment. They had been involved in offering PD for the previous three years. Their previous facilitation in PD programs involved the use of PowerPoint slides, and group discussions where teachers shared their experiences and learned from each other. Both PDTs said that they were motivated by their love for teaching. They

suggested that their participation in PD programs gave them an opportunity to interrogate their own teaching, as they interacted with and listened to other teachers' experiences. Throughout this dissertation, the PDTs are referred to as PDT1 and PDT2 to protect their identity.

When asked what was their motivation to provide professional development for other teachers PDT1 stated

> Honestly, I love teaching and I believe that a lot of what happens in the learning environment influences the outcomes. It is really what happens in the learning environment; the interactions that influence the outcomes in the classroom. And if those interactions are not very good, then we continue to say that you know our results are not very good. Secondly, I realize that between 1990 and 2006, I hardly had gone for professional development, so I was just relying on what I had learned in college [undergraduate training]. After going for my master's program, I realized that there is such a gap between what happens when you go to college for undergraduate training and the actual classroom contact with the learners. And so I have this driving desire to try and reach out to teachers who do not have a chance probably to go for a long term professional development either because they can't afford it in terms of money or in terms of time (PDT 1, entry interview).

PDT2 as well shared her motivation for offering professional development for other teachers in Kenya.

> I find it interesting. I think I like teaching and it is always very interesting to listen to teachers share experiences because I also get to learn a lot in the process. I also get to interrogate what I do in class because I am a teacher at the end of the day. So it is normally a process of give and take (PDT2, entry interview).

After PDT 2 suggested that she loved teaching, her response to the question concerning whether teaching was her first choice career was,

> Initially, I got into teaching through luck. I would have preferred something else [another career], but when I got in I realized that this is interesting and it is what I

> want to do. At that time it really wasn't clear what you wanted to do, it is what came along. So teaching came along and found me (PDT2, entry interview).

The teachers' and PDTs' profiles presented in this section provided their personal attributes including their career paths, their previous experiences as teachers and professional development providers. However, all the participants had knowledge, skills and expectations with more specific links to their participation in PD either as instructor expectations for PDTs or as participant needs for the teachers. These aspects are explored in the following sections.

Theme: Starting Point

This theme provides a glimpse into the entry levels to the PD intervention of both the teachers and the PDTs (the two categories of participants in this research). The teachers had performance concerns to be addressed through PD, while the PDTs brought to the research their practitioner experiences, knowledge and skills, as well as expectations to learn from their experiences in participation. There are two codes under this theme, namely: Teachers' needs assessment and PDTs' knowledge, skills and expectations.

Teachers' needs assessment

Needs assessment was an important starting point in designing the PD intervention in this research. As explained by Bannan-Ritland and Baek (2008), needs assessment is a traditional technique used to begin instructional design. Hendel-Giller and Stepich (2003) suggested that needs assessment is important to training effectiveness, and thorough analysis of identified needs assessment data is important. Needs assessment is usually the first step in the instructional systems design (ISD) process (Rothwell & Kazanas, 1998).

For this study, a needs assessment was done through one-on-one entry interviews with the ten teachers.

Teachers' needs assessment data were analyzed, leading to identification of a variety of instructional concerns in their teaching practices. The teachers' concerns included

- lack of access to and understanding of use of learning materials in teaching, thus confining them to lecture methods and use of chalk and talk;
- need to learn about use of technology in their teaching; and
- challenges of teaching large classes of between 45 and 55 that occasionally increased to 130 students when a colleague went on leave (e.g. maternity leave).

While there were other individual concerns, these were the common ones amongst the ten teachers. As one teacher stated,

> You know you can teach a class of forty or forty five, where there are obviously fast learners and slow learners. Maybe you are teaching forty students, and thirty have captured what you taught and for the other few, there is a problem. Now, do you leave them [slow learners] and move to the next topic or what do you do? (Emah, entry interview, 2).

Clearly Emah had a performance problem in that she could not understand how she could teach students with different learning abilities - fast and slow learners - in the same class. Emah was the youngest of all the teachers who participated in this research. She was in a dilemma: "What do you do?" She wondered how she could proceed with teaching all the forty to forty five students in her class when a few were clearly not learning. Churchill, when responding to the same question, indicated, "The only material they [students] have

is a pen and paper. I think that is not really enough. So all we do is lecture". Churchill had a problem with the prevailing practice in the school, of teaching by simply walking to class to do "talk and chalk," as he put it. Like other teachers, he had a concern for lack of access to and understanding of use of learning materials in their teaching because the school lacked basic materials like textbooks. Churchill stated thus

> Learning materials are inadequate, making it strenuous for the teachers to handle a given class effectively. For example, you have a class of 52 students and maybe you have six textbooks. You have not attained the student:text book ratio and it becomes very difficult for a class to use six textbooks when they are 52 (Churchill, entry interview, 6).

Other views on this same question on the need for professional development included

> This concept of technology; I mean the e-Learning sort that has been introduced. You see, being remote as we are, where our institution is based, we have a lot that we still have to do on methods. Just knowing how to operate a computer is different from using it to teach. I have never used it [computer] and I think we need a lot of in-service training (Mika, entry interview, 3).

The most common teachers' concerns during entry interviews were the large classes they teach, failure to use learning materials in their teaching practice, and interest in learning to use technology in their teaching. While their consistent mention of use of technology could possibly be a common concern in other contexts, this concern may as well have been triggered by my initial meeting and discussion with the teachers about my research project. In the first meeting convened by the head teacher, I had showed the teachers one of the tablets that they would use later in their PD. As the tablet was new to them and their context, it might have stimulated their interest in use of technology by introducing it as a PD need.

The eventual intervention under the broad topic of strategies for teaching a large class of students with mixed ability addressed the three concerns by the teachers. The teachers studied and implemented strategies for teaching a large class, used materials in their teaching, and studied through a blended learning approach on tablets, thus having an initial interaction with such technology.

PDT knowledge, skills and expectations

Entry interviews for the PDTs were meant to establish their previous involvement in provision of professional development as a prerequisite for their participation in this research. The interviews were essential in specifically identifying the PDTs' skills and knowledge in delivery of professional development programs since their practitioner experience was critical in implementation of the PD intervention. Their previous involvement in offering PD, their qualifications and topics of interest and expertise in PD were established from the analyzed entry interview data. I conducted one-on-one entry interviews with each of the PDTs.

Both PDTs had a postgraduate degree in education with specialization in teacher education. They also had been involved in providing PD programs for three years, and were interested in topics related to teaching, learning and assessment. Having knowledge, skills and experience in professional development did not mean that they were accomplished and did not have new things to learn from their engagement in the research. Indeed, they indicated during entry interviews, their expectations were to learn more. Specifically, PDT1 indicated that

> Apart from understanding what is on the ground especially in the rural areas - what the challenges there are, I believe I will also have learned how to write programs [instructional design] myself. You see a lot of times we have just done [developed PD programs] on paper, but not developed a program using any other technology, which other people can access and work on (PDT1, entry interview).

PDT2 as well had her expectations as a professional development provider. She said

> One thing I am looking forward to is to use the tablet, how to use it in professional development, like designing a course. Personally designing from the beginning to the end, on the tablet, and then helping teachers to use it because I actually don't know how to design.
>
> I will learn a lot. This is a group of teachers from a different place; we have never met them. Professionally I will grow as a teacher and as a professional development teacher (PDT2, entry interview).

The responses by the PDTS suggest that despite being professional development providers, they too had their performance gaps, which they expected to bridge by their participation in this study. The PDTs were both practicing teachers in the city of Nairobi. They mainly provided professional development programs for teachers in informal settlements - also called slums - in Nairobi. They therefore looked forward to learning from the teachers in a rural setting, and also were keen on the use of blended learning as a PD approach as they had previously only been involved in face-to-face instruction.

Theme: Assembling Appropriate Technologies

The appropriate technologies used in this research included the inexpensive yet robust Smart Q tablet, solar energy and learning resources commonly referred to as open educational resources (OERs). The two codes under this theme on assembling appropriate technologies are: choice of appropriate technologies and local technical capacity for solar

energy. The open educational resources (OERs) used in the PD content is addressed later, under the theme: Creating learning resources.

Choice of appropriate technologies

Clear and sound decisions had to be made on the choices of the technologies to use in a challenging context with no electricity or Internet access. As explained in the literature review, challenging educational contexts are generally associated with poverty, coupled with a series of constraints of access to basic requirements such as affordable electricity, reliable Internet, relevant learning opportunities, reliable transport and mobility, and other problems linked directly to poverty including lack of health services, lack of clean water and sanitation services, lack of appropriate clothing and housing.

The choice of tablet to use was based on the affordability of the device and robustness of functionality, which essentially included simplicity of use. The Smart Q fit the criteria of affordability as it was within the price range of $ 200 to $250 (Lai, 2010) compared to the more expensive tablets such as iPad, whose price was between $499 and $899 at the time of the field component of this research. Other tablets such as Acer Iconia 100; Assus Transformer; Dell Streak; Toshiba Thrive; and Sony Tablet S among many others were selling for between $ 350 and $ 600 (Franklin, 2011); hence they were still much more expensive than the Smart Q and had not been field tested through the jiFUNzeni process to establish their robustness.

The Smart Q tablet operated on the Open Source Ubuntu Linux Operating System that did not require license fees such as proprietary operating systems (e.g. Windows from

Microsoft. Through the jiFUNzeni selection process for the appropriate technology options, the Smart Q was pre-installed with free applications (apps) such as Midori browser, SMPlayer - a multimedia player, FBReader - an ebook reader, Abiword processor, Gnumeric spreadsheet, Evince PDF reader and PCMan File Manager (jiFUNzeni, 2010).

The Smart Q had the capability of playing multimedia including video, audio and pictorial content as well as displaying offline web formatted HTML content stored on an internal SD memory card. These content formats were compatible with the content developed during instructional design and used in this research, which were informed by the pilot done in summer 2010. Implementation of this research in rural western Kenya, an area with no electricity, meant that we had to provide alternative power for tablets. Solar energy was the logical choice for this context and is explained in the following section.

Local technical capacity for solar energy

Harnessing solar energy for use is a complex undertaking. However, Kenya has been acknowledged as the most dynamic and largest private-sector led photovoltaic (PV) panel (also called solar panel in this study) market in Africa, measured in per capita solar home systems units in use (Disenyana, 2009). To harness solar energy, technical capacity to assemble the solar chargers was a critical requirement in this research. A professor in Electrical Engineering at the University of Calgary and his doctoral student were helpful in determining the specifications for a solar charging unit that was capable of charging a common battery and recharging the Smart Q. Through this affiliation, we were able to

design and assemble one prototype solar charger at the University of Calgary. After getting the design and assembling the first solar charger, I worked with a technician in Nairobi, Kenya to assemble the solar chargers for this research. The solar chargers assembled in Kenya were based on the specifications of the initial charger designed at the University of Calgary's Faculty of Engineering. Assembling solar chargers; including sourcing materials and testing was done in Nairobi, and it took two months to produce six chargers with the same specifications, to be used for charging the tablets (See Figure 4.2)

Figure 4.2: Charging Tablet with Stored Solar Energy

By assembling the solar chargers used in this study in Kenya, I contributed to enhancing the local expertise in solar technology as well as supporting growth in a local business. Indeed Pilloton (2009) suggested that appropriate technology is designed to be an environmentally sensitive option, forcing designers to look to their surroundings, make use of waste products, and support local enterprises. Therefore, the jiFUNzeni approach met the criteria of an appropriate technology solution.

Theme: Creating Learning Resources

The PDTs had, during entry interviews, indicated their expectation to learn the process of instructional design. They asserted that previously they had delivered PD programs that had already been designed by other people, hence they had not engaged in systematic instructional design before. By engaging in instructional design in this study, the PDTs managed to create learning resources in new ways including web content in HTML and multimedia (videos, still images and audio files). As professional development providers, they had not previously produced content in those formats.

> We learned through the many times we tried to upload the content and sometimes we could just not do it. You know something would not connect. So through those mishaps, things could not work; like the audio or the video could not connect immediately. Earlier on, I had just thought I had been through great learning; when we could be able to say, this is what we have written. Now I can connect, I can upload this and it will work on the tablet. Then the disappointment that some of the multimedia is not working. The audio is not very clear, the video is not showing and then just to discover later, oh! This is where we went wrong. If I get onto this other support program, I will be able to upload it and everything will work. (PDT1, exit interview).

Under this theme, there are four codes including: Content development process; local experts; global web content for local contexts; and open educational resources. These codes are explored further in the following sub-sections.

Content development process

The content development and implementation process of professional development in this study was based on the jiFUNzeni learning approach guided by activity theory, situated learning and adult learning theory. For example, we took into consideration the relevance of PD content to teachers practice so that the content could be of immediate application

in their teaching as provided by adult learning theory and situated learning. Content development process also entailed continuous reference to teachers' PD needs and the objectives to address the needs consistent with activity theory.

The jiFUNzeni learning approach is a sustainable approach to content development and distribution (Crichton & Onguko, 2010). This approach emphasizes working collaboratively with regional partners, to develop digital content relevant to the setting. The jiFUNzeni approach underscores a needs-based implementation of blended learning for professional development, delivered on appropriate technologies such as inexpensive tablets, powered by abundantly available solar energy in challenging contexts.

There are four components in the jiFUNzeni approach. These components are

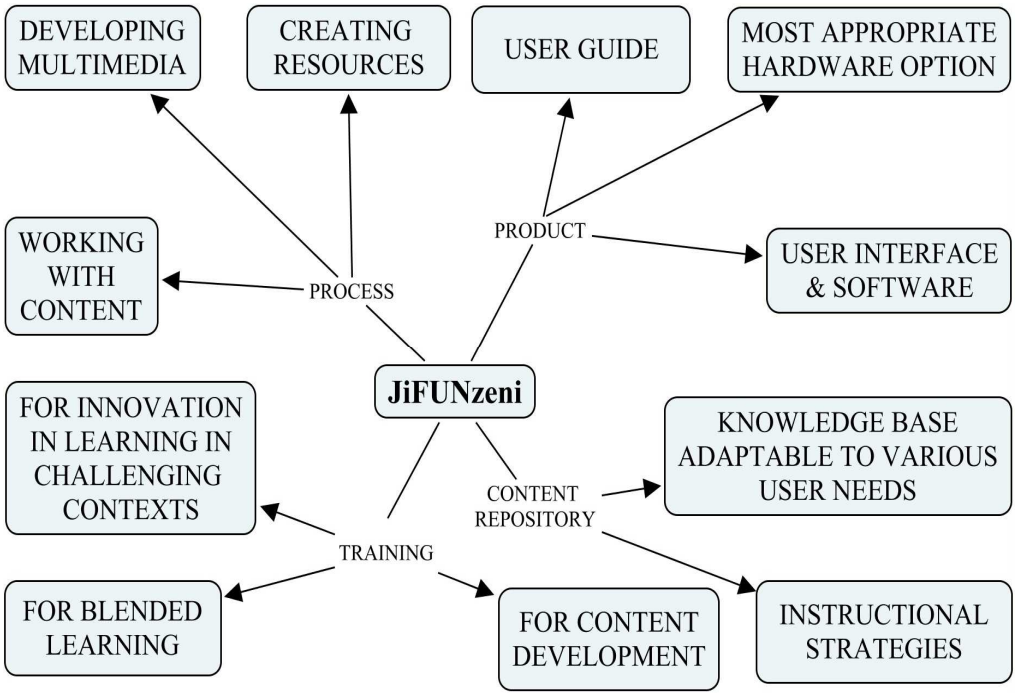
- content development;
- appropriate hardware solutions;
- training; and
- access to a content repository.

All four components are designed to provide a rich blended learning experience that can be supported by the simplest appropriate technologies. The jiFUNzeni learning approach was piloted with a team of teachers in Nairobi, Kenya in the summer of 2010 (Crichton & Onguko, 2010). The pilot was done as precursor to this study, as a way of establishing its efficacy before its implementation in a challenging setting such as the site of this study. The pilot findings revealed:

> Field trial participants recognized the importance of this approach for rural, remote learners, trainers, and teachers. They saw immediately the potential of multimedia to support low literacy learners, and they understood how this approach could put an entire library of resources, professional development, and support materials at peoples' fingertips (p. 5).

The four components of the jiFUNzeni process and the related sub-systems are presented in Figure 4.3. These components form an important part of this dissertation as they guided the professional development process used in this study.

Figure 4.3: Components of jiFUNzeni Learning Approach

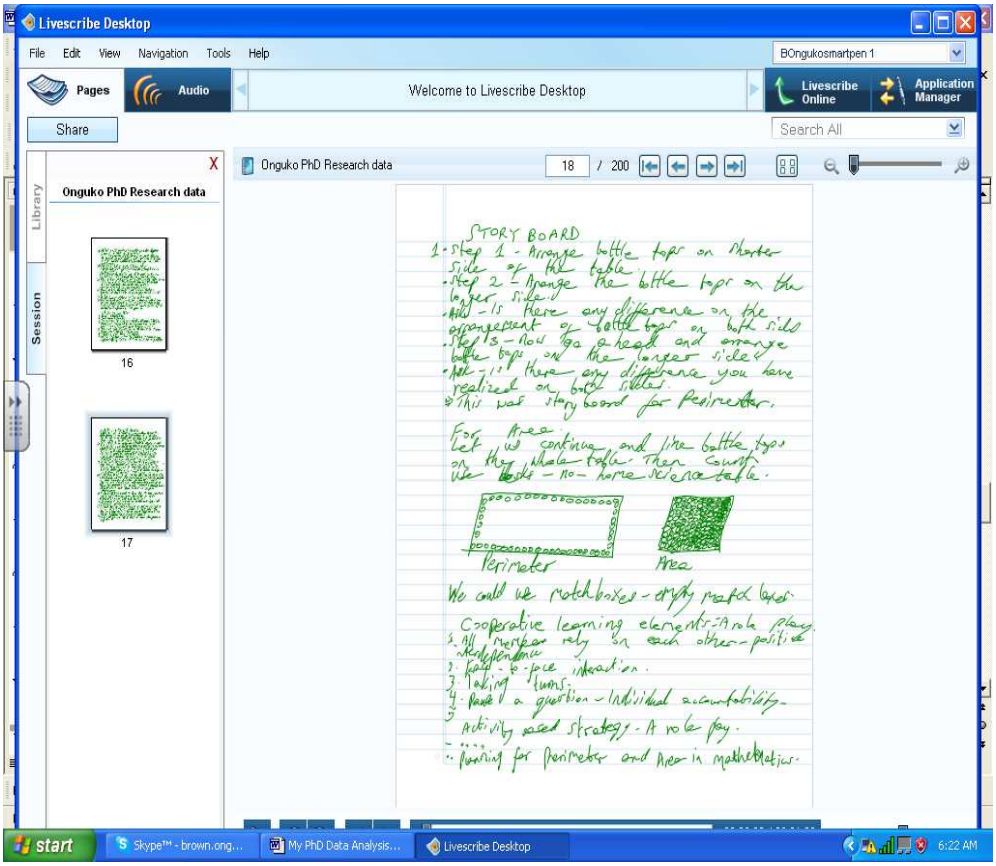


Source: jiFUNzeni (2011)

I worked with the PDTs through the four components of jiFUNzeni learning approach highlighted in Figure 4.3, to develop content for this research. Together we developed self-directed study content in HTML and exported as an offline website. The self-directed study content contained PDF readings, audio role plays, and video clips. Figure 4.4 is an

example of a storyboard. I recorded its development as the PDTs discussed the details of what should go to each of the two audio clips. The audio clips of the role plays were recorded using an Olympus digital voice recorder.

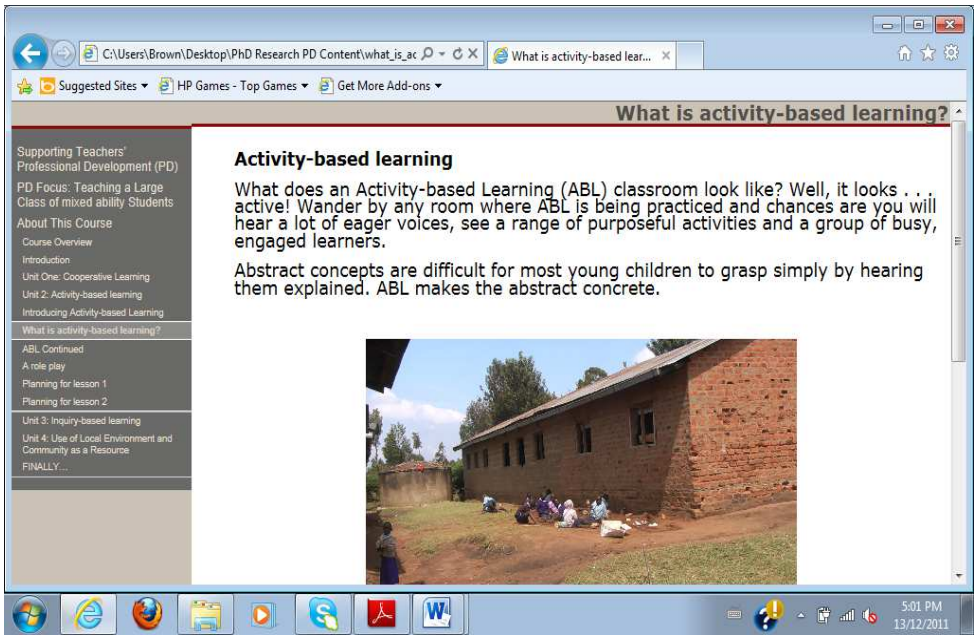
Figure: 4.4: Storyboard on Perimeter and Area



We recorded two videos using a very simple video camera - the Flip - which is a high-definition (HD) integrated unit that reduces chances of failure to record. The recording and transfer process to a computer takes three simple steps: press the on button, then the record button, and then dock it to the computer through the USB port for download. I recorded one of these videos in the research school, while teachers and students engaged in a lesson, using the local environment outdoors to explore water sources around the

school. The second video was recorded by the two PDTs in a school where one of them taught. They first developed a storyboard and then recorded the video based on the story as students and their teacher engaged in activity-based learning in the topics: perimeter and area.

Figure 4.5: Screenshot of PD Content Page with Picture of Research School



We initially created the content for the teachers' PD as a Microsoft word document and then later authored the content in HTML using eXe - an open source content authoring platform developed to assist teachers and academics publish web content without the need for proficiency in HTML (exelearning wiki, 2011). Once we had authored the content as HTML, we exported it as a self-contained website as shown in Figure 4.5. The content was so inviting for the teachers because it featured pictures from their school including the school building on the content page in Figure 4.5. The PDTs had not been through this process of authoring content as HTML before and hence came to this study

with the expectation to learn such new skills and knowledge. The PDTs confirmed that they learned new skills and knowledge in the instructional design process, authoring content on eXe platform, and creating multimedia content, especially video clips.

While jiFUNzeni learning process builds on existing instructional design (ID) models, its strength rests in user participation, iterative development and heightened respect of local contexts and relevant appropriate technologies. Generally, the jiFUNzeni components were instrumental in the content development process and implementation of this study. The specific alignment of each jiFUNzeni component in this PD initiative is indicated below.

- Content development: Multimedia learning resources were created with the PDTs as local experts based on teachers' needs.
- Appropriate hardware solutions: Identification and utilization of the most appropriate technology option for the context – the Smart Q tablet – that could play multimedia formats including HTML, video, audio and still images; was relatively inexpensive and yet could be powered by solar energy.
- Training: PDTs learned through instructional design process and contributed towards the design of blended learning approach, content development and identified specific instructional strategies for innovation for learning such as developing storyboards and recording audio and video clips.

- Access to a content repository: Teachers and PDTs are able to access content repository of the jiFUNzeni learning process at www.jifunzeni.com. This is explained later in this chapter in the section: The PD End Point.

Local experts

The PDTs as practitioners in professional development had the requisite knowledge and skills in the PD topic identified. Without the involvement of professional development providers, the intervention would not have taken the form it took. The PDTs were not only local experts (being teachers within the Kenyan education system), but they were also the subject matter experts. As a researcher, I did not have the content knowledge for the PD topic identified in the needs assessment. The teaching strategies in the four study units for which instruction was designed were

- cooperative learning;
- activity-based learning;
- inquiry-based learning; and
- use of local environment and community as a resource.

While the PDTs were subject matter experts and Kenyan professional development providers, they did not have experience in educational practice in a rural setting. The professional development structure in the rural setting, which comprised of Teachers Advisory Center (TAC) tutors, had basically collapsed because the local person designated as a TAC tutor also worked as the Area Education Officer and the Zonal Inspector of schools. Thus the local TAC tutor was not able to commit any time to

involvement in this research. The PDTs were, however, well placed as local experts for this research because of their previous experience and expertise in professional development.

During the instructional design process, the PDTs led the content development by identifying the teaching strategies delivered in four study units to address the topic of strategies for teaching a large class of mixed ability students. They also led by developing the learning objectives, selecting the content under each unit and designing the storyboards for both the audio and video clips. They recorded a video in a school where PDT1 teaches which was used in the unit on activity-based learning. They therefore were involved in digitizing the content and recording audio and video clips.

The PDTs were, however, not able to do instructional design on their own. Apart from being the researcher, I also brought to this study the innovation perspective, the ICT skills and expertise in instructional design. I therefore took a lead in providing the template for the content, which we initially designed as a word document and then later authored in HTML. I initially took the lead in authoring the first of the four units while the PDTs understudied the process. Once we had authored the first unit on cooperative learning, the PDTs took charge of authoring the remaining three units in HTML format. The PDTs had some tensions when, initially, the multimedia formats did not work as expected on the tablet. However, as the researcher and the ICT specialist in the group, I had gone through the process before and was not worried, as I was confident the multimedia content would

eventually work. Through several iterations and several days of trying out different approaches, we had all the content loaded on all the tablets.

The PDTs, reflecting on their participation in the instructional design process, confirmed their learning through the process. PDT1 said

> This approach opens new horizons for me, in the sense that we have new ways to reach out to teachers. I have learned instructional design. I don't think I have ever done that before; since in the other courses that I have participated in, the content we used was already prepared. So for the first time I actually did participate in designing instruction. Not only being able to design, but also be able to upload it onto a device that can then be used by the teachers (Exit interview).

PDT2 expressed the following sentiments on her participation in instructional design

> As a professional development teacher, I learned a lot especially on instructional design. It is a skill that I have learned and something that will help us in our work as PDTs. I learned a lot - how to design, authoring content in eXe, how to load content to the tablet. Yeah, that was the most learning I had (Exit interview).

For PDT1, the most exciting moment, when she thought her expectations were fulfilled during instructional design, was when deciding on content and the artifacts. She said

> The most exciting for me was when we were trying to identify the right materials to use, just what would be best to support the teachers out in the field, and what content would best fit in this area. That was exciting to me, and it was exciting because, for the first time I was sitting down as a teacher and telling myself, I am trying to see what would support another teacher out in the field, who is really in dire need of professional development. So I was trying to put myself in the shoes of someone else out there in the village, and trying to see how best they could understand the concepts without struggling with very difficult words and language (PDT1, exit interview).

PDT2 on the other hand, reflecting on her most exciting moment when she thought her expectations were met during instructional design, stated

> My most exciting moments during instructional design were the authoring part and then when we were able to record the videos and the audios and were actually able to see them come live on the tablet – we were able to access them. I was excited that I can actually do that! (Exit interview).

The PDTs came into this research as practitioners who had skills, knowledge and experience in providing PD. They, however, also brought authenticity to the PD program as experts in the local Kenyan curriculum, who contributed in designing contextually relevant content that included determining relevant global web content for the local context.

Global web content for local context

During the process of instructional design, there were a variety of sources of content and artifacts. Among the sources were personal notes from the PDTs' previous professional development programs, textbooks and creative, original ideas such as the storyboards that were written by the PDTs and recorded as video and audio clips.

There was, however, content from sources external to Africa, which is referred to in this dissertation as global web content. Global web content was adopted with adjustments for use in the local context. The two sources of global web content were: YouTube video on cooperative learning and web-based content on activity-based learning.

A video on cooperative learning, available on the video-sharing site at http://www.youtube.com/watch?v=6vQ54EFVGwk, was a public domain platform for open access. After assessing all related videos available, we settled on a video in which

students were recorded engaging in cooperative learning in class, guided by their teacher. Adjustments on the content included use of the www.Keepvid.com - video downloading software – to download the video to a local computer. The video was used as one of the multimedia content on cooperative learning. The video was very relevant because of its clarity in images and sound; was only 3.39 minutes long; and addressed all the elements of cooperative learning. It was a video recorded in the Western world, which provided a good balance and assurance that the PD content we worked with had a universal outlook. The other two videos used were developed from the local context, one of which was recorded in the research school.

We also identified the website of Latika Roy Foundation of India, which had relevant and clearly presented content on activity based learning. We sought permission to use it from the Latika Roy Foundation. As the researcher, it was my responsibility to seek for permission to use this content, and the response to my email was very fast: It took less than 24 hours for us to get permission from the organization. My email message to the Executive Director of Latika Roy Foundation read

> Hello. We are a team of teachers in East Africa - based in Nairobi, Kenya. We are currently working on instructional design for teachers' professional development in rural Kenya. We came across your site and are interested in using your resources on activity-based learning (ABL). We are therefore seeking for your support in either availing some content to us on this topic or allowing us to use and acknowledge the content on your site (B. Onguko, personal communication, April 11, 2011).

The response from the Executive Director, Latika Roy Foundation was encouraging and suggested a possible emergence of a collaborative network as reproduced here

> Hello! We could not be happier to have you use our material on activity based learning in your work in Kenya. What a thrill to think of this link being created - India and Kenya!
> Please feel free. We are presently working on a book on teaching math using the same activity based approach. I would love to send it to you if you give me your mailing address.
> I would also be happy to hear more about what you do and about the children you work with.
> Cheers! (J. Chopra, personal communication, April 11, 2011)

The two sources of global web content and the ease with which we were able to access them confirmed the view that education today is more technologically and globally minded and connected (Bonk, 2009). Global connectivity through technology makes sharing and collaboration across continents so easy, with potential benefits to all parties involved, by opening up communication channels for sharing back the content. The excitement of both parties – at Latika Roy Foundation and us in Kenya - on sharing the content on activity-based learning was evident. The Executive Director of Latika Roy was thrilled by what he called "a link being created – India and Kenya!" As for our team in Kenya, when we received the approval email from India, there was jubilation in the room where we worked. PDT1 summed it up: "That was very exciting when we were given green light to use that content because, to me it [content] was very simple" (Exit interview). Apart from having easy access to global web content, we as well utilized open educational resources (OERs) from the African context.

Open educational resources

Open educational resources (OERs) refers to material that is of use in the development of curriculum training content. It can be in a range of formats (e.g. a printed book or PDF file, a short video film, or an audio file), and it is shared openly (freely) by its creators in

order that others may use, distribute, and even modify or repurpose it (Commonwealth of Learning, 2010; Siemens & Tittenberger, 2009). According to Atkins et al., OERs are:

> Teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (2007, p.4).

While creating learning resources, we used relevant OER material specifically targeted to the African context. The Open Educational Resources for Teacher Education in Africa (Teacher Education in Sub Saharan Africa - TESSA, 2011) provided the most relevant OERs for our PD program, as compared to OER Africa or Commonwealth of Learning resources, for example, which are mainly targeted for universities, for use in degree level programs. However, TESSA resources were in the form of audio clips and PDF content on teaching practice, aimed at both primary and secondary school levels and teacher education.

We (PDTs and I) selected the appropriate OER materials that we could use based on the four strategies identified for the PD intervention (Cooperative learning, activity-based learning, inquiry-based learning and use of local environment and community as a resource). The audio clips from TESSA OER site had a heavy West African accent and thus would be confusing for participants in East Africa. The accents of the two regions are distinctively different. For that reason, we decided to record our own audio clips on role play as we spoke with a more regional East African accent. We, however, used PDF

readings from TESSA in the fourth unit on how to use the local environment and community as a resource. This content was so clearly organized in guiding steps for planning, implementation and review of lessons on use of the environment and community members around the school as resources for learning.

Recognizing that the TESSA OERs did not have audio materials from East Africa, we committed to share our audio clips with other users through the TESSA share link once we were through with implementation of our PD. As the researcher, it was my responsibility to share our audio content on TESSA share, which can be found on the TESSA OER site. Our interest and willingness to share this content on TESSA site effectively opened up our content as OERs. Sharing this content was motivated by my previous attendance at the 6th Pan Commonwealth Forum in India, organized by the Commonwealth of Learning (COL), in November 2010. During the forum, the TESSA team requested users of their OER content to share back, to enable other users access to the content they had modified or created. By the time of the forum, sharing back was not really happening as expected by the TESSA team.

Theme: Proceedings at Face to Face Meetings

Face-to-face meetings were an important component of the blended learning approach used in the PD approach in this research. The blend comprised a combination of self-directed study of offline content deployed on tablets, with the occasional face-to-face meetings, moderated through instructor-led sessions, including artifacts in the form of website with embedded readings, pictures, video and audio clips.

Traditional instructor-led educational delivery constituted the face-to-face component of the blended learning approach. We made considerations of the best fit in terms of time to allocate between face-to-face sessions and self-directed study of content on the tablets. The initial plan was to hold face-to-face meetings every Saturday for the entire 1 month PD period hence we would have had five face-to-face meetings. However, during the first face-to-face meeting, the teachers, citing their busy schedules, requested that face-to-face meetings be held fortnightly. The teachers needed some time to accommodate their personal and communal responsibilities. We accepted the request and made adjustments to the PD schedule, and hence we held three face-to-face meetings over the four-week period. Considered in terms of days, our blend was 10% instructor-led face-to-face and 90% self-directed study through technology mediation and peer collaboration.

There are four codes under this theme. These codes are: technology familiarization; reflective conversations; professional dialogues; and communal and professional commitments. These codes are explored in the following sub-sections.

Technology familiarization

Apart from four teachers, the other six had never worked on a computer before. None of the teachers had ever touched a tablet. Since the tablet was the basic platform for accessing PD content, familiarization tasks on operations of the tablet were scheduled for teachers during the first face-to-face meeting, held on 7th May 2011. As Davis (2011) argues, one must be able to use the technology before developing the capacity to use it as a learning tool. Davis suggested that to gain instructional effectiveness and efficiency, guided practice seems to be much better than self-discovery. The PDTs, who were

already familiar with the operations of the tablet, having been involved in usability testing one year earlier, guided teachers through six practice steps (Appendix K: Six steps on tablet operations and content familiarization).

Each of the participants had a copy of a document outlining the six steps required to access content, as well as the tablet user manual. Before guiding the teachers through the six steps, the PDTs had taken the teachers through understanding the operations, parts and buttons of the tablet including the on-off button, the stand, the stylus, the re-set button and the function button.

I observed that the teachers did not read the six steps on familiarization with tablet operations and accessing the content; instead, they immediately navigated through different applications. While some were busy struggling to access the Internet, despite lack of connectivity at that location; others immediately went for audio or video clips. It was also interesting to observe the emerging division of labor, whereby as one teacher scrolled to access the files on the tablet, the partner's role was to read the file names to identify the file they were seeking. For example, while Josh was scrolling through the tablet applications, he asked his partner, "Timo, are you checking?" (Face-to-face meeting, 1) And Timo responded, "Yes, alphabetically you are still too far" (Face-to-face meeting, 1). Working on the tablet for the first time was indeed a new experience, which required teachers to explore the applications by using their fingers or stylus on the tablet touch screen. The teachers had not yet experienced tablet and touchscreen technology and thus they had not developed touchscreen manipulation skills.

Teachers' attraction to audio clips and video clips could be explained by the fact that they always have access to readings in textbooks and pamphlets and yet in this study they had content that could speak to them. When teachers were requested to read the introduction to PD study process in their pairs for 30 minutes, they instead opted for a plenary approach, whereby one person read the content loudly. One teacher suggested: "Let us go together step by step" (Dennis, face-to-face meeting, 1). This might have been influenced by familiar practice in their classrooms, where due to lack of text books, they always call on one student to read aloud as others listen.

After familiarization with the tablet operations and introduction to PD content, the teachers also had to get familiarized to the solar power charging process. They had to learn to charge the reservoir batteries through exposure of the solar panels to the sun and how to recharge the tablets. This was an outdoor exercise so that they could experience how they would be harvesting solar energy by connecting the solar panels and the reservoir batteries.

Since both the reservoir batteries and the batteries in the tablets had initially been fully charged, the demonstration took only 30 minutes. On reflection, new challenges had emerged when I surprisingly discovered that the teachers assumed that they would only need a short time to charge and recharge the batteries based on the demonstration they had gone through. I realized later that the teachers did not quite understand that they needed to charge the reservoir batteries for 7 to 8 hours and to recharge the tablet

computers for at least 4 hours. During their self-directed study, they attempted to charge the reservoir battery for a short time, and this never quite gave them enough power as required. The other challenge with the solar charging process was that this research was done during the long rain season, whereby rains started as early as 1:00 pm. This made it difficult to charge the batteries with solar power on one day, such that to fully charge the battery required at least two days.

The familiarization process for the use of appropriate technologies in this research fits with that suggested by Davis (2011), that guided practice exercises tend to reduce the amount of time required to become familiar with equipment and allow groups to get started on the primary learning activities more quickly. It took only four hours for the teachers to acquire basic competency to operate the tablets and be able to access content at their own time. On solar charging, there was need to allocate more time for demonstration of actual charging of batteries (several hours of exposure of solar panels to the sun).

Reflective conversations

Reflective practice has been popularized as a perceived means of changing teaching practice (Dewey, 1933; Schon, 1983). However, emphasis on reflective practice and its perceived ability to change teaching has been limited to the West (Ashraf & Rarieya, 2008). Researchers (for example, Otienoh, 2009; Reitmaier, Bidwell & Marsden, 2011) have suggested that teachers in East Africa find it difficult to keep written reflective journals. These teachers are, however, comfortable to engage in group reflective conversations. This preference for reflective conversations rather than written reflective

journals might be influenced by the view that Africa has an oral culture (Maathai, 2009). Aware of preference for group reflective conversations rather than reflective journaling, face-to-face meetings two and three were structured as reflective conversation sessions.

In the second and third face-to-face meetings, teachers were requested to tell their stories, in terms of successes and challenges, experienced over the previous two-week period. These stories formed their reflections as they engaged in self-directed study, while implementing the teaching and learning strategies in their classrooms. Each teacher had an opportunity to talk about their experiences in studying and implementing teaching strategies in their classrooms, while their colleagues provided audience and feedback based on their own experiences, knowledge and skills. The reflective conversation sessions were very friendly whereby teachers talked openly and listened to each other, with the intention of understanding one another and learning from the experiences (Ashraf & Rarieya, 2008).

Reflective conversation sessions were closely related to those recorded by Stegman (2007). Stegman's study, done in a medium-size midwestern state university in the United States of America, involved six student-teachers in music education holding debrief sessions with their cooperating teachers over one semester. In the debrief sessions, student-teachers identified and discussed their successes and problems, while cooperating teachers facilitated the discussions, offered suggestions, observations, comments and advice.

Teachers in this study shared their personal experiences through reflective conversations on the successes and challenges as the PDTs facilitated the discussions, offered suggestions, observations, comments and advice as in Stegman's (2007) study. Teachers' reflections captured both their successes in implementing new teaching approaches and associated challenges.

The following excerpts of a reflective conversation session on how teachers catered for slow learners are indicative of what transpired during face-to-face meetings. Nita, with a burning desire to tell the story of what happened in her grade one class started off:

> May I share my experiences? They [slow learners] were advantaged in that, for my case, I encouraged those who were inactive in the group to be involved. For example, I had a girl, Kate. Initially she was just seated alone. So I remember I went to where she was seated several times, just to make her also take part in the counting. I attached her to whoever I had chosen as a group leader. I told the group leader to ensure that Kate was also involved in arranging and counting, because I had realized that she was not participating. I had to encourage her to also arrange and count (Face-to-face meeting, 2).

Nita shared with her colleagues her experiences of helping Kate participate in classroom activities with her colleagues. Nita's reinforcement of students' active participation contributed to students beginning to take responsibility for their learning, as later on Nita confirmed in another discussion that students started requesting to become group leaders. In response to Nita's contribution on how she catered for slow learners, PDT2 encouraged other teachers to speak to Nita again to gather more details on how she catered for students with different learning abilities in her class.

> So those of us who are of the view that the slow learners were not catered for, you should try and borrow a leaf from that teacher [Nita] so that she can explain to

> you exactly what she was doing. We have to cater for slow learners in activity-based learning (Face-to-face meeting, 2).

After PDT2 encouraged other teachers to further consult Nita on how she catered for slow learners, Dennis was next requesting to share his experiences. Dennis requested to contribute to the conversation saying

> May I contribute as well? Let me start with the success about slow learners. Now in the group during the lesson, they were doing some modeling; constructing housing structures. So the fast learners came up with an idea that those houses they had constructed needed to have some living things inside. So they resorted to collecting some crawling insects and keeping them inside. They then realized that the insects were so fast. As insects were put in, they immediately came out. They [students] had to assign one of them [students] saying that "we want you to find a way of preventing insects from coming out". This one student was to manage the insects inside the structure. The student decided to use his hand to block the insects and then realized that there was a risk of being bitten. They [students] made a door so that every time they came with an insect and put it inside, his work was to shut. So you see they were all working together to achieve their goal; that the insects should remain inside. So I found it to be very interesting that all of them were now working. It was team work (Face-to-face meeting, 2).

Dennis shared with his colleagues his reflections on how slow learners were engaged in his lesson through some kind of division of labor. Dennis' taught the special education class whose students had varied levels of learning ability. His reflections on the students taking up responsibility and deciding how they could structure their learning was striking, prompting me to ask if the students took the initiative to get insects as living things in the houses on their own. Dennis continued

> Yes, mine was just to facilitate where they were all to participate in construction and then after that one of the fast learners thought there are people who live in houses, so we must have some living things inside these structures. So they came up with that one. I found that slow learner now very much active, so that as others went out scouting for insects and brought them, he opened very fast. Sometimes

> when he opened, other insects came out. Occasionally he broke the house; the fast learners got busy fixing the house again. So the whole thing became very interesting. I really enjoyed it (Face-to-face meeting, 2).

During the reflective conversations, some teachers had felt that slow learners had an advantage in their learning through activity-based learning and collaborative learning. On the other hand, other teachers suggested that the slow learners had become lazy and were taking advantage, thus, letting the fast learners do most of the activities. Dennis therefore continued to elaborate on how slow learners in another of his lessons did not actively engage in their learning. Dennis stated

> Now on slow learners becoming lazy, that one came up in class during a number work lesson [math lesson]. I placed them in a group then I asked them to sort out bottle tops according to color. So a slow learner starts picking a few of the bottle tops and then relaxes saying, 'You keep on sorting. I will only be receiving what you have sorted out'. So you see, now he just becomes somebody [decides his role is] to receive instead of sorting together. Yet the concept of receiving was not there; he was to sort out as much as possible. So he doesn't want, because the exercise is strenuous (Face-to-face meeting, 2).

As the reflective conversations went on, the PDTs picked up areas that needed reinforcement to help the teachers in implementation of the teaching strategies they had learned. PDT2 realized that the reflections shared by Nita and Dennis concerned the distribution of roles to group members to encourage their participation. She clarified thus

> What I am hearing coming out of your experiences is: roles - the importance of roles. Maybe somebody can comment on that from the two experiences. According to the content we have, as we plan for cooperative learning, we were to make sure that when students sit in a group, then they are allocated roles. And the other thing is, you know your students, how do you put them in groups? (PDT2, face-to-face meeting, 2).

Nita was teaching grade one mathematics, while Dennis was teaching a multi-grade special needs education class. They shared their experiences during the face-to-face session, thus enabling them to think back about what they did in class, while they received feedback from the PDTs and their colleagues. At the same time, through reflective conversations, peers learned from each other's experiences unlike the reflective journals which tend to be for individual writer's consumption. The reflective conversations were greatly enhanced by the teachers' consent for their colleagues to view the short video clips recorded during the class observation sessions. They were able to critique and advise as they viewed the video clips and offered suggestions on how they might have handled different scenarios in classroom. On one hand, it was a bit surprising to observe teachers easily consent to their colleagues to watch them on video as they taught; yet on the other hand, I realized that their enthusiasm to watch the videos was influenced by the individual teacher's interest and excitement that they had been recorded on video.

The reflective conversations did not, however, involve much of analytical and evaluative discussions of what went on, and what would be done differently in their teaching. As has been noted by Otienoh (2009; 2011), the teachers remained at the descriptive level and did not move to the analytical level. Their reflections were mainly descriptions of what transpired in class. These reflective conversations were, however, a marked change from teachers' regular practice in the Kenyan context, as they were more detailed on thinking about what transpired in class, than the remarks teachers normally write when they do self-evaluation of their lessons. Based on my previous experience, writing scanty

comments such as “taught” or “lesson was successful” in the remarks column of a lesson plan is the closest teachers in Kenya get to attempt reflective practice in their teaching. This practice of writing one, two or three-word evaluation remarks suggests failure by teachers to even make descriptions of events in their classroom practice.

Professional dialogues

While reflective conversations could encompass professional dialogues, these two aspects are distinctively different in this dissertation. They are distinct in the way they were enacted. Reflective conversations were part of the design of the PD program and were facilitated by the PDTs, for participants to share their successes and challenges over the two-week self-directed study period, leading to a face-to-face meeting. Reflective conversations were discussions about the “mechanics” of daily teaching, tracing some of the critical incidents that happened in classroom teaching. Professional dialogues, on the other hand, were discussions that emerged during face-to-face meetings, where teachers got the opportunity to spontaneously raise key professional issues of concern for discussion. Such dialogues did not necessary involve all participants, as teachers got together in small groups of two or three and engaged in discussing an issue. Professional dialogues were meta-reflections on professional practice, encompassing a wider array of more general issues concerning the teaching profession.

The professional dialogues were not regulated, facilitated or moderated by the PDTs, though the PDTs occasionally got involved in some of the discussions and gave their views on the issues under discussion. My interpretation as a researcher was that the teachers got an opportunity which they never have, to share with colleagues aspects of

their practice which were puzzling them. An example of a topic that came up was in solving a mathematics problem: “What is one half of one third?” This problem was posed by Churchill and then Dennis took to responding to it in an informal set-up just before lunch during the second face-to-face meeting as can be seen in Figure 4.6. The dialogue went on for about 15 minutes until the two teachers ended up on the blackboard, to work out the answer to the problem, using both diagrammatic illustrations and numerical calculations. It was only much later, as they finally resolved the problem that they were able to link the statement question posed at the beginning, to the numerical problem: what is 1/2 X 1/3?

Figure 4.6: Screenshot of a Video during Professional Dialogue

The following excerpts of professional dialogues are illustrative of the engaging debates that arose during such discussions.

> Ok, coming to this issue of technology, it is true that in this program it [use of technology] has come up very well. We hear of e-Learning. It is just like more of a song to most of us; but it is true that this thing [e-Learning] in the next five years, it is going to take over our system [to be important for teaching practice]. And if we are not computer literate; I am telling you a teacher who was trained during [through] the training that we received in college is going just to be redundant. We are not going to feature anywhere in terms of acquiring and meeting the needs and objectives of education. Things are changing. I challenge you that if you go to an urban school, you see a student will challenge you [a student will be more informed] (Mika, face-to-face meeting, 3).

In this professional dialogue, Mika veered into the area of technology integration in teaching and learning and sounded as if he was scaring his colleagues. However, his contribution to this dialogue also brought out the fear teachers have when their students are more informed on a particular aspect than they do. This is reflected in his statement; "I challenge you that if you go to an urban school, you see a student will challenge you". By this statement, Mika meant that in urban schools, there were students who were way ahead of their teachers in access and use of technologies such as computers. Later in the dialogue, he gave an example of a teacher who punished a student because the teacher misunderstood the student's use of the word 'windows' from a computer technology perspective. Mika elaborated further through professional dialogue:

> There was a teacher, my colleague I was sharing [had a conversation] with. This colleague of mine was not computer literate therefore he went into a class and asked his pupils [students] 'I want you to mention the types of windows, yeah'. Then a student told him, Window 2007. So this teacher was wondering what is window 2007. *Laughter*... In fact he punished the pupil in class (Face-to-face meeting, 3).

Mika felt, therefore, that if the teachers from Lumbwa were to work in urban schools with their low levels of exposure to computers then, the students there would be way ahead of them in computer-related knowledge and skills. He became a strong advocate for his colleagues to go out of their way to acquire more knowledge and skills.

The PDTs got a chance to contribute to professional dialogues as well. PDT1 picked on one of the aspects Mika mentioned and responded:

> Mika talked of a teaching philosophy. And because this curriculum is lived in the classroom; at the end of the day, whoever writes it [curriculum], it is just on paper – it is just paper-based until it gets to the classroom, and that is where it is lived. And that is why the personal interpretation of each teacher makes it very different. And the experience of each classroom very different, depending on how I have interpreted that curriculum, how I feel it restricts me. If I decide it is too restrictive, then I know that mine is just this [narrow way of curriculum interpretation] (Face-to-face meeting, 3).

Professional dialogues therefore opened up discussion of aspects that were out of the PD topic, yet very important professional matters. There were many other topics including: congested curriculum; personal teaching philosophy; ideal outputs of an educational system; and expectations of the quality assurance/inspection services of the Ministry of Education.

Communal and professional commitments

As members of a community, there are communal responsibilities and expectations that people have to satisfy. Communal commitments are activities that a community member participates in such as a women's group for small scale enterprises, a funeral in the community or religious activities in churches or mosques. A number of the teachers took

time to attend to communal responsibilities and expectations such as attendance at funeral service. While Emily, Perita, and Rita missed at least one face-to-face meeting to attend funeral services of their relatives, they still were able to follow up with their colleagues on the discussions and continued their commitment to participation in the research.

There was a different version of communal and professional commitment observed in Mika's participation. Mika was a participant who was also a very committed Seventh Day Adventist. Members of this faith in Kenya do not engage in any work on Saturdays, which is their Sabbath day. Some of them do not even take time off from observing their Sabbath commitment to prepare their meals for the day.

Mika missed the first two Saturday face-to-face meetings (7th May and 21st May, 2011). He did not even participate in the technology and content familiarization session, though at least he was familiar with computers, being one of the four teachers who had worked with computers before. He, however, worked with his partner, Churchill and another friend, Timo, during the week and was able to follow up with the program. When I observed him teaching in the classroom, he had grasped the teaching strategies so well that he utilized most of the elements and structures of cooperative learning presented in the PD content. He was, indeed, the only one I observed who effectively enacted the use of round-robin structure of cooperative learning, with the grade 8 students he taught. By his own choice, Mika finally decided to commit his time for Sabbath to his professional development by attending the final face-to-face meeting on a Saturday, 4th June 2011.

The teachers were aware that Mika did not attend to work-related assignments on Saturdays. He therefore did not have to explain why he missed the previous meetings. Indeed the teachers were the ones who made the PDTs and me aware that Mika was of the Seventh Day Adventist faith. When he attended the final face-to-face on Saturday, he simply said that he had not been able to attend the two previous sessions due to "some circumstances" (Mika, face-to-face meeting, 3). At the exit interview, Mika confirmed that he used to speak to his colleagues about what transpired in the face-to-face meetings 1 and 2, held on Saturdays and they briefed him and also shared their notes with him. In this respect, he mentioned his partner Churchill, Timo and Josh as the colleagues he consulted.

Theme: Self-directed Study

Self-directed study in this dissertation refers to the freedom to choose when and where to study and the pace of study. The teachers remained with the tablets that contained the content for their study for the entire four weeks of the PD. It was up to individuals and pairs to determine their study time and place, by balancing their daily commitments, which included professional, family and communal commitments. While individuals could determine when and where to study, and the pace of their study, they needed to accommodate their colleagues with whom they shared a tablet. Based on data from my observations and exit interviews with the teachers, key codes emerged under this theme. The codes are: peer-support, sharing and feedback; and the technology stewarding.

Peer support, sharing and feedback

The PD was designed such that teachers would work collaboratively with their peers, supporting one another, sharing experiences and providing feedback to each other. Two

teachers shared one tablet. The teachers had an opportunity on day one of implementation of PD (during face-to-face meeting 1) to choose their own partners. They made their choices of partners from the moment they started on familiarization activities for appropriate technologies and the content. It was important for teachers to choose their partners because they knew each other and could determine for themselves the person they thought they could work with amicably. Pairing was important because it was envisaged that teachers could be able to resolve potential problems in their study process, and also choose if they wished to collaborate and support each other in planning for their lessons as they incorporated the teaching strategies in the PD content.

Sharing one tablet between two teachers was a good design decision because this sharing arrangement inevitably enabled the teachers to share some of their experiences one-on-one. I realized a few challenges, such as some teachers deciding to keep the shared tablet for a longer time than their colleagues; and for others, the tablet became a tool for the entire family as the teachers' children and spouses were interested in using it. Generally, I observed that teams of pairs emerged for professional engagement during this period.

My observation of one of the pairs that did not share the tablet equitably suggests a unique approach to learning and planning for lessons. The disadvantaged teacher in this inequitable sharing - Josh - discussed with several teachers to learn more about the teaching strategies in the content, without necessarily reading it on the tablet and eventually taught a successful lesson. The lesson on the solar system (the topic of the lesson which I observed Josh teaching) really engaged the students actively as they

developed models of the planets in the solar system. The lesson illustrated in Figure 4.7 shows students working in groups with materials to model the solar system. The different planets and stars were modeled on flip charts and then the students displayed their work on the walls for others to look at. It is not common to get such basic materials like the flip charts in classrooms in Lumbwa School; hence, the ones used in Josh's lesson were acquired specifically for use during the PD period.

Figure 4.7: Josh's Grade Six Students Engaged in Cooperative Learning

The lesson illustrated in Figure 4.7 was planned after discussions through peer collaboration, sharing and feedback, involving a number of teachers participating in the PD, as explained by Josh during exit interview.

> We used to share the activities. You know we don't have enough time to go through everything [to study PD content]. I would tell him [Timo], you read the first activity and I will go through the second one, then we shall exchange and discuss. That discussing was even better than I, personally reading. So in fact I reached a place, I didn't really get all the knowledge from the tablet. I was now getting from my colleagues. I could go to Emily and tell her, this activity, I am unable to interpret it. How do you do it? Perita was around, Churchill was around.

> So they start explaining - now this is what we do - as I took notes (Exit interview, 4).

This was an interesting approach to accessing PD content through peer collaboration, sharing and feedback because, of the three teachers mentioned by Josh, none of them was his chosen partner in this study. His partner was Timo, and he did not feature much in the collaborative and sharing conversation Josh referred to, apart from when as a pair, they read about the PD activities in turns. I had observed that Timo used to dominate the use of the tablet, and rarely did I see Josh with the tablet over the four-week period. Josh's approach could as well be a case of a disadvantaged teacher resorting to other options, to achieve the same goal, as those who were advantaged.

Technology stewarding

Deployment of any innovation, including those involving use of new technologies requires technical support, which Wenger et al. (2009) referred to as technology stewardship. Deployment of technologies in educational programs has to be accompanied by technical support otherwise the users quickly get frustrated. In this research, I had to ensure that the teachers received the technical support necessary to enable them to work with the tablets, the solar panels and chargers. As a researcher, I moved into the village where the research school was located and lived there for six weeks during the study.

I was called upon many times, especially during the first two weeks, to address technical problems. Teachers, having never worked with tablets before, had many technical support requirements during the first two weeks. Teachers in the challenging context would

normally have experience with technology devices such as mobile phones, radios and a few with televisions, mainly powered by motor vehicle batteries. However, after stabilizing their use of the tablets and the solar charging system over the first two weeks, there were no more calls for technical support during the remaining two weeks. I was always able to get to the school in three to four minutes, once I received a call, because I lived only 3 kilometers away. One day, I received a telephone call from Emily, who was in panic. She said: “The tablet has hanged and cannot work” (Emily, personal communication, April 2011). The tablet required resetting through a process called calibration. My attempt to help her over mobile phone voice conversation, to troubleshoot and solve the problem was fruitless; so I immediately drove off to school and resolved the issue, which had scared Emily. She was rather apprehensive and so could not concentrate on my instructions on phone. She was worried that she had spoilt the tablet.

Later during exit interviews, it emerged that some of the teachers had acquired troubleshooting skills, through their observation of the procedures I followed in resolving technical problems. Dennis said

> In the beginning computers [tablets] were jammed. But with time we were able now to access the information. We used to invite you to solve the problems. You never touched my device [tablet] for support, but the ones you supported were able to share with me. I learned how to resolve the problems. So whenever it could jam, I could not actually hold back and wait for you. I could give it out and they resolve for me. For example, I learned how to resolve the issues from Josh. I could give him and he fixes the problem (Exit interview, 3).

Emily, who called me in a panic, mentioned her difficulties with technology indicating

> Difficulties; may be the handling of the systems. You realize that during the time we were to charge from the solar, it [battery] was not able to take power. It could take time. You find that the tablet itself sometimes may hang. You operate and then it disappears without your knowledge [inactive touch screen]. Also accessing the content took long. Later on I came to know how to go about it. We resolved these problems with your support. Your closeness; you were very fast in coming up to assist. There is a time I called you up. I wanted you to come and help me, you came in very fast. I also realized that it [tablet] was just disturbing at the earlier stages; before I had gotten used [had initial difficulties operating the tablet before getting fully familiar with its operations]. After I had gotten used, it was easy for me to handle (Exit interview, 5).

The views by the participants indicate that they learned some troubleshooting skills and also got more comfortable working with the appropriate technologies as time went by. However, it is important to provide technology stewarding for the users so that they are not frustrated by new innovations and technologies. If, for example, Emily failed to get technical support to solve the problem she encountered, she would have been frustrated and might have thought of dropping out of PD. As they become more comfortable working with the technologies, the technology stewardship required reduces. Indeed, it is advised that one-on-one support by technology stewards is important, as individuals gain the ability to drive their use of tools, eventually becoming technology stewards (Wenger et al., 2009).

Theme: Classroom Practice

The ultimate goal for professional development is to facilitate in-school impact on teaching and learning (Christie, Harley & Penny, 2004). The impact of the PD intervention on student learning was out of the scope of this study as impact might, for example, manifest through improved outcomes over a long and sustained period focusing on the use of the teaching strategies. However, there were evident changes in the

teaching approaches at the time of PD implementation. Classroom observations, reflective conversations and exit interview data provided evidence of the changes in teaching approaches. For this theme on classroom practice, there are two codes namely: Change in teaching approaches and use of local learning materials.

Change in teaching approaches

Teachers had indicated in the entry interviews that among the instructional problems they had, three were most common: handling large classes of students with mixed abilities, lack of use of teaching materials and need to use technology. Based on the lesson observation, reflective conversations and the teachers' own confirmation at the exit interviews there were marked changes in the way the lessons were taught over the period of PD intervention. Teachers moved away from use of rote learning and what they referred to as lecture method to more learner-centered teaching approaches.

I observed each teacher in their classrooms teaching once during this study. In all lessons I observed, there was changed practice that could be attributed directly to the PD materials – the students were actively engaging in activities and working with learning materials. These materials were mainly found from the local environment. Only flip charts and marker pens, which were used in lessons taught by Churchill and Josh, were bought away from the local area. Otherwise most of the teachers used simple materials such as clay, sticks, flowers, and leaves, which were readily available in the local environment.

Two teachers, Dennis and Nita, both mentioned at different times that, if one did not prepare and have learning materials as they implemented the teaching strategies, the students would embarrass them. By “embarrass” they implied that learning would not take place as their students were getting used to active involvement in their learning. Further, it is possible the teachers thought of their getting embarrassed by their students because I was observing their lessons as they implemented the teaching strategies. They would not have wanted to be in a situation where a lesson I observed did not go well because of lack of learning materials. Embarrassment could also be understood from the perspective that teachers’ participation in PD disrupted the routine, whereas previously, teachers were the ones who always provided the ‘knowledge’ by talking in class, yet during the PD period the students were getting their voice as well and contributing to classroom discourse.

In their individual exit interviews, the teachers indicated how their involvement in PD had benefited them. Looking back to their entry interviews, for example, Emah mentioned that she did not know what to do when she taught her students and seemingly ten or so slow learners could not grasp what was taught. Teachers confirmed they had learned some ways to resolve the difficulties. Statements by the ten teachers suggest their participation in PD benefited their practice.

> This course supported my work as a deputy head teacher, and being in charge of curriculum, in reminding teachers about teaching strategies. The technology saved time. It was very possible for me to carry it [tablet] along and keep revising [studying PD content] wherever I was - in school, at home, or in church. I was very impressed. Having gone through the first unit on cooperative learning, I discovered that it was very effective. Cooperative learning has proved that it is

> very effective in ensuring that all students participate and they learn from one another (Churchill, exit interview, 1).

Rita stated:

> I have learned about cooperative learning and actually how to arrange my class. It has not been actually normal for us to group students, but because of learning through this program, there is a must for them [students have] to interact (Exit interview, 2).

Dennis observed: "I had an opportunity to use technology and the approaches outlined were very interesting. They actually exposed me to issues [strategies] such as how to use the round robin"[10] (Exit interview, 3). While Josh said, "There are a number of benefits. I had a chance to use the tablet. The approaches were beneficial because they make children active in class" (Exit interview, 4). Emily on the other hand, spoke of her changed teaching thus: "I have improved my teaching methods. Where we were used to lecture methods; now I have turned to use of activities in class" (Exit interview, 5).

Other teachers such as Nita spoke to the achievements she realized in her teaching approaches, directly touching on the topic of PD. She stated:

> I am also able to manage a large class, where by group work is effectively managed. Another benefit is that I have known my pupils better than earlier because I have had cases whereby even the slow learners have participated in group work (Nita, exit interview, 6).

---

[10] Round robin is one of the structures of cooperative learning where, students take turns in speaking, one after the other till they have all had a chance to contribute or share their thoughts. The other cooperative learning structure used in the content was think-pair-share. Think-pair-share involves a student beginning by thinking individually about a question, then two students get together to share their responses and agree on a common answer.

Emah too spoke about her having acquired skills for handling the dilemma she frequently found herself in when handling students of varied abilities. She said, “I have learned several things. For example, through grouping pupils, I can have some time to attend to those learners who have low learning abilities; those ones with problems” (Exit interview, 7). In addition, Perita said, “I have gone through the methods of teaching and have liked them and they are helping me. In fact, when it comes to teaching, I tend not to strain very much because now, I am using those methods” (Exit interview, 8).

Timo also confirmed changes in his classroom practice thus: “I realized that children were very much interested in the lessons, they were also active. Even those who never participated in class had opportunity to handle the material and also to do some work” (Exit interview, 9). And finally, Mika as well echoed similar sentiments to those of his colleagues by stating that: “Personally, I really benefited in terms of acquiring skills especially the teaching strategies. I was able to learn some new teaching strategies such as application of the round robin” (Exit interview, 10).

The teachers’ views on how their teaching practice changed as a result of PD were corroborated by my observations during their teaching in classrooms. Due to the PD implementation there were changes in teaching approaches with emphasis on learner-centered approaches. The students engaged in group activities while learning with materials derived from the local environment.

Local learning material

As indicated in the previous sub-section, most of the learning materials used in the classrooms were sourced from the local environment. This suggests that even in challenging settings, where poverty has been identified as a key indicator of such contexts, teachers can still make the learning experience a rich one through use of locally available material.

Indeed, teachers agreed on the need to improvise learning materials, while also voicing concerns about expectations to improvise everything. They said there should be room for improvisation, but also for provision of some materials specifically bought for teaching and learning purposes. These views arose from Emah's reflective conversation on how she worked with grade two students to create paint from leaves and flowers.

> I was handling a creative arts class. As Josh said, it is tiresome to find materials, and if you do not have materials, learning won't take place. We were doing a leaf printing lesson and I had some problems with the paints; although children participated very well. In fact, those ones who are always dull [passive learners] are the ones who made the best prints compared to those ones who are always active. For the paints we used, I just took the learners out and they used the environment. They used leaves and flowers, and then they mixed with some water. Then they made paint and that is what they used for printing. But it [print] didn't come out clearly. So there is need to buy some of the paints (Emah, face-to-face meeting, 2).

Emah's reflections, suggest that not only does the local environment provide materials that can be used in making learning authentic for the students, but also that some students who may have been missing out on learning because of their hands-on nature benefit when learning with learning materials. This experience must have helped Emah a great

deal because; she was in a dilemma during the entry interview, on how she was supposed to handle the 10 - 15 students who were slow learners in her class.

As implied by Emah's dilemma during the entry interviews, some students that teachers would typically leave alone in Kenyan schools, because they are not able to cope with the speed of their colleagues, only need a different approach such as more hands-on experiences and they will learn as depicted in Figure 4.8. Indeed Emah confirmed that by using cooperative learning and activity-based learning strategies, she now had time to attend to students "who have low learning ability, the ones with problems" (Exit interview, 7). The students in Figure 4.8 were from the special needs education unit who require learning at their own individual pace based on their challenges. Thus they engaged in activities of different levels of cognition.

Figure 4.8: Students in a Special Needs Education Class with Local Material

Theme: The Professional Development End Point

From data gathered during one-on-one exit interviews with the teachers and PDTs, three codes emerged under the theme the PD end point: teachers gain new knowledge and skills; PDTs gain new knowledge and skills; and an emerging sustainability framework.

Teachers gain new knowledge and skills

All the teachers participating in the PD intervention attested to having learned a lot and gained both new skills and knowledge. While the teachers consistently mentioned that they had learned a lot from the PD, they also singled out the two strategies that they were able to address over the four-week period: cooperative learning and activity-based learning. The teachers did not have enough time in this study to explore the other two strategies: Inquiry-based learning and use of local community and environment as a learning resource.

The teachers decided to improve on the first two strategies over the four week period by going back to implement these strategies in their own practice after the second face-to-face meeting. This scenario where teachers decided on their own how to proceed in PD is a reflection of the qualities of adult learners as self-directed, independent, internally-motivated, and self-regulated (Merriam, 2001; Robertson & Merriam, 2005). Reflecting on the research process, I realized that teachers needed more time than we had to address all the four teaching strategies. Their busy teaching schedules; their inability to share the use of the tablets equitably (some teachers kept the tablet for a whole week before their colleagues got an opportunity to use it); and their wish to “perfect” their practice of the

first two teaching strategies made it impossible for them to study through all the four strategies.

Teachers mentioned some of the specific aspects they had learned. They mentioned that they had learned computing skills – with some using different variants such as manipulation skills, computer literacy, and computation skills. Mika's experiences manifested the most use of the tablet, as he extended its use beyond his own use to access the PD content, but also attempted to use it as a teaching tool in his lessons. He said:

> I acquired computation skills. The other skill is recording. Using the tablet; being a math teacher in standard [grade] five, I was able to engage where in the tool bar we had an item on the use of something – calculator. You know I have never used that tool on the computer [desktop]. The tablet gave me an opportunity to be able to use it and enhanced my own skills in computation. I was able to pass it [tablet] around to some of my learners. I used the tablet in class. And more especially, there was some content on perimeter and area, and coincidentally I was also teaching that topic. So on this topic of perimeter and area; it really gave me an opportunity of using this [tablet] with the learners according to the content from the tutorial [audio role-play] that had been presented on the tablet (Mika, exit interview, 10).

Mika's lesson referred to in the excerpt above was not one of those I observed. He had planned to use the tablet in the social studies lesson, which I observed him teaching grade eight students. He failed to bring the tablet to class on that day, though later on after the lesson, he was able to show me some content that he had typed on the tablet. Mika's initiative to go beyond using the tablet for his own self-directed study of PD content, to using it in class, was a sign of a creative teacher who was able to do more with new technology in his teaching practice. He was the only teacher who attempted to use the tablet in class. As Mika confirmed, coincidentally, he was teaching the same topic in

math on area and perimeter, that we had used in the PD content to illustrate the use of activity-based learning and cooperative learning. This coincidence gave him an opportunity to directly transfer the PD content to his teaching practice.

Apart from the computing skills, teachers as well mentioned that they had acquired a variety of skills. These skills included: Social skills, creativity, critical thinking, analytical skills, interpretation skills, application skills, and responsibility skills. Teachers' views on their acquisition of new skills during the study period are reflected in Josh's views.

> Yeah, one skill is that I became creative. I can say it [PD in this study] makes one to be creative. We had to come up with new - you had to come up with something. That is creativity. Then you need some critical thinking there. Also children will be made to think as you ask questions. Also the teacher becomes analytical. Yes analytical skills, whereby you analyze what you are going to come up with (Exit interview, 4).

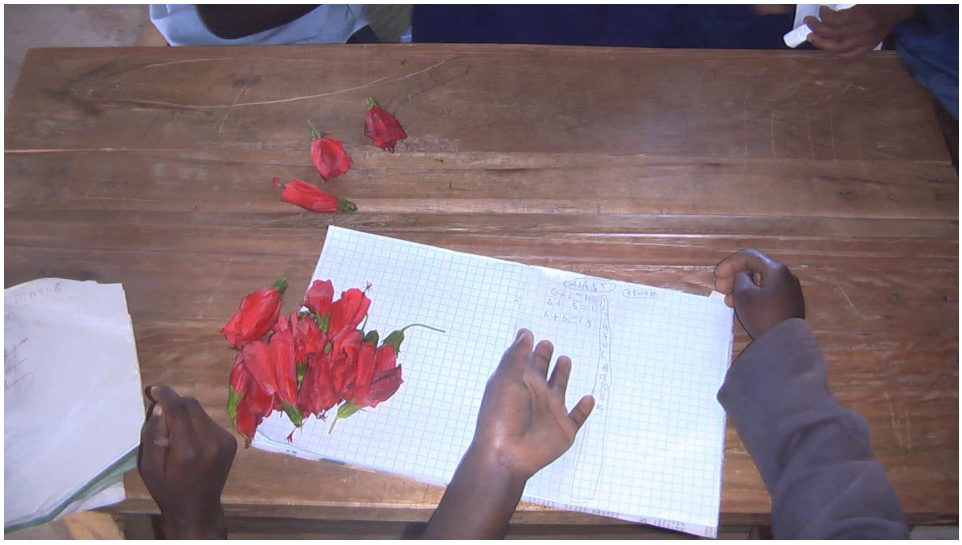
On responsibility as a skill acquired as teachers engaged in this PD, Nita observed during her exit interview:

> I have also acquired the skill of responsibility. I think I am more responsible than I was because I feel I have to engage a few teaching aids [learning materials] to make the class active and to set them [students] going. There is also an experience I have had; I don't strain anymore. You see when you are standing in front, you have to shout, but when they [students] are grouped, you can even teach from the middle of the class and they all get the instructions (Exit interview, 6).

This was an interesting revelation by Nita, that she had become more responsible thus she had acquired a responsibility skill and was now using learning aids (materials) to make her students active learners. These views were corroborated by my observation of Nita's

grade one lesson. She had the most variety of learning materials including three different shades of flowers, used calling cards and bottle tops as represented by one group of her grade one students in Figure 4.9. The view by Nita that she was no longer straining could imply that teachers' lack the skills and knowledge that could help them teach with fun instead of toiling and struggling so much. Thus such revelation makes a case for the need for consistent and sustained provision of PD for teachers.

Figure 4.9: Flowers from the Local Environment as Learning Materials



PDTs gain new knowledge and skills

PDTs started from a higher level of pedagogical and content knowledge and skills than the teachers. Indeed the PDTs qualification to participate in this study was based on their knowledge and skills in delivering PD, especially in the area of teaching and learning. Nevertheless, the PDTs confirmed that they learned new knowledge and skills as they had anticipated during entry interviews. At the exit interview, PDT 1 confirmed this.

> I think in the past I have not had to support teachers in any other ways except when we meet. This time, I even had to do it [support teachers] on phone. You know, I am just a phone call away; and I can support the teachers in the field.

> Something else that was very interesting; you know having to do some audio [record audio content] again to support further. You know to think through and see that because the teachers are not there with you, how best this message can be communicated and therefore look for extra ways including the role-plays – trying to do a role-play to support the teachers. And then do a video that can still further support; and then have all these as tools that teachers can access and be able to use.
>
> I think even sitting with teachers just learning to listen and appreciate just what it means to each of these teachers to be able to get access to professional support. So I believe I just improved on my listening skills. You see in the past in the other courses, when we met on Saturdays, the teachers would have very brief sharing because there is still input to be done [PDTs' face-to-face presentations]. So the Saturday would also have an input. So there was so much of relying on what you can give to the teachers in terms of input, other than sitting there and listening to them sharing. So it was different for me this time in that half day, that we met with teachers (PDT1, exit interview).

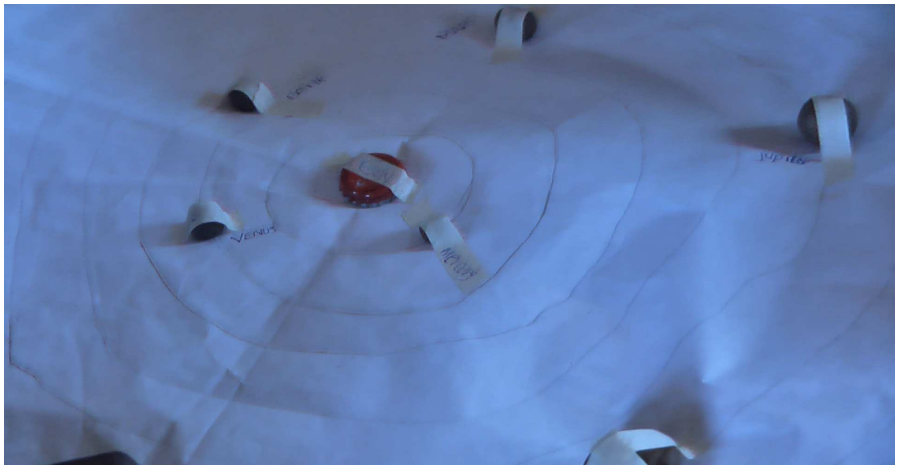
PDT2 as well confirmed that she had learned and gained in both skills and knowledge as anticipated. She said

> First of all, I really gained a lot on the designing part – the instructional design. That is the part that I learned a lot. How to design; how to load it [content] to the tablet; yeah! That was the most learning I had. The particular part that I really say, that I learned something that I didn't know, was putting the content in eXe - changing content from Word [Office program] – authoring the content. Yes that is the part that I learned a lot.
>
> As I listened to the teachers when we went for the second and third face-to-face [meeting], when they were sharing their experiences, and as one shared a challenge, the other one tried to give how to overcome it; then you tend to see things in a different way. Maybe that was not how I had looked at it or how I had solved my problem. Then you get like an alternative on how to overcome. I learned from the participants through their sharing.
>
> Ok, like when we were watching the videos, there were two lessons that actually struck me. The first one, for class [grade] one. This comment that the teacher made: 'Is that Lumbwa?' [Pseudonym for school]. That really made me think we really take for granted our environment and what we can do as teachers. So when that teacher commented that way, and everybody laughed, then I thought ok, he didn't actually look at it that this can actually happen in his own class. Yet the teacher didn't go away to go and get the things [learning materials]. She just got

> them around and used the same children and made her lesson so nice that the other teacher was wondering. Then there was this other lesson for class [grade] eight. The teacher that was teaching Kiswahili; that he said he was also actually surprised he could do that. This means, there is a lot in us, as teachers that we really don't try to think about. There is a lot of potential and the way we can teach, that we just don't get out of our way to do. The children were able to write poems. In forty minutes they were able to write their own poems and recite them in class (PDT2, exit interview).

The two lessons that PDT2 mentioned, presented evidence of change in teaching practice in this study. Josh, who wondered if the video recording of Nita's lesson he was viewing was happening in his school, later on taught a lesson that engaged his students as is evident in the students' product of their learning depicted in Figure 4.10. It seems Josh's viewing Nita's lesson on video must have inspired him to actively engage his students in their learning as well.

Figure 4.10: Students' Model of the Solar System in Josh's Class



The other incident that PDT2 referred to was from Churchill's lesson, where in 40 minutes, students of grade eight were able to work in four cooperative groups, through

activity-based learning to compose four poems. Churchill's students are shown in Figure 4.11 displaying their poems composed in a 40-minute lesson. In previous teaching practice, Churchill mentioned that he would only have had one poem, which he had already composed earlier and brought to the classroom as an example. He had used the poem he brought to class to demonstrate what a poem should look like, and then at the end of his lesson there were four additional poems composed by students and displayed on the walls.

Figure 4.11: Grade Eight Students Display Poems Composed in 40 Minutes

Clearly the two PDTs acquired some skills especially to do with instructional design and technical skills on authoring content in HTML format. They, however, also confirmed to have learned from their interaction with teachers during face-to-face meetings. That their engagement in this research was a new experience for them, is confirmed in their realization that they did not have to be the ones making presentations to the teachers as the teachers listened, during face-to-face meetings. Instead they became the listeners

while the teachers did most of the talking in the meetings as shown in Figure 4.12. The PDTs therefore facilitated learning by designing the learning environment, organizing resources and providing the tools while learning took place both in virtual offline environments and the occasional face-to-face meetings (Januszewski & Molenda, 2008).

Figure 4.12: Teachers and PDTs during Second Face-to-face Session

Emerging sustainability framework

Discussions emerged on the way forward during the one-on-one interviews with individual participants, forming important data for this code. Apparently both the teachers and the PDTs were keen on sustaining the initiatives started through this research.

The teachers were all unanimous that they still needed more professional development, especially considering the changing learning environments such as introduction of eLearning to the educational scene. They felt they have to keep upgrading their skills and knowledge. Some of them including Churchill, Josh and Mika are already enrolled in degree programs in Kenyan universities. They are pursuing programs in early childhood

and special needs education. Enrolment for university study by primary teachers is a recent trend in Kenya as universities are opening up through study programs called school-based programs. Other teachers who have not enrolled for degree studies such as Dennis, Emah and Nita hope to enroll, though they all cited financial constraints which they have to overcome before they commit themselves. Other teachers like Churchill, Rita, Perita and Emily, had aspirations to enroll in training programs on use of computers, since there are some small commercial training institutions within the local shopping centers with one or two desktop computers. These teachers felt their experiences' working with the tablets was just a beginning on their journey to getting more skills in using computers.

However, the teachers were also keen to have the PDTs go back to Lumbwa School and provide more professional development programs; especially involving the other ten teachers who did not participate in the PD intervention in this study. When they learned of the jiFUNzeni initiative which came up during discussion in the third face-to-face meeting, the teachers suggested that this would be a good platform for them to engage in further professional development. Their request to have the PD content on a website will be actualized through www.jifunzeni.com. Once the content is on this site, the teachers will be free to become members of jiFUNzeni and contribute content as well as access content developed by others through open access arrangements. Availing the PD content designed in this study will actualize the content repository component of the jiFUNzeni learning approach.

The two PDTs were keen on not only sustaining their relationship with the Lumbwa School participants, but also to design more PD programs on their own for other teachers who always call them requesting PD programs. PDTs asserted that their way forward would include their going out to establish other teachers' PD needs through needs assessment; design of instruction for blended learning; and utilization of tablets to implement PD through blended learning. The PDTs retained the technology used in this study including: ten tablets; five solar panels; six batteries; five solar chargers; and one flip camera. Therefore, they have the tools in their hands to implement PD through blended learning approaches. They suggested that they would involve more members of their professional development association in their future initiatives. They will involve those members by first taking them through the process of instructional design they learned through their participation in this study.

Chapter Summary

In this chapter I presented the findings of this study. First, I presented contextual and background information to the study, which included the school context, teachers' and PDTs' profiles. In the second part of the chapter I presented the findings of the study through the themes and codes that emerged from the data. I included examples from the data to illustrate the themes and codes. The teachers and the PDTs both confirmed that they benefited in terms of knowledge and skills through their participation in this study. Both groups of participants were keen to continue engaging with each other on more professional development. In the next chapter, I present the discussion of these findings.

CHAPTER 5: DISCUSSION

> On the other side, it is not desirable that a person should learn how to teach at the expense of, or without adequate knowledge of what to teach.
>
> John Dewey, Lectures in the Philosophy of Education.

Introduction

In this chapter I present a discussion of the findings of this study. In this discussion, I focus on research question one, drawing from the findings presented in Chapter Four and the literature reviewed in Chapter Two. Research question one sought to establish how professional development, offered through a blended learning approach and delivered by appropriate technologies, could inform potential change to teaching practice in rural western Kenyan – which this research describes as a challenging context. I present the discussion of questions two and three in Chapter Six as they deal with issues of implications, sustainability and scalability.

Data from teachers' responses at exit interviews, reflective conversations during face-to-face meetings, and my observations of the teachers' practice in the classrooms suggest changes in teaching approaches could be directly attributed to the professional development in this study, since nothing else changed during the study period for the teachers. While this study cannot claim to have made an impact on student learning, the apparent changes in teaching approaches suggest changes were made in students' learning experiences over the period of this study. In their previous practice, teachers used the lecture as the primary method of teaching, and students were encouraged to remain quiet and merely listen to the lessons. As presented in Chapter Four, after the

professional development provided in this study, I observed teachers engaging students in their learning through activities that used readily found local resources like flowers; bottle tops and calling cards for counting; clay and sticks for constructing building structures; flip charts to model / draw the solar system; and cooperative group work to compose original poems. These observed changes in teaching approaches can be directly related to the teaching strategies advocated in the PD content.

Teachers reflected on the changes they were experiencing during their reflective conversations. For example, Nita asked her colleagues: “May I ask a question according to what we are doing surely. Do you think this cooperative learning will be like a project whereby the impact will be felt in a few years to come?” (Face-to-face meeting, 3). This question provoked more discussion as teachers were beginning to see changes that they thought could impact on the whole school’s teaching and learning processes in future. Josh shared the experiences he had with his students who asked him:

> *Mwalimu* [Kiswahili word for teacher], why can’t you bring our visitor again? They believe that when I went in with Mr. Brown [Mr. Onguko], with some camera, that is what made me do what I was doing [teach the way I did]. So I told them again next week I will come. And I am now on animals [teaching a topic on animals]. I told them now next week, we shall be looking at animal feeds. So go and look for any green plants, we shall name them and [discuss] how they help the animals and I will again bring the visitor (Face-to-face meeting, 3).

The discussion shared by Josh on the request by his students and the question asked by Nita indicated that during the period of this study, both the teachers and their students realized the changed teaching practices. These immediate changes suggest the importance of engaging adult learners in activities that have relevance to their work and can be of

immediate use. These are important tenets of adult learning theory, situated learning and activity theory. The teachers were not only addressing their identified needs, but they also immediately applied what they learned in their work context. Discussion of the subsidiary questions under research question one is presented in the following sections.

Question 1.1: Designing a Course for Blended Learning

In this section, I discuss the instructional design process of the PD content for blended learning in this study. The findings suggest the teachers' practice changed as a result of their participation in this study. However, no claims can be made about the long-term impact of this PD intervention as that is outside the scope of this study. From the findings, it is also evident that the PDTs gained skills and knowledge, arising from their participation in developing instruction and leading face-to-face meetings for teachers in this study.

The teachers' enthusiasm and motivation exhibited while they participated in this study point to the importance of availing local opportunities for teachers' professional development. As argued by Christie et al. (2004), PD remains a relatively ad hoc occurrence in Kenya, owing to erratic and irregular funding among other reasons. These scholars wrote case studies on continuing professional development in Kenya and South Africa and suggested there is never a guarantee for opportunity for professional development through the career life of a Kenyan teacher. Specifically, for teachers in a challenging context, such as the ones in this study, chances for such opportunity are low, if not non-existent.

Therefore, the value of blended learning in the challenging context illustrated in this study was evident through the commitment exhibited by both teachers and PDTs. It suggests strongly that PD can be provided to rural teachers in challenging contexts if the common model for delivery where teachers are removed from the classrooms for extended periods is changed. Teachers' lack of access to professional development denies them an important part of their professional life, and opportunities for alternative approaches such as blended learning offer promise. Larson and Murray (2008) suggest:

> For developing countries, we propose a type of OER initiative that leverages not only technology but also the skills of the in-class teacher, that utilizes not only the Internet but also lower-tech delivery platforms, and that is created not only by developed countries of the West but also by educators in many countries worldwide (p. 85).

Implementation of PD in this study, based on the jiFUNzeni learning approach, emphasized the importance of a needs-based approach to blended learning, delivered through the most appropriate technology options, with content developed by local experts. The inclusion of both locally relevant Africa-based OERs and contextually adaptable global web content contributed to the authenticity of instruction designed for blended learning for the challenging context. Three aspects in designing content for blended learning in this study included: content development by local experts, use of African open educational resources and access to global web content that could be modified. I elaborate on these aspects further in the following subsections.

Content development by local experts

Involvement of local experts in designing blended learning for teachers in a challenging context, as experienced in this study, emphasized sensitivity to the local context in terms

of relevance and degree of academic sophistication. As explained in Chapter Four, the PDTs, while making choices on PD content, ensured it was clear enough for the teachers' understanding and relevant to their daily teaching. Teachers would have faced difficulties if the content had not been personalized to their prior knowledge, situated to their contexts, and relevant to the daily teaching tasks.

Unwin (2005) asserts the importance of local content development is continually stressed in international meetings on ICT for Development (ICT4D). He states

> Scarcely an international ICT gathering takes place without a call for emphasis to be placed on the need not only to produce local content, but also to train people across Africa in appropriate content development. Yet despite this rhetoric, the picture on the ground is very different. There is very little multimedia content being developed by and for African people (p. 120).

The importance of locally developed content in Africa has been emphasized by Chitiyo and Harmon (2009, citing, Zinyeka 2005), who argued that to be able to integrate ICT in Zimbabwean education, relevance of content was a major obstacle. Thus, they noted that the current heavy dependence on external content inevitably leads to problems of suitability and relevance in solving local African problems. While well known, there have been few initiatives that have addressed this issue. Instead, the majority of projects tend to import content from organizations and institutions in developed countries.

My experiences from working with the PDTs as local experts in this study suggest that it is viable to engage local experts to develop contextually relevant content. Indeed we created contextual and authentic work-based activities situated in the workplace practice and aimed at developing the teachers' ability to solve problems in their everyday teaching

roles. The PDTs stated that they had gained in both skills and knowledge in their engagement in content development. The words of PDT2 captured their appreciation and sense of empowerment.

> When we were planning during the instructional design, we went through [a] step-by-step process so that we can do it ourselves. We can plan, upload [multimedia content] to the tablets, delete the information, plan afresh, design a different course and do it all over again. And that is what we plan to do after this [end of PD]. For us it was a learning experience and we have really benefited (Face-to-face meeting, 3).

PDT 1 as well pointed to their gained knowledge and skills in instructional design, which they claimed they would utilize in their future engagements. She asserted that

> When we wrote this design, we were thinking beyond, because we have been working with other teachers. We thought probably when this is through [after this study] we will be able to use the same [knowledge and skills] with other teachers and even write more [design more PD], so that many more teachers will benefit (Face-to-face meeting, 3).

With the views above, I am confident the two PDTs will in future be leaders for subsequent African educators who will contribute PD content for teachers. I look forward to my continued contribution towards this aspiration once I return to my own university and embed this approach within our masters programs.

With expanding availability of new and emerging technologies such as smart phones and tablets, I am optimistic that there will be a steady increase of local content developed in Africa on the World Wide Web. For example, an initiative such as Nairobi's Innovation Hub for the technology community is an open space for technologists, investors, technology companies and hackers to create content covering a wide range of varying

interests of consumers (iHub, 2012). While still in the early stages, the iHub is a positive step toward content independence for African educators and their students.

Over the past few years, there have emerged new approaches such as the open educational resources (OER) movement that are making it possible for African experts to develop content and avail it for other users within Africa. Recent trends show that both OER Africa and TESSA – the two most prominent OER organizations in Africa - are enabling increasing availability of content developed by African experts. The use of OERs as sources of relevant content for African contexts is discussed in the following subsection.

Use of African open educational resources (OERs)

Open educational resources are emerging as a major educational initiative with the potential to reduce costs in production of educational materials (Daniel, 2010). Sir John Daniel, former President and Chief Executive Officer of the Commonwealth of Learning, asserted that finding suitable OERs and adapting them to the particular approach to a topic that an institution wants to take, presents the possibility of major cost savings. Cost saving may include both (1) the monetary costs for purchase of learning resources and (2) the time required for skilled labor to develop, modify and / or design learning objects. For example, by utilizing the OERs from TESSA, we took less time on writing content for the fourth unit on use of local community and environment as a resource in learning. Likewise, if we had gotten contextually relevant audio and video clips, we would have saved on time and money taken on recording, editing and production of audio and video

content. Since we posted our audio clips on TESSA share site, it is now possible for other users to realize savings, if they find our two audio clips relevant.

Open educational resources present PD providers with content that is shared freely for others to adapt and use by either translating it to their language of choice, or modifying to fit their contexts and objectives; with options for sharing back so that others can also benefit from the improvements made to the material. OERs offer opportunity for educational practitioners in challenging contexts access to quality content that would not have been possible a few years back. Continued access to OERs will alleviate the limitations of access to educational resources in such contexts. OERs are mainly found in online repositories, and therefore the PD providers require access to facilities for downloading the material before using them as offline resources. The increasing availability of converging media devices, including smart phones and tablets, coupled with expanding internet access through mobile phone service providers, will hopefully make it easier for PD providers to access OERs.

Access to relevant OERs will increase if local higher education institutions develop repositories. Following her research at Moi University in Kenya, Gakindi (2010) recommended the university should initiate an OER project. Her research findings revealed that both faculty and students welcomed the idea of OERs, and there were experts willing to provide support to the institution in setting up OERs. Further, the Kenya Methodist University has initiated discussions on the viability of OERs at their institution (OER Africa, 2011). Initiatives such as the ones mentioned here will hopefully

expand access to quality educational content for Kenyan teachers, including the ones who participated in this study.

The jiFUNzeni[11] repository is under development, and it has the potential to contribute towards availability of contextually relevant OERs for challenging contexts such as the one in this study. The jiFUNzeni repository is discussed further in Chapter Six.

Drawing from global web content

I have already made a distinction in Chapter Four of this dissertation between regional OERs and global web content. While OERs are typically resources found in designated OER repositories, there are other sources of content that are not necessarily from OER repositories. Two of such examples used in this study were the open access video sharing site YouTube and the Latika Roy Foundation. The two sources illustrate global web content that could be used in providing PD content for challenging contexts.

There are millions of YouTube videos available on the World Wide Web. Although YouTube was created in 2005 as a video sharing service for the everyday user, its potential for use in education has been growing with colleges and universities creating their video sharing webpages called YouTube channels (Snelson, 2011). Apart from YouTube, there is another related site, with more relevant videos for educational purposes, called TeacherTube. This is a site like YouTube for video sharing generally, for

[11] See jiFUNzeni site for more details at www.jifunzeni.com.

educational purposes, and particularly content for instructional purposes. According to Rios

> The goal behind TeacherTube was to provide an online community for sharing instructional videos. The concept is essentially the same as YouTube, except that the videos are required to be instructional. TeacherTube is free to join and there is no cost to upload videos created (2008, p. 462).

Both YouTube and TeacherTube are designed in a way that anyone with Internet can access and utilize the videos. Anyone can, as well, create their own video sharing channel by subscribing with their user name and password. This gives PD providers and teachers an opportunity to create and share content as long as they have access to the Internet. In addition, for a challenging context, with simple Internet enabled cellphones with inbuilt cameras, educators can create educational videos and share with others around the globe, through YouTube and TeacherTube. These videos can be particularly valuable if they are situated within instruction and linked to instructional strategies and curricular topics.

There are numerous organizations with rich educational content on the World Wide Web. The Latika Roy Foundation is one example of such organizations. By searching at various sites, educators and PD providers are able to determine the most relevant content for their context or their needs, and use the available and acceptable channels to access such content. For us to utilize Latika Roy Foundation's content on activity based learning involved emailing the foundation requesting permission to use their content. With current global connectivity a phone call or an email message are easily available communication channels to use in requesting permission from an organization anywhere in the World for

global content which can be used in a variety of local contexts. Many organizations have space dedicated for communication with people who may need more information on content on such sites. The most common approach is for a user to type, in the space provided, a message or request with the relevant identification details.

As educators and providers of PD in Africa draw from available global web content, they will have to be aware of the advice provided by Ivala (2011). Citing Williams (2000), Ivala warned

> Additionally, for African and other developing countries to share and collaborate in 'internationalization' forms of education, they need to develop expertise so that they do not only become consumers of another country's products, however irrelevant they may be, but can act as partners in an enterprise (by being active producers of content/knowledge), as well as gaining access to new resources (2011, p. 84).

Content development approaches like the ones we used in this study will guard against Ivala's fears of Africa remaining a consumer of content developed elsewhere. As demonstrated in this study, African professional development providers, such as the PDTs, can create their own original learning objects as well as draw on Africa-based open educational resources and global web resources that are relevant to the needs they seek to address. Indeed Ivala's (2011) suggestion that information technology has made the education processes and products more open, enabling others to use and build on the existing knowledge and practices, was demonstrated in this study. By utilizing global web content we enabled the teachers in this study to learn from experiences and practices from other contexts.

As Ivala (2011) states, global content has to go through a value addition process, which is essentially adaptation of the material to local contexts. According to Ivala, "this value addition should take care of localisation of materials and services, adaptation of materials, sensitisation of the processes to the local cultures" (2011, p. 93). To succeed in value addition and localisation of content, there has to be access to relevant resources such as stable Internet and electricity. Availability of these resources will enable ease of access to global web content and open educational resources. As was the experience in this study, we developed content in Nairobi, the Kenyan capital where there was stable Internet access and electricity. As content alone does not ensure learning, other supportive resources are equally critical such as a good and sound pedagogical process. This is a central component to the jiFUNzeni approach which was tested in this study.

Question 1.2: Appropriate Technologies for Blended Learning in a Challenging Context

For a challenging context that does not have the basic infrastructure such as electricity, and Internet connectivity, coupled with teachers' lack of access to professional development and learning resources, this study illustrates that it is possible to develop an approach that uses alternative ways of providing access to offline multimedia content for teachers' PD. The alternative ways used in this study included use of inexpensive tablets - the Smart Q – to provide access to multimedia content to enable self-directed study while utilizing the abundant and reliable solar energy.

The findings in this study support the use of appropriate technologies to provide PD through blended learning in a challenging context. These technologies neither require high levels of technical expertise nor large spaces such as laboratories for their installation. Conventional approaches for PD have deployed more expensive hardware such as computer labs and more complex software that also require a heavy investment in expensive network servers, air conditioning and secure rooms to prevent dust and burglary, and significant training and support, among other requirements. In the following subsection, the focus is on use of tablets as appropriate technology in this study.

Appropriate technology I: Tablets

Tablets are fast becoming the devices of choice for performing a variety of functions on different digital platforms. However, in 2008 when I first became involved in the initial plans of the jiFUNzeni learning process, there were very few options for tablets available. Over a period of four years, the tablet landscape has changed a great deal. Currently there are multiple brands of tablets in the market at varied prices. Examples include Apple's iPad, Smart Q from Smart Devices Company, Samsung's Galaxy Tab, HP's Slate 500, and many others. Currently, the tablet segment is one of the fastest growing of the technology devices, with new models coming up frequently. Tablets have a range of variations including computing capability, ways of manipulation, operating systems and costs.

This study suggests that tablets are an appropriate technology for the delivery of PD through a blended learning mode in challenging contexts. Tablets have low power

requirements as compared to desktop computers or laptops. Tablets have capability for playing multimedia content and are typically used as output devices to access existing content rather than as input devices to develop content. Thus tablets are not, for example, used for doing the heavy tasks such as typing long documents, printing or processing videos which are tasks more easily completed on desktop and laptop computers. Therefore, the content development in this study was done in Nairobi, a location with a more stable power supply, Internet access and laptop computers because content development is a more complex process.

Once content has been developed on input devices like laptops, it may be uploaded on a memory card or storage device to be accessed on tablets. Tablets operate on easy to use apps unlike computers that run more complex software packages, which take a long time to learn how to use. For this study, inexpensive yet robust tablets such as the Smart Q showed good potential to support PD through blended learning. The Smart Q, which was used by the teachers for self-directed study of the PD content, had pre-loaded Ubuntu open source applications from Linux Foundation, which supported a number of digital media formats including photographs, HTML files, e-book reader, PDF content, dictionaries, video and audio files (jiFUNzeni, 2010).

As the teachers mentioned in their exit interviews, the tablets enabled them to personalize their learning by accessing content wherever they went including at home, in school, and some even indicated that they used to carry the tablets with them to church. As recorded in Chapter Four, one teacher asserted that due to the convenience and portability of the

content on the tablet, coupled with his busy schedule as the deputy head teacher, he carried the tablet around with him and studied whenever he got some free time (Churchill, exit interview, 1).

Teachers, therefore, had access to the content consistently throughout the period of study and could refer to any section of the content whenever they needed. The blended learning PD in this study was a marked difference from the traditional face-to-face PD seminar, whereby once teachers leave the training venue, they do not have access to multimedia content. During a traditional face-to-face PD seminar, typically the take-home content is a teacher's personal notes or a training manual. In this study, PD time was extended through multimedia PD content available to teachers on the tablets for self-directed study anytime anywhere.

Based on findings in this study, I anticipate there will be more opportunities in future for blended learning in similar challenging contexts as more robust tablets become available at reduced prices due to competition in the market. There will be opportunities to work with any of the numerous models of tablets, depending on compatibility with content formats, affordability of tablets and relevant infrastructure such as electricity or alternative power options including solar energy. There is a potential to leapfrog to the use of tablets for teachers' professional development while bypassing desktop and laptop computers in challenging contexts. This would be similar to recent examples such as the leapfrog cell phones for those without existing landlines telephony. However, without a reliable source of power to charge the tablets, users in challenging contexts would still be

unable to access PD on any device. Thus solar energy was a reliable source of energy for charging the tablets used in PD and is the focus of the following subsection.

Appropriate technology II: Solar energy

In this study, solar energy was the only alternative power option explored. Careful steps were taken to enable the appropriate use of solar energy, and these steps were critical for the success of PD. These steps included both the assembly of the solar chargers and the process of charging the batteries and tablets. As explained in Chapter Four, assembling the solar chargers was an effort that involved working with experts who included a professor and his doctoral student at the University of Calgary's Engineering Faculty and a technician in Kenya.

Involving expertise from both the developed world (Canada) and the developing context (Kenya) was important in terms of transfer of knowledge and skills, as well as in expanding the profile for the Kenyan technician and the business. Three principles suggested by Pilloton (2009), which designers should study and adapt in the appropriate technology discipline, were applicable in assembling the solar chargers. These principles include: "Building as a generative process, the optimization of local resources, and using craft production as economic empowerment" (Pilloton, 2009, p. 6). In other words the principles suggested by Pilloton emphasize use of locally sourced materials and engaging technicians available in the local community in assembling appropriate technologies such as solar chargers, as happened in this study.

Assembling the solar chargers in Kenya also provided a more affordable and scalable, sustainable solution than if assembly had been done in Canada and the completed units shipped to Kenya. The cost for a complete solar charging system including, a solar panel, battery, and charger, was US$ 70. This cost was relatively inexpensive, compared to what the cost would have been, if I had purchased the parts and assembled the chargers in Calgary. Estimates from the Faculty of Engineering indicated that it could cost about US $ 200 to buy parts for one solar charger in Calgary, and up to about US $ 500 to acquire one complete solar charging system; including a solar panel and battery.

Getting the charging process right was yet another important aspect which contributed to the success of the PD intervention. The teachers who participated in this study had not previously dealt with solar energy. My reflections after going through the research process suggest that generally we take for granted some of the resources within our reach without taking advantage of or noticing the importance of resources such as solar energy. Kenya is blessed with adequate sunshine yet people there have not generally utilized it as an alternative source of power. Indeed while teachers initially had challenges with the number of hours required to collect enough solar energy in the storage batteries, they finally understood that they needed a long period of at least 7 to 8 hours. At the end of the study, the teachers appreciated the use of solar energy to power the tablets. Appreciation of their use of solar energy is evidenced in the following statement.

> It [use of solar energy] was a convenient way of getting the energy because it was readily available, so long as there was the sun; it was portable and easy to manage. We didn't need a lot of training for us to use it – just needed to know that the red terminal fits with red and black with black (Josh, exit interview, 4).

The words used by Josh echo the key tenets of appropriate technologies. To be appropriate, technologies should cause least disruption to the societies in which they are used, and users should have the ability to manage the technology on their own (Schumacher, 1973). Conteh (2003) suggested that appropriate technology should utilize locally available material and energy resources, with tools and processes maintained and operationally controlled by the local population. The teachers in this study demonstrated these tenets of appropriate technology by easily managing and using the solar charging system.

Appropriate technology III: Mobile phones for communication

Mobile phones were utilized minimally in this study for communication between participants. There was no in-built design requirement in the PD for use of phones, although they naturally became a convenient means of communication between pairs, peers, PDTs and me. Use of mobile phones was explained by PDT1 as: “support for teachers was just a phone call away” (exit interview).

There were three instances when the mobile phones came in so handy. As indicated in the findings, when Emily’s tablet failed to work, she used her mobile phone to alert me of the problems she was encountering. If one or both of us had not had access to mobile phones, technology support to her would definitely have been delayed until I appeared in school. I initially attempted to guide her, through phone conversation, by attempting to troubleshoot the calibration process of the Smart Q, but the phone support did not work well because we had not thought through or prepared for such an approach. I, therefore,

immediately went to school and provided the necessary technology stewardship. However, several times mobile phones were used by the participants to address schedules of specific components of this study or inviting me to observe lessons. If I was to do this research again, or when I implement a related research project in another site, I would include mobile phone support for troubleshooting purposes. I would include a brief face-to-face session for operationalization of the mobile phone support process.

Mobile phone communication was also used for other PD related support aspects with Mika, who had some unique circumstances, including faith-related commitments. After I observed Mika's lesson, he started to ask some questions concerning specific aspects of the PD content. Realizing that Mika had already missed two face-to-face meetings, I made a phone call to PDT1, who guided Mika by responding to the content-related questions, which I was not able to respond to effectively. Mika and PDT1 had a discussion that took about 25 minutes and both of them were satisfied with the telephone support approach used.

Another instance where we used mobile phone communication was during the exit interview with Mika. Mika had gone off to Nairobi, the Kenyan capital, to attend to personal issues, so he was not available at the scheduled time. I later called Mika on phone and conducted the exit interview with him. These instances when we used mobile phone communication suggest the options available in challenging contexts for supporting teachers in blended learning. When circumstances cannot allow for meeting

face-to-face, mobile phone communication is a viable option for conversation in real time.

Mobile phones are increasingly gaining prominence as important educational tools in developing countries, in which challenging contexts like the location for this study are common. Some institutions in developing contexts in Africa have previously used mobile phones to enable access to educational programs. They include the University of Pretoria's implementation of mobile learning (m-Learning) at the Faculty of Education (Brown 2003); the Makerere University's use of SMS in research supervision in Uganda (Muyinda, Lynch & Lubega, 2008); and the Aga Khan University's use of SMS in educational leadership programs in Kenya and Tanzania (Onguko, et al. 2011). These three institutions' use of mobile phones in educational programs, points to the importance of the mobile phone as an appropriate technology for challenging contexts.

Mobile phones are the second most accessible form of information communication technologies in Kenya, after radio. While radio had 85% penetration in the population, mobile phone penetration was at 64% or 25 million people of the total population of Kenya by end of 2011 (Communications Commission of Kenya, 2011). On the other hand, the commission reported that fixed line telephone had declined to 374,942. Mobile phone service charges in Kenya had dropped to as low as the equivalent of US $ 0.04 per minute for calling both local and international numbers, while text message charges were as low as US $ 0.013 per message (Nation Reporter, 2010). Mobile phone subscribers in

Kenya paid for only the calls or texts made rather than having subscriber plans, such as in Canada, where whether you use the service or not, you had to pay the bills for the plan.

Question 1.3: Supporting Teachers in Blended Learning

In proposing to implement blended learning in this study, I was aware that this was going to be a new experience for teachers because they had not previously participated in blended learning or worked with tablet devices. The teachers therefore required support. Among the support mechanisms discussed in this section are: occasional face-to-face meetings; sensitivity to language and local culture; self-directed study and peer collaboration; and technical ICT support referred to as technology stewarding (Wenger, et al. 2009).

Occasional face-to-face meetings

Occasional face-to-face meetings were held fortnightly. In total, three face-to-face meetings were held on Saturdays to avoid interference with the school programs during weekdays. The purposes of the face-to-face meetings were to familiarize teachers to the PD program including the use of appropriate technologies and the self-directed study process and to allow the teachers share their experiences in PD through reflective conversations on successes and challenges. These face-to-face meetings gave teachers and PDTs an opportunity for feedback on progress.

The formal familiarization session to both the appropriate technologies and self-directed study process was held in the first face-to-face meeting. In the second and third face-to-face meetings the teachers engaged in reflective conversations which were moderated by the PDTs. Teachers' attendance during all three meetings was high, with nine of ten

teachers attending face-to-face meeting one; eight teachers attending face-to-face meeting two; and nine teachers attending face-to-face meeting three. The high attendance rate was indicative of the teachers' commitment to their participation in PD, especially considering that the meetings were held on Saturdays when they might have been at home with their families or attending to other commitments.

While developing the PD structure in this study, I was cognizant of MacKeracher's (2004) advice that educators should be aware that considering adult learners to be either independent or self-directed does not mean they do not need instruction. Thus, it was important to consider the amount of time teachers would devote on each of the approaches being blended – from face-to-face instruction to self-directed study on tablets. In this study, offline self-directed study was the predominant learning approach supported by fortnightly face-to-face instruction as portrayed in the notion of a continuum of practice approach (Crichton & Childs, 2008). The continuum of practice presents a selection of different instructional approaches ranging from complete face-to-face instruction to complete technology mediation.

Being aware that the teachers had full teaching loads with most of them teaching during all the available 35 or 40 lessons during the week, we designed PD such that the teachers would draw from their study of the content as they planned their lessons. This approach of embedding the PD activities within teachers' day-to-day tasks was consistent with adult learning and situated learning theories and enabled us to create content that was of immediate relevance to the teachers' daily work. On the other hand, face-to-face

meetings were limited. Initially planned for five meetings, we reduced them to three and held them on Saturdays. The blend amounted to 10% of PD time as whole group face-to-face interaction, while 90% was committed to self-directed study and peer collaboration.

During the familiarization session to appropriate technology, despite the teachers not having used tablets before, it was heartening to notice that they did not need weeks of instruction to become comfortable users of tablets. The familiarization to use of tablets focused on the key apps that teachers would need to use in their study of PD content. Unlike computers that require extended periods of introduction to use of the programs, introduction to use of tablet apps takes a short time. Familiarization to tablet use took the participants less than four hours. They worked through the key apps and content formats including HTML web content on Midori Browser, listening to audio clips and viewing videos on SMPlayer, and reading PDF content on Evince Document Reader. This speaks to the appropriateness of tablet technology in terms of ease of use.

Teachers in this study reported they were satisfied with the process of familiarization through which they were introduced to use of the tablet devices. They all appreciated the blended learning approach used in this study apart from Timo, who was of the view that they should have had a one week face-to-face course instead. During exit interviews he stated: “How I wish for this course, that we just took days with the teachers going through face-to-face training for about a week. But you can see also time was a problem, maybe in the holidays it would work” (Timo, exit interview, 9).

I really appreciated Timo's views, as he was articulating concerns about his most comfortable approach to learning. Timo articulated his preference for a week of face-to-face instruction rather than the four-week blended learning approach. He, however, also appreciated that there was no time available to him and his colleagues, to withdraw from their work place to participate in a whole week of face-to-face instruction.

Implementing PD in a blended learning mode enabled teachers to immediately apply the strategies they learned in their classrooms. If the PD was implemented in a face-to-face mode only during the school holidays, it would have been almost impossible to follow up the use of the teaching strategies in the classrooms. In addition, if PD had been held in the school holidays, it would have been difficult to rely on teachers' memory to implement in class the teaching strategies they would have learned a month earlier. Likewise, it would be a challenge to stretch teachers' involvement in PD too long, considering their time constrains.

Timo, as the head of examinations in Lumbwa School, was keen on maximum use of school time for preparation of students for examinations. He suggested that teachers were required to cover the prescribed syllabus for the year in preparation for examinations. As the examinations officer in the school, he was required to frequently report to the District Education Office to attend to examinations-related issues. Because of these engagements, he said: "So, there was a lot [many tasks to attend to] and I would say I did not exploit those units very well [did not have enough time to study PD content]" (Timo, exit interview, 9).

As explained in the findings, reflective conversations during face-to-face meetings two and three gave teachers an opportunity to share their experiences in terms of successes and challenges as they implemented the teaching strategies advocated for in PD, in their classrooms. The PDTs facilitated and contributed to the conversations, and the teachers rightfully dominated the talk as they shared their successes and challenges. The reflective conversations were an opportunity for teachers to talk about what happened in the classrooms in ways that they had not done before. This is a significant change from the approach done in the scant PD opportunities available for Kenyan teachers.

Teachers generally operate in isolation in their classrooms (Schlichte, Yssel & Merbler, 2005; Burbank & Kauchak, 2003; Hill, 1999). Providing opportunities through PD for teachers to collaborate with colleagues and share what went on in their classrooms was one way of reducing the isolationist tendencies (Burbank & Kauchak, 2003).

The reflective conversations enabled the teachers to talk and share their experiences in their teaching in ways that would not have happened if they engaged in reflective journaling. As pointed out in literature (for example, Otienoh, 2011; Maathai, 2009), teachers in Kenya generally prefer speaking to each other rather than documenting their reflections in journals in view of the African oral tradition. The likely scenario if we had required teachers to do reflective journaling would have been for teachers to record their reflections, which the PDTs would read, and provide written feedback to individual teachers, after which the journals would be kept away. However, in engaging in reflective

conversations, teachers got opportunity to provide feedback to one another, and also to share their personal views on how they handled situations in their classrooms.

Reflective conversation, according to Ashraf and Rarieya (2008), is a discursive process by which teachers come to understand their practice better. Reflective conversation involves teachers or educators undertaking an inquiry into their practice through verbally sharing, discussing, questioning and reasoning about their teaching experiences, either with their peers and/or a reflective coach. Ashraf and Rarieya did their study in Karachi, Pakistan, another challenging context, where they suggested that emphasis on reflective practice has not been widespread and many educators are largely unaware of its perceived potential as a teacher development strategy. Their study used an action research methodology in which Ashraf engaged two teachers in reflective conversations. Ashraf was the reflective coach and the two teachers taught English language.

Similar to Ashraf and Rarieya's study, reflective conversations in this study contributed to changing teachers' professional development, because the conversations were directly linked to incidences in their teaching practices. In reflective conversations, multiple perspectives on issues in teaching were shared and this was helpful in developing a trusting professional relationship and commitment to teaching by the teachers (Ashraf & Rarieya, 2008). Trusting professional relationship and commitment were, for example, evident through willingness by the teachers to allow their peers to view them on video as they taught, in the lessons that I observed and recorded.

The professional dialogues that became an important part of the face-to-face meetings contributed towards teachers' articulation of their professional concerns and views. While the professional dialogues were not planned for initially, they emerged in the process of PD as important avenues for teachers to share ideas. The professional dialogues that emerged in this study form a basis for an argument on the need to avail school-based opportunities, either formally through regular seminars or informally through short open discussion sessions, for teachers to discuss with their peers in a school setting. Professional dialogues for example, may enable teachers to share ideas on how to change their teaching practice while also allowing them an opportunity to open up to colleagues on any professional frustrations. In this study for example, through professional dialogues teachers shared their frustrations on the way inspection services are structured by focusing on checking dates in students' notebooks to confirm whether teachers taught through the period under inspection.

Another way teachers were supported in this study was by familiarity and awareness of languages spoken locally and some local cultural practices such as the conceptualization of time. These support processes are discussed in the following subsection.

Language and local culture

Supporting the teachers in blended learning and working with the PDTs to develop local content were important in this study, as was an awareness of the importance of language and cultural concerns. Cultural sensitivity and concerns about language are not unique to this study. Larson and Murray (2008) in their collaborative network of BLOSSOMS (Blended Learning Open Source Science or Math Studies) understood that they needed to

provide a pool of translators versed in local culture and pedagogy. Such local experts would, over time, alert Western module producers of the BLOSSOMS study content to potential pedagogical or cultural differences for users in developing countries. BLOSSOMS was an initiative of the Learning International Networks Consortium (LINC) at the Massachusetts Institute of Technology (MIT) and implemented in developing countries including: Jordan, Syria, Lebanon, United Arab Emirates, Israel, Pakistan, Egypt, Turkey, Iraq, China, Nigeria, Tanzania, Kenya, Rwanda and Botswana (Larson & Murray, 2008).

While the official language of instruction is English in Kenyan schools, the lower primary, comprising of grades one to three, and nursery schools use the local language of the catchment area. If there is a mixture of communities in a catchment area that speak different local languages, then the language of instruction at the lower grades is Kiswahili – the most widely spoken language in East Africa. Because the school in this study was located in an area of immigrant communities from different language groups, the language of instruction in lower grades was Kiswahili. Further, as English was not the native language of the teachers in this study, they inevitably were not very fluent speakers. The quality of English spoken by some teachers therefore was limited. This coupled with their frequent use of Kiswahili in teaching the lower primary grades, caused them to frequently code switch between the two languages – Kiswahili and English. Both the PDTs and I being Kenyan, we were well versed in both English and Kiswahili and communication was not a problem.

However, we decided to write the PD content in English because it is the main language of instruction in the Kenyan Education system. The PDTs understood there might be challenges with this and supported the participants in both languages. Code switching between Kiswahili and English also happened during my interviews with Rita, when responding to the interview questions. Since I speak Kiswahili, I did not need an interpreter to help me make sense of what she meant when she spoke in Kiswahili. Rita taught the nursery school section where Kiswahili was the main language of instruction which may explain her comfort in using both languages interchangeably.

Consideration of regional African accents was critical when determining the use of OERs as explained in Chapter Four. Because the audio clips available on the TESSA site were mainly recorded by West Africans, the phonological features are significantly different from those of East Africans (Bobda, 2001). Bobda presented a pronunciation atlas for parts of East and Southern Africa by grouping Kenyans, Ugandans and Tanzanians under one pronunciation group, and the Southern Africans in Botswana, Malawi, Namibia, Zambia, Zimbabwe, and black South Africans under another pronunciation group. Likewise the countries of West Africa such as Cameroon, Ghana, Nigeria and Sierra Leone fall in their own pronunciation group. When people from the different pronunciation groups speak, members of another pronunciation group might not understand all the words spoken at once. This was a potential concern in this study. Instead of complicating the teachers' study by presenting them with audio clips from the West African pronunciation group, it was more ideal to record audio clips with an East African accent, and customize the content to reflect the regional context.

On local cultural practices, the PDTs being Kenyans, understood the 'It is never late in Africa' adage where people commonly show up for meetings two hours after the scheduled time. This practice occurred during the face-to-face meetings where some teachers arrived at 11:30 instead of scheduled time of 10:00 o'clock in the morning. Being familiar with local culture, both the PDTs and I understood and indeed expected this to happen; hence adjustments were made to accommodate those who came late thereby acknowledging cultural practices. Without this understanding, it would have been difficult to realize positive results in this study, and ensure the teachers' participation in the study.

Interestingly, some teachers suggested that I was no longer acting like an African because of my tendency to arrive at school at the exact scheduled time and keep to the agreed time for meetings or class observations. My position, however, was that I was not going to interfere with the school schedule and always availed myself at the time agreed upon with the participants.

The traditional African concept of time was explained by the Kenyan philosopher Mbiti (1969). He wrote that time in Africa is conceptualized as present (*sasa*) and past (*zamani*). *Sasa* and *zamani* are Kiswahili words for present and past respectively. That there is no concept of time in future terms in African traditional thought could explain why many people fail to keep to a scheduled meeting time.

For the teachers in this study, while we scheduled face-to-face meetings at specific times, some of them appeared much later after the scheduled time. On arrival they had good reasons to explain their late arrival. They suggested that other activities requiring their attention had come up after previous scheduling and yet it was difficult to predict what the future would be like. In other words, they did not anticipate or know that other matters would come up that would require their attention.

The other support for teachers in this study was self-directed study and peer collaboration. This support mechanism is discussed in the following section.

Self-directed study and peer collaboration

As already clarified in Chapters Two and Four, self-directed study in this dissertation refers to the freedom to choose when and where to study and the pace of study, thus enabling adults to assume personal responsibility and control of their learning (Garrison, 1997). Self-directed study is the notion that adult learners have the capability to determine their study processes as elaborated in the self-directed learning theory of adult learning (Merriam, 2001). Further, teachers' involvement in this study and implementation of the teaching strategies advocated in the PD content reflect the self-directed learning theory of adult learning, which is pegged on the understanding that adults have personal motivation, and capacity for self-monitoring and self-regulation (Robertson & Merriam, 2005; Garrison, 1997). As explained in literature review, in self-directed learning theory adults are deemed to be independent, internally-motivated, problem-centered and interested in immediate application of knowledge (Merriam, 2001; MacKeracher, 2004). Merriam (2001) asserted that since adults manage many other

complex aspects of their lives, they are capable of directing or at least assisting in planning their own learning.

In this study teachers exhibited the qualities of adult learners identified by Merriam (2001), MacKeracher (2004) and Robertson and Merriam (2005). Teachers engaged in studying the content at their own chosen time, self-regulated their study process and engaged colleagues in discussion of content. For example, peer collaboration was evident in Josh's approach in discussing with three of his colleagues the teaching strategies in PD content as he wrote notes which he referred to as he planned for his lessons.

The teachers were internally-motivated as they were neither coerced to participate in this study nor promised any external reward. Perhaps since the PD content related to their daily teaching experiences in the classrooms, the teachers deemed the activities relevant, as they were situated within their work context and were valuable because of the immediate application in their classrooms. Perita articulated this point in her contribution during reflective conversations.

> The methods that I read on the tablet are helping the students quite a lot. The lesson I was observed teaching was quite wonderful. I grouped students, carried out cooperative learning and the participation was very wonderful. I discovered that they [students] really enjoyed that lesson more than the way it has been when I normally go there [than in previous lessons]. Most of the time I go there [to class] it is as if I am lecturing, but that time, using the methods on the tablet, the children became very active and they contributed quite a lot more than they normally do other times, when I use other methods – the crude methods. *Laughter*… So I discovered surely these children are being denied a number of things because of the methods we use (Perita, face-to-face meeting, 3).

Perita's observation echoes the other teachers' views on the occurrences in their classrooms. On one hand, teachers tended to pass harsh judgements on their previous teaching practices as can be discerned from Perita's use of the words: "the crude methods" followed by laughter from the other teachers. On the other hand, their critical views on their teaching practices could be an important factor in determining their future teaching practices. For example, Perita recognized through her participation in the PD that Lumbwa students had been "denied a number of things" by the teaching approaches teachers in this study previously used.

Peer collaboration was another support component for teachers in blended learning because it helped in reducing teacher isolation as mentioned in the previous subsection. Teachers were able to share aspects of their teaching experiences with colleagues either through one-on-one discussions or in small groups. Some teachers, who were not part of this study, became involved in some of the peer collaboration arrangements. Several participating teachers reported that the teachers who were not participants borrowed the tablets and briefly read the PD content. A few instances where teacher participants and non-participants in this study actively collaborated in application of PD content were reported. For example, Nita stated

> It so happened that I worked closely with a teacher who was not a participant in the course, but was a silent participant, in that I felt as I learned, I should also teach her whatever I was doing. Teaching her made me to master a lot [understand content better] and it gave me more confidence, because she was also eager to know what we were doing. So at least up to now we are planning for our lessons together (Exit interview, 6).

Nita's views were indicative of peer collaboration across the teaching staff including those teachers who were not participants in this study. The teachers' beginning to plan for their lessons in partnership was an important step towards breaking the isolation tendencies in their practice. At that stage, it appeared that teachers had started opening up their practice for peer support and eventual learning from one another's' practices. Technology stewarding, which enabled more peer support, is the focus of the following subsection.

Technology stewarding to support teachers

Teachers required just-in-time technical support to successfully engage in blended learning. This type of support can also be referred to as technology stewardship (Wenger, et al. 2009). As explained in Chapter Four, initially I was the technology steward. Gradually, some teachers acquired basic troubleshooting skills and started supporting each other. Teachers appreciated the technical support they received as it enabled them to continue their participation in PD. Without technical support, there was a risk of massive drop out arising from the teachers' frustration by the technologies. The teachers' acquisition of basic troubleshooting skills suggest they had become comfortable enough with the ability to drive their own use of the tablets, which allowed them to gradually become technology stewards for their colleagues (Wenger, et al. 2009).

A study done in the United Kingdom by Williams, Coles, Wilson, Richardson and Tuson (2000), found that teachers normally turn to technicians and librarians for technical support. Their research emphasized that lack of technical support for teachers is problematic. They recommended that mechanisms had to be put in place for teachers'

adequate access to technical support for ICT. In addition, they argued that teachers did not have to feel that they had become technical experts themselves. The views by these scholars emphasize the need for a specific cadre to provide technical support so that teachers focus on their pedagogical roles without having to feel that they are technical experts.

Other scholars such as Lai and Pratt (2004) have also emphasized the importance of technical support for teachers as they work with ICT. Bryderup and Kowalski (2002) interviewed teachers in Denmark and found both the teachers and principal of Anholt School were unanimous about their frustration because the municipality provided the school with insufficient operational ICT infrastructure and technical support.

The teachers in this study became very apprehensive when the technologies, including the solar charging system and tablets, failed to work. Signs of frustration would show when they spoke about the problems arising from the solar charging process which were contributed to, by weather conditions, especially the rain season, and the teachers' failure to charge the batteries for the required duration. Thus, they required basic technical support, such as reminders to charge batteries for a longer period of seven to eight hours. This required harvesting the solar energy for at least two days continuously to make up for the shortened intense sunshine period when it rained.

During the exit interviews, some of the teachers' frustrations arising from technology concerns were articulated as recorded below:

> On solar charging, for us [with colleague Rita] we had shortcomings. I don't know whether the charging system had a problem or what the problem was. On the first day, I went with the tablet at home and charged it for two days. Although it [storage battery] did not charge the tablet, so I brought to teacher Rita. Rita tried to use it [battery to charge tablet] and failed, then she borrowed Timo`s battery. I think it is Timo`s battery that worked well with our tablet. (Emah, exit interview, 7).

Challenges like those mentioned by Emah could have been a recipe for frustration, and I recognized the teachers required timely technical support to deal with problems as they arose. As teachers gradually started being technology stewards for one another, this was an indicator that they were learning much more than their PD content. Eventually, when teachers encountered problems with the tablets and the solar charging process, they did not always have to call on me to provide technical support. In the findings, Dennis stated he got support from his friends such as Josh in troubleshooting problems. The practice where teachers supported each other in technical troubleshooting speaks to the qualities inherent in the definition of appropriate technologies. As reviewed in Chapter Two, Batteau (2010) reminded us that appropriate technologies are devices and implements with which users can establish up-close and familiar relationships and easily master their use and management.

The teachers' experiences in this study are supported by Williams, et al. (2000) who suggest teachers need technology stewardship when working with new technologies. However, experiences in this study also suggested that with the simplicity associated with appropriate technologies such as the solar charging system and the Smart Q tablet, teachers are able to quickly acquire basic troubleshooting skills and support each other

when technical support is not closely available. In week three and four of the PD, there were no calls requiring me to provide technical support, and I was pleased to learn the teachers were solving problems on their own. I had assumed that the use of appropriate technologies had stabilized and the teachers no longer required my technical support, yet the reality was that they had already established 'up-close and familiar relationships' with the technologies. The teachers had become technology stewards as suggested by Wenger, et al. (2009). "Technology stewardship is something anyone can do. It does not require absolute expertise with technology, but enough to play the role" (p. 25).

Question 1.4: Appropriateness of Blended Learning in a Challenging Context

The findings of this study support the view that blended learning is appropriate for teachers in a challenging context. Teachers in this study had neither participated in blended learning nor had they ever worked with tablets, yet they were able to engage in this study and effect changes to their teaching practice in a short period of four weeks. During that period, they grasped the technological skills needed to study the content provided on the tablets. They also acquired pedagogical skills through the teaching strategies suggested in the PD content. These strategies enabled the teachers to begin to become facilitators of learning, rather than the sole providers of knowledge in their classrooms, who relied solely on lecture as their instructional strategy. Teachers' acquisition of these skills through their participation in this study is the focus of the following subsections.

Technological skills

The teachers attested to their acquisition of skills, which they identified as manipulation skills, computing skills, computer literacy, and computation skills. The label of each of

their identified skills appears to be not as important as the underlying message, which is, the teachers were confident that they acquired skills that enabled them to use appropriate technologies to study through a blended learning approach.

Most of the teachers were in the age ranges of 30 to 49 and so were in the category of people who had not grown up with tools such as computers. According to Koh and Lim (2008) those individuals have to make a conscious effort to gain technological skills. For the teachers in Lumbwa, this was their first chance to work with tools such as tablets to access PD content, unlike educators in other places who either have access to PD online or in other modalities such as face-to-face PD opportunities. From the first day of PD, teachers were enthusiastic about their use of appropriate technologies, and this was critical to their success in the acquisition of the technological skills required to study the PD content.

The teachers' capacity to learn and use technological skills within a short time has been confirmed in a study by Leach and Makalima (2006), who implemented the Digital Education Enhancement Project (DEEP). The DEEP project explored the use of ICT in teacher education in Eastern Cape region of South Africa. They observed that the teachers learned to use ICT very quickly, whether they had previous exposure or not, and felt greatly empowered by the new skills. Where support was scarce, the teachers together worked to solve the problems and become technology stewards for each other.

This study recognizes the benefits that come with appropriate technologies deployed for teachers' professional development. Appropriate technologies such as tablets are not only becoming smaller and portable, but they are also becoming easier to operate and more affordable. Due to the ease of use, the tablets used in this study enabled teachers to move quickly and focus on their practice rather than being distracted by the technologies. Apart from acquiring technological skills, teachers also acquired pedagogical skills as explained in the following subsection.

Pedagogical skills – teachers as facilitators

The teachers in this study moved rapidly beyond being fascinated with the technology to being actively engaged in study of PD content and how it might apply in their classroom practice. Right from the first week of PD, the teachers started planning for their lessons as they incorporated activity-based and cooperative learning strategies. They concentrated on reading the PD content on the tablet devices with minimal distraction as there were no other competing functions for the tablets apart from the PD. For example, there was no Internet access in the community, so teachers were not distracted by the urge to browse the World Wide Web. Whenever they worked on the tablets, they always would be accessing the PD content, a situation that must have made them more focused on their study of the content, as there was no other content preloaded on the device.

At the very first time they interacted with the tablets, a few of the teachers' who were familiar with the Internet initially attempted to access the Internet. As for some of the teachers who did not have previous experience with the Internet, they all along assumed they had always been using Internet throughout their study period. For example, one

teacher mentioned at the exit interview that she got an opportunity through this study to use the Internet (Nita, exit Interview 6). These experiences were contrary to those by teachers based in the city of Nairobi who, while participating in the pilot of the usability of the jiFUNzeni approach, likened their experiences in accessing PD content as HTML on Midori browser to the Internet for those without access (Crichton & Onguko, 2010).

In this study, teachers did not have experience of learning online because there was no Internet access near them either in Internet cafes, homes or school. The content for this study was developed using the eXelearning content authoring software (www.exe.org) and viewed on the tablets using an Internet browser (Midori). Basically, this created an "offline" Internet-like experience for the teachers in the challenging context for this study. As Pavlik and McIntosh (2011) note, writing from an American perspective, "we may be thoroughly familiar with and comfortable using the Internet and online media, but there are still many people throughout the world who have limited or no contact with the online world" (pp. 41- 42). This is the reality in many challenging contexts including the one in this study.

It was evidenced by the lessons I observed that the teachers in this study implemented both cooperative learning and activity-based learning strategies in their teaching practice arising from their study of PD content. The lessons which I observed illustrated marked differences in teaching strategies. They reorganized the sitting arrangements, utilized learning materials and used activities in smaller cooperative groups in their teaching. The teachers began to understand their new role as 'facilitators' in learning rather than as

'teachers' in the traditional sense (Larson & Murray, 2008). This means that they were no longer the sole custodians of knowledge, but rather their role was changing to that of guiding students to actively learn from each other as they engaged in learning activities.

The changes in teachers' pedagogical approaches were evident in their contributions during face-to-face meetings, their responses at exit interviews and my observations as they taught in their classrooms. The change in pedagogy during the period of their study was expressed well in the words used by Churchill.

> That the students were able to compose poems shows there is a lot of potential. We are jamming the system with a lot of use of the lecture method. As I left the class, there were four poems on the walls (Face-to-face meeting, 3).

I observed Churchill's lesson and realized that he did not initially believe that he and his students had achieved so much. He commented: "In fact I was surprised that students could compose poems in 40 minutes" (Churchill, face-to-face meeting, 3). The poems were composed during a cooperative learning activity. Working individually, the students were asked to think about and compose one line for a group poem. This activity was followed by students working in pairs to share and compile their two lines of a poem. Finally, two pairs of students got together and merged the two lines contributed by each pair and composed a verse. The students had initially determined what the topic of their poem would be with assistance from their teacher. The poems were an example of a cooperative learning structure called 'Think, pair, share'. The students recited their own composed poems at the end of the lesson.

Chapter Summary

In this chapter I have presented discussion of the findings of this study. In discussing the findings, the focus was on the first research question. The findings support the view that professional development, offered through a blended learning approach and delivered by appropriate technologies, indeed had the potential to change teaching practice during the study. However, it is beyond the scope of this study to know how sustainable or scalable this change in practice might be.

Teachers grasped the key skills in use of appropriate technologies, studied the content, planned their lessons based on the teaching strategies, and delivered the lessons in their classrooms. It was evident from the teachers' lessons I observed, their contributions during face-to-face meetings, and the comments made during the exit interviews that their teaching practice changed during the study through their study of activity-based learning and cooperative learning groups.

In Chapter Six I present the implications of the PD approach implemented in this study, a response to research question two. I also offer thoughts on the sustainability and scalability for PD based on the approaches used in this study which addresses question three. The recommendations for further research and conclusion of this study are also presented in Chapter Six.

CHAPTER 6: IMPLICATIONS, SUSTAINABILITY, RECOMMENDATIONS AND CONCLUSION

> Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.
>
> Margaret Mead, Interculturalstudies.org.

Introduction

In this chapter I present a discussion of the implications of the professional development (PD) offered in this study with reference to the teachers' and PDTs' experiences. In this discussion I focus on research questions two and three, drawing on the findings presented in Chapter Four and the literature reviewed in Chapter Two. Question two sought to understand the implications of the blended learning PD approach used in this study for teachers and PDTs. Question three, on the other hand, sought to establish the potential for sustainability and scalability of the PD approach. Finally, I present recommendations for further research and the conclusions drawn from this study.

Question 2: Implications of Professional Development Approach

Implications for teachers

Based on the findings from this study, blended learning was probably the most viable mode of offering PD to teachers in the challenging context described in this study. Teachers who participated in this study had full teaching loads throughout the week as the majority of them taught between 35 to 40 lessons per week to lower and upper primary sections respectively. The teachers articulated their PD needs, and if it had been offered in any other manner than via a blended learning approach, it would have required them to be away from their classrooms for extended periods. For many reasons as stated

earlier, this would have been impossible, and the potential for such an opportunity might not even be available. Therefore, blended learning provided the only opportunity most of the teachers might get to engage in professional development after many years of service.

It has been acknowledged that it is important to design PD embedded in the work-based activities and implemented in the workplace context, within the structure and stimulation of peer-to-peer learning guided by an expert instructor (Collis, Margaryan & Amory, 2005). Teachers in this study learned through authentic tasks informed by situated learning theory which suggests human learning is best achieved if situated in the contextual social world of daily experience (Lave & Wenger, 1991).

By embedding PD within the teachers' everyday work experiences in schools, this study enabled them to interact with their colleagues and support each other as they implemented the teaching strategies they learned. The teachers further shared their professional experiences through the whole group interactions at fortnightly face-to-face meetings that were led by the PDTs. Thus situating PD in the school context allowed teachers to focus on their practice in their interactions, an opportunity they had not had in their school before.

Moon (2007) and Daniel (2010) advocate for teachers' professional development being done on the job and within the schools and classrooms instead of having teachers withdrawn to external institutions such as teacher training colleges. According to Sir Daniel, teachers' professional development is very important not only for enhancing

student learning but also for motivating teachers, especially those who are newly trained. Both Moon (2007) and Daniel (2010) emphasized the importance of providing professional development for teachers by using alternative and innovative modes of delivery with technology. Among the innovative alternative approaches is blended learning on appropriate technology as was used in this study, while keeping teachers in the work context in their schools and classrooms.

The blended learning approach used in this study suggests that teachers in challenging contexts can change their teaching practices given opportunities for alternative modes of delivery of professional development. This was evident in the changed teaching practices in Lumbwa classrooms over the study period. The teachers were able, within a short period, to embrace the teaching strategies advocated in the PD content thus engaging students as active participants in learning activities, through cooperative groups and using locally available learning materials.

First of all, based on the experiences in this study, it is suggested that teachers are aware of their needs and concerns impacting their teaching, therefore teachers working in even the most challenging contexts such as the ones in this study should be consulted by providers of professional development, in order to situate the needs and concerns in their practice and content. Findings from this study suggest that after gaining an understanding of teachers' needs, the contextual realities including the resource constraints in their teaching and learning environment, it was possible to design relevant PD content to address the needs and situate it within their work place.

Secondly, implementing PD within the work-context in a school has immediate benefit for teachers' professional practice. In this study, teachers experienced immediate changes to their teaching practice by implementing the strategies learned in PD in their teaching. The teachers easily incorporated the cooperative learning and activity-based learning strategies in their teaching. Because the PD content guided them through planning for specific lessons that incorporated the teaching strategies, it was easy to connect PD content to their daily teaching tasks.

Thirdly, the teachers gained from implementation of this study during the school term rather than in the school holidays because they got an opportunity to immediately apply the strategies in their teaching. In essence, the teachers not only found immediate value for the content, but they also achieved their PD objectives based on the identified needs as suggested in activity theory. Furthermore, once the teachers' immediate needs were met, the teachers realized they had new needs such as their interest to pursue further studies as revealed in their exit interviews. These findings are consistent with the activity theory in which new needs emerge once an earlier need is satisfied.

Fourthly, implementing PD in the teachers' work context in school ensured that teachers continued their professional development in a collegial manner in close contact with the day-to-day reality of the classroom (Daniel, 2010). As Hanks (1991) argues, learning is a process that takes place in a participation framework and is mediated by the differences of perspective among co-participants. Hanks' views, coupled with the collegial learning

interactions in this study, echo the emergence of a community that enabled teachers to achieve their common tasks through division of labor as advocated by Engestrom (1999) and others (Roth & Lee, 2007; Botha, et al. 2007). For this study, confirmation of teachers' engagement in both reflective conversations and professional dialogues in a community of colleagues is evidence of the collegial cooperation that is possible when PD is implemented in the workplace setting.

Finally, the study suggests teachers' discussions during face-to-face meetings through reflective conversations and professional dialogues can lead to the establishment of a community of practice. A community of practice for teachers means that they can engage in a process of collective learning in a shared domain of interest (Wenger, 1998). Communities of practice normally emerge in groups of people who share a concern or a passion for something they do as they learn how to do it better and interact regularly (Wenger, 1998). The teachers' interactions in PD, as they studied the content together in pairs and shared their knowledge and experiences with peers in reflective conversations and professional dialogues, were hallmarks of an emerging community of practice.

However, the challenge for the Lumbwa School teachers will be how to sustain the emerging community of practice after the PD provided in this study. There might be hope for a sustained community as suggested by Lave and Wenger, "because the place of knowledge is within a community of practice, questions of learning must be addressed within the developmental cycles of that community" (1991, p.100). For the emerging community of practice at Lumbwa School, through the conversations and collegiality

observed, teachers learned within the community of learners in this study. If PDTs' respond to the teachers' request to them to offer continued support by providing more PD, this could determine the sustainability of the community of practice. If the PDTs maintain periodical contact with the teachers, then they might be able to steer them through as a sustainable community of practice and become PD leaders themselves. I also hope to contribute towards sustainability of this community of practice when I go back to my university in East Africa. In the following subsection, I focus on the implications of the PD approach for the PDTs in this study.

Implications for professional development teachers (PDTs)

For PDTs who had never offered PD through any other mode apart from face-to-face instruction, they confirmed that they learned through the process of design and implementation as they facilitated PD through a blended learning approach. As already presented in Chapter Four, the PDTs appreciated the new skills they gained from their involvement in this study. They stated they had gained skills ranging from the more technical ones such as instructional design, recording video and audio, and authoring PD content in HTML, to basic skills such as listening, as the teachers shared their experiences in face-to-face sessions. A number of implications for PDTs' continued involvement in offering PD arose from this study.

First of all, involvement in instructional design and subsequently as facilitators of blended learning gave the PDTs new and important skills for their future practice in offering PD. The PDTs participated in designing activities to engage teachers actively through the PD content. As a result the PDTs were able to let go some of their control of

the learning process by designing instruction for blended learning, while providing teachers a level of control over their learning environment. This approach is consistent with the work of Sims (2006) who suggested a pedagogy centred on emancipation and empowerment of the engaged learner. By developing content that allowed teachers to have some freedom to control their learning environment the PDTs realized that they could not be the sole custodians of knowledge when working with adult learners. In essence, the PDTs surrendered part of their previous control over the learning process in PD by giving up their role as the core sources of knowledge. As elaborated in Chapter Four, the PDTs confirmed that in their previous practice of offering PD, they always dominated the face-to-face meetings through instruction – what one of them referred to as "we also had to give our input" (PDT1, exit interview).

Secondly, since the PDTs had previously offered teachers' PD in urban slum settlements, their participation in this study by offering PD for teachers in a challenging context in a rural setting was a new experience. They learned how to navigate through the contextual differences between their previous practice in an urban setting and the rural setting. While both locations offer degrees of challenging contexts, the challenges in slums are not necessarily the same as those in a rural setting. Therefore, the PDTs expanded their scope of knowledge and experience, which will be instrumental as they continue to offer PD for teachers in Kenya. They are now able to appreciate the differences in the varied challenging contexts in Kenya, as they engage in their noble commitment to offering PD.

Thirdly, the PDTs quickly and easily embraced their newly acquired mode of offering PD via blended learning without resistance to change as might be expected, considering they had previously offered PD in the face-to-face mode only. They were prepared to engage in offering PD using a new mode - the blended learning approach - and indeed embraced this learning approach fully, based on their responses at exit interviews.

Fourthly, PDTs confirmed their learning of very basic skills such as listening, as they participated in facilitating blended learning. By designing PD such that teachers were given the opportunity to do most of the talking during face-to-face meetings, the PDTs inevitably became the listeners in the meetings. The PDTs then realized that they had not previously been good listeners as their previous practice required them to dominate in PD delivery as the instructors and presenters of content.

Apart from PDTs recognizing their acquisition of listening skills as quoted from PDT1 in Chapter Four, teachers also appreciated that the PDTs were able to listen to them. Dennis asserted:

> The PDTs were well versed in content – they knew the content very well. They were willing, ready and available to support us where we were not able to comprehend some issues. They were also ready to listen to our views and opinion. And they were also ready to learn from us. For example, when they gave us opportunities in groups to tell what we went through in this kind of approach. They would actually take whatever we have, combine with what they had and come up with a comprehensive thing [view]. Yeah, they did not just come with a formed mind that we shall go and enforce these things on them. It is like they knew we were also resourceful in one way or another (Exit interview, 3).

As advocated by proponents of adult learning theory, the views by Dennis suggest the importance of respecting the participants' opinions in PD. The teachers, like any other adults, had a wealth of experience from many years of teaching, and for PDTs and any other PD providers it is always important to recognize participants' previous experience, hence the need to facilitate PD while letting teachers talk to each other about their experiences. For the PDTs in this study it is likely they would not have been successful as facilitators if they attempted to transfer all their previous experiences in offering PD from their urban setting to the challenging context in the rural setting. For example, it was important for PDTs to listen to teachers' experiences in face-to-face meetings rather than becoming the presenters thus duplicating what teachers had already studied through the PD content on the tablets. That the PDTs appreciated their learning to listen could imply that both the blended learning approaches used in this study and the challenging context had a role to play in their learning new skills. In other words, both blended learning approaches and the challenging rural context were new experiences for the PDTs, and they inevitably learned some new skills and knowledge.

Finally, as a way forward, the PDTs' involvement in offering PD in a challenging context in a rural location opened up new opportunities for them to extend their services to others in similar settings. As presented in Chapter Four, the PDTs are prepared to design more PD programs and deliver them through blended learning. They felt empowered not only with new knowledge and skills, but also by retaining the appropriate technologies used in this study for their future practice in offering PD to other teachers.

That the teachers in Lumbwa School invited the PDTs to continue engaging with them in PD attests to the opportunities available to them for offering PD. Particularly, Dennis stated:

> We appeal that the PDTs avail themselves to provide PD for the other teachers who were not part of this [teachers who were not research participants]. We are in the rural place here and we have started an initiative which we would like actually to come out successfully. We are realizing that what we have gone through, on the part of the research, may not be adequate enough to enable us exploit this avenue of professional development effectively. We are calling upon you to support us go through the entire course. Having said that, the jiFUNzeni program that has been mentioned is something new to us. We are now eager and we want to be part and parcel of that community (Face-to-face meeting, 3).

The request for further engagement with the PDTs was three pronged in that:

- it was a request for support to complete the four units of the PD content;
- a request to bring on board the ten teachers in Lumbwa School who were not part of this study; and
- a request for continued engagement with the participants through the jiFUNzeni community.

The statement above by Dennis was an invitation for sustained PD in their school. Dennis was the teacher appointed by the head teacher to coordinate my engagement with Lumbwa School, so at that stage he was speaking for the other participants during the closing session of face-to-face meeting number three which was the final meeting as a whole group of research participants. Certainly, if the teachers had not found value in the PD, they would not have invited the PDTs back. In the following section, I discuss question three that focused on sustainability of the PD approach in this study.

Question 3: Sustainability of Professional Development Approach

The jiFUNzeni learning approach has been fashioned as a sustainable approach to content development and distribution. Its goal is the co-development of digital content relevant to each setting through working collaboratively with regional partners (Crichton & Onguko, 2010). First of all, the jiFUNzeni process is sustainable because of its emphasis on needs-based interventions, suggesting that participation in PD is likely to be sustained because of the interest and motivation arising from identified concerns by participants in performance of tasks. Secondly, the jiFUNzeni process is sustainable because of the involvement of regional partners as experts in content development. In other words, by empowering local expertise through content development they are likely to sustain the practice through utilization of the knowledge and skills gained. Thirdly, through continued implementation of the jiFUNzeni learning approach with the PDTs and in my own university, it is anticipated that participants will qualify as members of the jiFUNzeni community. By becoming members of the jiFUNzeni community of practice it means that they will cultivate mutual relationships with common interests in specific activities over time and contribute to the repository of resources and PD network (Lave & Wenger, 1991).

The Lumbwa teachers' request for the PD content in this study to be posted on the World Wide Web, for future access will be realized through the jiFUNzeni website: www.jifunzeni.com. The PD content for this study has been fashioned on the creative commons copyright terms so that other people can freely access it for their use. Creative commons provides a standardized way for creators of content to grant copyright

permission for their content to be copied, distributed, edited, remixed and built upon (Creative Commons, 2012). The teachers who were involved in the usability testing of the jiFUNzeni approach and the teachers who participated in this study have indicated their willingness to become community members of jiFUNzeni with the requisite user privileges. In essence they will be the first user members of the jiFUNzeni community.

The ambition for sustained PD engagement through jiFUNzeni is motivated by the prevailing situations in many of the developing countries for which this approach is relevant. On the jiFUNzeni learning approach, it is observed:

> The solution is designed to bridge the digital divide, address the UN Millennium Development Goals, and develop sound educational processes for the creation and delivery of resources and training. There are over a billion people in the world today who do not have regular Internet or electricity, and these are our potential clients (jiFUNzeni, 2011, para. 1).

The implementation of this study in Lumbwa gave me, as one of the champions of the jiFUNzeni initiative, an opportunity for a beginning that will hopefully enable access to PD for more teachers in challenging contexts such as the one in this study. I hope to continue learning from experiences in this study and look forward to implementation of the jiFUnzeni learning approach in other sites, and hopefully contribute towards achievement of the MDGs and Education for All (EFA) goals. The enthusiasm exhibited by both the PDTs and the teachers, who have been involved in the initial roll-out of the jiFUNzeni learning approach, has been encouraging. Scalability of this learning approach is addressed in the recommendations - the focus of the following section.

Recommendations for Further Research

Based on the findings in this study, I offer some recommendations for further research. The recommendations include

- scaling up this study in other challenging contexts following the jiFUNzeni approach to learning;
- a follow-up study in Lumbwa to establish how the interventions in this study fared especially the emerging community of practice; and
- an extended and continued literature study on professional development initiatives (including blended learning) in East Africa, in particular, and Africa in general.

Scalability of the PD intervention was not achieved in this study. However, I am optimistic that I will conduct more studies similar to this one to scale as design research provides for scalability after an initial intervention. According to Bannan-Ritland (2003), after learning from enacting an intervention at one site, which is called evaluation phase, local impact, the intervention is studied in multiple contexts, which is known as evaluation phase, broader impact. For example, after implementing the intervention in Lumbwa School and having learned through the intervention, I will endeavour to implement similar interventions in other contexts in East Africa.

First of all, an area for further research identified in this study is a consolidation of research literature on professional development in general and specifically that offered through blended learning in Africa and with emphasis on East Africa. Through this study I was confronted with the reality that there was not much literature on professional

development and blended learning from these contexts. A study focusing on consolidating the initiatives that have been implemented in Africa through meta-analysis of literature will contribute a lot towards knowledge on the current and previous studies. Such a study might require physical visits to libraries in African universities because I believe there are studies housed there that have not been published or made available on the web or in international journals.

Secondly, it is recommended that a study be done to establish whether a community of practice that was emerging in Lumbwa School extended beyond the period of this study. There were professional engagements and peer-collaborative efforts emerging as evident in Dennis and Churchill's professional dialogues and Nita's confirmation that she was working with her colleague who was not part of this study in planning for their lessons together. Such a study would aim at finding out whether initiatives like the ones referred to above were extended beyond the four weeks of implementation of PD in this study and to what effect if any.

Thirdly, in rolling out the jiFUNzeni learning approach, I hope to continue to work through my institution, the Aga Khan University's Institute for Educational Development in East Africa, to address teachers' PD needs through blended learning. I look forward to playing a leading role in identification of contextually appropriate technologies and working with local experts to conduct needs-based interventions. The www.jifunzeni.com repository will be an important source of content in the future as we engage with different contexts.

Working through the jiFUNzeni learning approach, there will be opportunity to continue with research on addressing needs-based PD delivered through blended learning on appropriate technologies in other parts of East Africa. My work at a university that engages in offering teachers' professional development in three countries of East Africa, Kenya, Tanzania and Uganda, will give me an opportunity for scaling up research on the jiFUNzeni approach, while improving the interventions based on lessons learned through this study.

In this study, due to time and financial constraints, I did not have the opportunity for extended implementation of PD to evaluation phase broader impact as advocated by Bannan-Ritland (2003). I take solace in the fact that this study was a beginning and should act as a springboard for more research activities. I therefore look forward to implementation of similar interventions on a broader scale within the East African context and possibly the larger sub-Saharan Africa.

Finally, I look forward to specifically contribute towards integrating the jiFUNzeni learning process into the programs at the Institute for Educational Development of Aga Khan University in East Africa. By introducing the Master of Education students to the jiFUNzeni learning process, on graduating, they may be able to utilize the learning approach in their work as PDTs, which is an important role they have to play in their communities on leaving the university. The two PDTs who participated in this study will

hopefully continue to embrace the jiFUNzeni process and introduce it to their colleagues through their professional association.

Conclusion

Through this study, I have observed that teaching practices in a rural and challenging context can be changed by working with local experts to create locally-relevant content for needs-based PD, implemented in a blended learning approach using appropriate technology. As presented in Chapter Four, teachers accessed and studied through offline content; planned for and implemented lessons using cooperative learning and activity-based learning; used locally available materials; engaged in reflective conversations on successes and challenges; and spontaneously engaged in professional dialogues on key issues of professional concern. While teachers appreciated that it took long to prepare for active learning lessons, it was less strenuous to implement the lessons because they engaged their students as active participants in their learning.

Through this study I actualized theoretical notions on the use of OERs by implementing them in real contexts in practice. It is one thing to speak about the availability and access to learning resources through the OER movement; however, as established in this study, there are other contextual considerations to be made when implementing OERs in the real contexts. For example, through this study it has been established that some of the OERs such as the audio recordings cannot be used universally across Africa because of contextual differences like the regional accents. People from North Africa, West Africa, East Africa and Southern Africa all have their distinctive accents and these have to be taken into consideration while advocating for use of OERs. While working with PDTs on

content development we had to record our own audio content for this study due to this practical reality of African regional accents.

Through this study it was possible to provide learning resources prepared with consideration of the contextual realities. Following the jiFUNzeni learning approach, a sustainable and respectful application of interventions in local contexts, I was able to avail locally relevant experiences to the teachers in a challenging context. Considered against projects such as the One Laptop Per Child (OLPC) initiative, where it is assumed that learners in challenging contexts only need a laptop and they will be able to learn on their own (Watters, 2012), it is my contention that teachers are needed to facilitate learning. Teachers can and do make a difference in learning. They need to be empowered to perform this noble role rather than investing in initiatives that aim to replace them with technology as the OLPC would have it. Teachers can make learning a pleasant experience for their students if provided with contextually relevant and needs-based professional development.

Further, through this study I observed there are possibilities for a sustainable approach to harvesting and utilizing solar energy to power tablets in a challenging context. The involvement of the Professor at the Faculty of Engineering at the University of Calgary and his doctoral student was a strategic approach to designing and developing specifications for solar chargers, which were then assembled for this study locally in Kenya. Such an approach to designing and assembling appropriate technology presents a ray of hope for challenging contexts as a means of bridging the digital divide, which is an

important consideration in the jiFUNzeni learning process. In the endeavour to bridge the digital divide, the open source resources will continue to be relevant as I established through this study.

The open source community will hopefully continue to play an increasingly important role in availing technology to challenging contexts. Open educational resources, for example, may be an important catalyst for access to contextually relevant content particularly for challenging contexts such as rural Kenya. Open source resources such as Ubuntu-based Linux apps, and OERs played a crucial role in enabling teachers in a challenging context to access PD in this study. Perhaps the African origin of the term "Ubuntu" is relevant here as it means a sense of community where people live and operate in a mutually supportive environment (Ford & Batchelor, 2007). The Ubuntu spirit was evident in this study as teachers recognized that they needed each other as they studied and implemented their newly acquired teaching strategies. It is my hope that the Ubuntu spirit will live on among the teachers as a means of growing their nascent community.

Using eXe elearning content authoring platform, another open source solution in creating content for this study, was easier than the previous web authoring processes that required one to learn HTML code. All it required was to have the content copied and pasted in the eXe content authoring platform with a few steps for uploading pictures, videos, and audio content. However, with the changing content authoring platforms, such as the emergence

of HTML5 for electronic publishing, content authoring for presentation on mobile devices such as tablets will become even easier.

HTML5 is a product of the fifth major revision of the core language of the World Wide Web (Hyper Text Markup Language) (van Kesteren & Pieters, 2012). van Kesteren and Pieters stated that HTML has been in continuous evolution since it was introduced to the Internet in the early 1990s. With the ongoing HTML evolution, it is becoming easier for more people to be able to author content for the World Wide Web. With HTML5, more practitioners such as teachers who own smaller and portable devices like smart phones and tablets will be able to author and contribute content for PD. This progress is particularly encouraging for challenging contexts where there is a dearth of content for blended learning.

This study demonstrated that teachers and PD providers in challenging contexts can both benefit from a respectful contextually situated approach to PD provision. The annual Global Monitoring Reports for Education for All published since 2003 recurrently emphasize the need to improve the quality of teaching in challenging contexts. The 2005 Report argued that how teachers are prepared to teach is a critical indicator of education quality. The report states, “preparing teachers for the challenges of a changing world means equipping them with subject-specific expertise, effective teaching practices, an understanding of technology and the ability to work collaboratively with other teachers, members of the community and parents” (UNESCO, 2004, p. 108).

This study was all about the quote above from UNESCO. If the Education for All and the two Millennium Development Goals related to education are to be achieved, the quality of teaching will be a major factor to consider. I am convinced that this study might be part of the answer for addressing the quality of teaching especially in challenging contexts. To accelerate the realization of quality of teaching there is a need to radically restructure the way teachers' professional development is conducted. This study presents one tested way.

Finally, the quality of teaching and learning in challenging contexts will not be realized by placing one laptop in each student's hands so that they can figure out on their own how to learn, as the OLPC people would like us to believe (Watters, 2012). It is my contention that the teacher's role to facilitate learning will continue to be important. This is consistent with the zone of proximal development (ZPD) which provides that learning is mediated through the guidance of a more capable other (Vygotsky, 1978). I look forward to more interaction with teachers in challenging contexts in the endeavour to improve the quality of educational provision and to contribute towards the achievement of Education for All and Millennium Development Goals, for that is an inevitable undertaking for those, like me, concerned with and committed to the improvement of the human condition.

References

Akyeampong, K., Pryor, J., Westbrook, J. & Lussier, K. (2011). *Teacher preparation and continuing professional development in Africa: Learning to teach early reading and mathematics*. Retrieved from www.sussex.ac.uk/cie/documents/tpa-synthesis-report-july2011.pdf.

Ali, S. (2004). Using visual materials. In C. Seale (Ed.). *Researching society and culture*. London: Sage.

Ali, S., Campbell, K., Branley, D. & James, R. (2004). In C. Seale (Ed.). *Researching society and culture*. London: Sage.

Allen, W. C. (2006). Overview and evolution of the ADDIE training system. *Advances in Developing Human Resources* 2006 8: 430-441.

Amutabi, M. (2011, December 28). Replace 8-4-4 system yes, but with what. *The Daily Nation*. Retrieved from http://www.nation.co.ke/oped/Opinion/Replace+8+4+4+system+yes+but+with+what/-/440808/1296626/-/x6bunrz/-/index.html.

Anderson, T. (2005). Design research and its application to a call centre innovation in distance education. *Canadian Journal of Learning and Technology, 31(2)*. Retrieved from http://www.cjlt.ca/index.php/cjlt/article/view/143/136.

Anderson, T. and Shattuck, J. (2012). Design-based research: A decade of progress in education research. *Educational Researcher*, 41 (1), 7 – 36.

Andrews, M., Sclater, S. D., Squire, C. & Tamboukou, M. (2007). Narrative research. In C. Seale, G. Gobo, J., F. Gubrium, & D. Silverman (Eds.). *Qualitative research practice*. London; Sage Publications Ltd.

Ashraf, H. & Rarieya, J. F. A. (2008). Teacher development through reflective conversations – possibilities and tensions: a Pakistan case. *Reflective Practice* 9(3), 269 - 279

Atkins, D. E., Brown, J. S. & Hammond, A. L. (2007). A review of open educational resources movement: Achievements, challenges and new opportunities. Retrieved from http://www.hewlett.org/uploads/files/Hewlett_OER_report.pdf.

Bannan-Ritland, B. (2003). The Role of Design in Research: The Integrative Learning Design Framework Source. *Educational Researcher, 32(1),* 21-24.

Bannan-Ritland, B. & Baek, J. Y. (2008). Investigating the act of design in design research. In A. E. Kelly, R. A. Lesh & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Barab, S. A. & Duffy, T. (2012). From practice fields to communities of practice. In D. Jonassen & S. Land (Eds.). *Theoretical foundations of learning environments*. New York: Routledge.

Barab, S. & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, 13 (1), 1 – 14.

Batteau, A. W. (2010). *Technology and culture*. Long Grove, Illinois: Waveland Press, Inc.

Bersin, J. (2004). *The blended learning book: Best practices, proven methodologies and lessons learned.* San Francisco, CA: Pfeiffer.

Bobda, A. S. (2001).East and Southern African English accents. *World Englishes*, 20 (3), 269 – 284.

Boitshwarelo, B. (2009). Exploring blended learning for science teacher professional development in an African context. *International Review of Research in Open and Distance Learning*, 10 (4), 1 – 19.

Bonk, C., J. (2009). The world is open: How web technology is revolutionizing education. San Francisco, CA: Jossey-Bass.

Botha, A., Cronje, J. C & Ford, M. (2007). Upclose and very personal – A proposed conceptual framework for mobile technology as a participant. In P. Cunnigham & E. Cunnigham (eds.). *Proceedings of the IST Africa 2007 conference*. Retrieved from www.IST-Africa.org/Conference2007.

Boyinbode, O. K. & Akinyede, R. O. (2008). Mobile learning: An application of mobile and wireless technologies in Nigerian learning system. *International Journal of Computer Science and Network Security, 8(11),* 386-392.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. Journal of the Learning Sciences, 2 (2), 141 – 178.

Brown, T. H. (2003). The role of m-learning in the future of e-learning in Africa. *Proceedings of the 21st ICDE World Conference, Hong Kong.* Retrieved from http://www.tml.tkk.fi/Opinnot/T-110.556/2004/Materiaali/brown03.pdf

Bryderup, I. M. & Kowalski, K. (2002). The role of local authorities in the integration of ICT in learning. *Journal of Computer Assisted Learning* (2002) 18, 470-479.

Bryman, A., Teevan, J. J. & Bell, E. (2009). Social research methods. Ontario: Oxford University Press.

Bunyi, G.W., Wangia, J., Magoma, C.M., Limboro, C. M., & Akyeampong, K. (2011). *Teacher preparation and continuing professional development in Africa: Learning to teach reading and mathematics and influences on practice in Kenya*. Country Report prepared for the William and Flora Hewlett Foundation. Retrieved from www.sussex.ac.uk/cie/documents/report-kenya-1july2011.pdf

Burbank, M., D. & Kauchak, D. (2003). An alternative model of professional development: Investigations into effective collaboration. Teaching and Teacher Education 19, 499–514.

Byrne, B. (2004). Qualitative interviewing. In C. Seale, (ed). *Researching society and culture*. London: Sage.

Chapman, C. & Harris, A. (2004). Improving schools in difficult and challenging contexts: Strategies for improvement. *Educational Research*, 46 (3), 219 – 228.

Chitiyo,R. & Harmon, S. W. (2009). An analysis of the integration of instructional technology in pre-service teacher education in Zimbabwe. *Educational Technology Research and Development*, 57, 807 – 830.

Christie, P., Harley, K. & Penny A. (2004). Case studies from sub-Saharan Africa. In C. Day and J. Sachs (Eds). *International handbook on the continuing*

professional development of teacher. Maidenhead, Berkshire: Open University Press.

Chogi,B. F. M. (2007). *The impact of mobile phones technologies on medium and small enterprises/jua kali (MSEs)*. Proceedings of Communication Policy Research South on National and Regional Innovation Systems. Retrieved from www.cprsouth.org/wp-content/uploads/drupal/Francis_Chogi.pdf.

Chopra, J. (2011). *Latika Roy Foundation*. Retrieved from http://latikaroy.org/projects/karuna-vihar-school/karuna-vihar-education-therapy-school-age-children-disability/

Clandinin, J. & Huber, J. (2002). Narrative Inquiry: Toward Understanding Life's Artistry. *Curriculum Inquiry*, 32 (2) pp. 161-169.

Cobb, P. and Gravemeijer, K. (2008). Experimenting to support and understand learning processes. In A. E. Kelly, R. A. Lesh,& J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Collis, B. (2006). Putting blended learning to work. In C. J. Bonk and C. R. Graham (Eds). *The handbook of blended learning: Global perspectives, local designs*. San Francisco, CA: Pfeiffer.

Collis, B., Margaryan, A.& Amory, A. (2005). Multiple perspectives on blended learning design. *Journal of Learning Design*, 1(1), 12-21.

Commonwealth of learning, (2010). *Copyright and open education resources*. Vancouver: Commonwealth of learning.

Communications Commission of Kenya, (2011). *Quarterly Sector Statistics Report 4th Quarter April – June 2010/2011*. Retrieved from http://www.cck.go.ke/resc/downloads/SECTOR_STATISTICS_REPORT_Q4_2010-11.pdf.

Confrey, J. (2006). The evolution of design studies as methodology. In R., K. Sawyer, (ed). *Cambridge handbook of the learning sciences*. Cambridge University Press.

Conteh, A. (2003). Culture and the transfer of technology. In B. Hazeltine and C. Bull (Eds). *Field guide to appropriate technology*. San Diego, CA: Academic Press.

Creative Commons, (2012). *About the licenses*. Retrieved from: http://creativecommons.org/licenses/.

Creswell, J., W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. Los Angeles: Sage.

Crichton, S. (2011). Using digital tools in qualitative research: Supporting integrity, simplicity, deep insight and social change. In C. N. Silva (Ed.). *Online research methods in urban and planning studies*. Hershey, PA: IGI Global.

Crichton, S. (2007). A great wall of difference: Musings on instructional design in contemporary China. In Michael J. Keppell (ed). *Instructional design: case studies in communities of practice*. Hershey, New York: Information Science Publishing.

Crichton, S. & Childs, E. (2008). Looking forward: Stories of practice. In S. Hirtz (ed). *Education for a digital world: Advice, guideline and effective practice from around the globe*. Vancouver, BC: Commonwealth of Learning.

Crichton, S. & Childs, E. (2005). Clipping and coding audio files: A research method to enable participant voice. *International Journal of Qualitative Methods, 4*(3), Article 3. Retrieved from http://www.ualberta.ca/~iiqm/backissues/4_3/pdf/crichton.pdf

Crichton, S. & Onguko, B. (in Press). Appropriate technologies for challenging contexts. In S. Marshall & W. Kinuthia (Eds.). *Educational design and technology in the knowledge society*. Charlotte, NC: Information Age Publishing.

Crichton, S. & Onguko, B. (2010). *Colorboard – a product and process to enable quality education for all*. Retrieved from http://wikieducator.org/images/0/01/Susan_Crichton.pdf

Daniels, H. (2004). Cultural historical activity theory and professional learning. International Journal of Disability, Development and Education, 51 (2), 185 – 200.

Daniel, J. S. (2010). *Mega Schools, technology and teachers*. New York: Routledge.

Davis, B. & Bloom, G. (1998). Support for New Teachers. *Trust for Educational Leadership*, 28(2), 16–18.

Davis, R. S. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. *TechTrends* 55(5), 45 – 52.

DeBruin-Parecki, A. @ Henning, J. E. (2002). Using reflective conversations as a tool for constructing meaningful knowledge about classroom practice. *Catalyst for Change*, 31 (3), 16 – 20.

Dede, C. (2004). If design research is the answer, what is the question? *The Journal of the Learning Sciences*, 13 (1), 105 – 114.

Dede, C. (2005a). Why design-based research is both important and difficult. *Educational Technology*, 45 (1), 5 – 8.

Dede, C. (2005b). Commentary: The growing utilization of design-based research. *Contemporary Issues in Technology and Teacher Education*, 5 (3 & 4) 345 – 348.

Delamont, S. (2007). Ethnography and participant observation. In C. Seale, G. Gobo, J., F. Gubrium, & D. Silverman (Eds.). *Qualitative research practice.* London; Sage Publications Ltd.

Design-based research collective, (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32(1)*, 5-8

DeVane, B. & Squire, K. D. (2012). Activity theory in the learning technologies. In D. Jonassen & S. Land (Eds.). *Theoretical foundations of learning environments*. New York: Routledge.

Dewey, J. (1933). How we think: A restatement of the relation of reflective thinking to the educative process. Chicago: Henry Regnery.

Dewey, J. (1964). The school and society. In R. D. Archambault (Ed.). John Dewey on education: Selected writings. Chicago: Chicago University Press.

Dey, I. (2007). Grounded theory. In C. Seale, G. Gobo, J., F. Gubrium & D. Silverman (Eds.). *Qualitative research practice*. London; Sage Publications Ltd.

DfID, (1998). *Primary education in Kenya:* An evaluation of the s*trengthening primary education (SPRED) project, Kenya, 1991 - 1996*. Retrieved from http://www.dfid.gov.uk/Documents/publications1/evaluation/ev627s.pdf

DfID, (1999). *Strengthening primary education in Kenya*. Retrieved from http://www.dfid.gov.uk/Documents/publications1/evaluation/ev627s.pdf

Disenyana, T. (2009). China in Africa solar energy sector: Kenya case study. South Africa Institute of International Affairs. *Occasional paper No. 25*. Retrieved from: http://library.africaportal.org/?itemid=|dspace|29712

Engestrom, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-konsultit.

Engestrom, Y. (1999). Innovative learning in work teams: analysis cycles of knowledge creation in practice. In Y. Engestrom, R. Miettinen & R. Punamaki (Eds.). Perspectives on activity theory. Cambridge: Cambridge University Press.

Engestrom, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics 43(7)*, 960 – 974.

Engestrom, Y. (2008). *From teams to knots*. Cambridge, Cambridge University Press.

Engestrom, Y. (2011). From design experiments to formative interventions. *Theory and Psychology*, 21 (5), 598 – 628.

exelearning wiki (2011). *exeLearning*. Retrieved from http://exelearning.org/wiki.

Ford. M. and Batchelor, J. (2007). *From zero to hero – is the mobile phone a viable learning tool for Africa?* Retrieved from http://researchspace.csir.co.za/dspace/bitstream/10204/1568/1/Ford_2007.pdf

Franklin, E. (2011). *CNET looks at current and upcoming tablets*. Retrieved from http://news.cnet.com/8301-17938_105-20037960-1/cnet-looks-at-current-and-upcoming-tablets/?tag=contentBody;contentHighlights.

Fullan, M. (1985). Change process and strategies at the local level. *The Elementary School Journal*, 85 (3), 390 – 421.

Gakindi, M. W. (2010). *Information access needs of satellite campuses in Kenya - can OER close the gap? The case of Moi University Nairobi Campus*. Oslo: Unpublished Master's thesis.

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, 48 (1), 18 – 33.

Garrison, D.R. & Vaughan, N. (2008). *Blended learning in higher education: Framework, principles, and guidelines.* San Francisco, CA: Jossey-Bass.

Gereluk, D. (January, 2012). *Strategic literature review*. Seminar presentation for graduate students at the University of Calgary, Calgary

Glennerster, R., Kremer, M., Mbiti, I. & Takavarasha, K. (2011). *Access and quality on the Kenyan education system: A review of progress, challenges and potential solutions.* A report prepared for the Office of the Prime Minister of Kenya. Nairobi. Retrieved from http://www.povertyactionlab.org/fr/publication/access-and-quality-kenyan-education-system.

Goetz, J. P. & LeCompte, M. D. (1984). *Ethnographic and qualitative design in educational research*. San Diego: Academic Press Inc.

Government of Kenya, (2010). *Constitution of Kenya*. Retrieved from http://www.coekenya.go.ke/images/stories/Resources/the_proposed_constitution_of_kenya.pdf

Grinnell, R. M. & Unrau, Y. A. (2008). *Social work research and evaluation*. Oxford: Oxford University Press.

Gunga, S., O. & Ricketts, I., W. (2007). Facing the challenges of e-learning initiatives in African universities. *British Journal of Educational Technology, 38(5);* 896 – 906.

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8 (3/4), 381 – 391.

Hanks, W. F. (1991). Foreward. In Lave, J. & Wenger, E. (1991*). Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Hansman, C. A. (2001). Context-based adult learning. In S., B. Merriam (Ed). *The new update on adult learning theory: New directions for adult and continuing education, no, 89*. Columbus, Ohio: Jossey-Bass.

Hardman, F., Abd-Kadir, J., Agg, C., Migwi, J., Ndambuki, J. & Smith, F. (2009). Changing pedagogical practice in Kenyan primary schools: the impact of school-based training. *Comparative Education*, 45 (10, 65 -86.

Hardman, J. (2005a). Activity theory as a potential framework for technology research in an un equal terrain. *South African Journal of Higher Eductation*, 19 (2), 378 – 392. Retrieved from www.web.uct.ac.za/depts/educate/downlaod/SAJHE.pdf.

Hardman, J. (2005b). Activity theory as a framework for understanding teachers' perceptions of computer usage at a primary school level in South Africa. *South African Journal of Education*, 25 (4), 258 -265.

Harris, A. (2002). Effective leadership in schools facing challenging contexts. *School Leadership & Management*, 22 (1), 15 – 26.

Hendel-Giller, R. & Stepich, D. A. (2003). Case study 20: Diane King. In P. A. Ertmer & J. Quin (Eds.). *The ID casebook: case studies in instructional design*. Upper Saddle River, New jersey: Pearson Education, Inc.

Hjalmarson, M. A. & Lesh, R. A. (2008). Engineering and design research. In A. E. Kelly, R. A. Lesh & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Holton, E. F., Swanson, R. A. & Naquin, S. (2001). Andragogy in practice: Clarifying the andragogical model of adult learning. *Performance Improvement Quarterly*, 14(1), 118-143.

Howard, L., Remenyi, Z. & Pap, G. (2006). Adaptive blended learning environments. *Proceedings of the 9th International Conference on Engineering Education T3K-16*, July 23 – 28, 2006 San Juan, PR.

Howland, J.L., Jonassen, D. & Marra, R. M. (2012). *Meaningful learning with technology*. Boston: Pearson.

iHub, 2012. iHub: Technology, innovation, community. Available at http://www.ihub.co.ke/pages/about.php

Ivala, E. N. (2011). Globalisation: The role of new information and communication technologies in distance education. *Africa Education Review* 8 (1), 79 – 101.

Janssens-Bevernage, A. & Stern, R. (2006). *Facilitated e-learning in sub-Saharan Africa*. Paper presented at the Fourth Pan-Commonwealth Forum on Open Learning (PCF4). Available at http://pcf4.dec.uwi.edu/viewabstract.php?id=325

Januszewski, A. & Molenda, M. (2008). *Educational technology: A definition with*

commentary.New York: Lawrence Erlbaum Associates.

Japan International Cooperation Agency, (2009). *National staff on a familiarization tour of SMASE project*. Retrieved from www.jica.go.jp/kenya/english/office/topics/topics_smase.html.

JiFUNzeni, (2010). *Colorboard user guide version 4.0*. Calgary: Unpublished.

JiFUNzeni, (2011). JiFUNzeni organization- developers of the Colorboard system. Retrieved from http://www.jifunzeni.com/.

Johnstone, S. M. (2005). Open educational resources serve the world. *Educause Quarterly Magazine* No. 3, 15 – 18.

Jonassen, D.H. & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educational Technology, Research and Development*, 47 (1), 61-79.

Joyce, B. (2004). *At Odds: Strategic planning. How are professional learning communities created? History has a few messages*. Phi Delta Kappan, 86 (1), 76 - 83.

Kabaji, E. (2012). Do we take our children to school to learn or to kill themselves over grades? Daily Nation. Retrieved from http://www.nation.co.ke/oped/Opinion/Do+we+take+our+children+to+school+kill+themselves+over+grades/-/440808/1299162/-/p3rlts/-/index.html.

Kali, Y. (2008). The design principles database as a means for promoting design-based research. In A. E. Kelly, R. A. Lesh & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Kaufman, D., M. (2003). ABC of learning and teaching in medicine: Applying education theory in practice. *BMJ Vol. 326*. Retrieved from http://www.bmj.com.ezproxy.lib.ucalgary.ca/content/326/7382/213.full.pdf+html.

Kelly, A.E. (Ed.). (2003). The role of design in educational research. *Educational Researcher*, 32(1), 3 – 4.

Kelly, A. E. (2004). Design research in education: Yes, but is it methodical? *The Journal of the Learning Sciences*, 13 (1),115 – 128.

Kelly, A. E., Lesh, R. A., & Baek, J. Y. (2008). Preface. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Kelly, A. E., Baek, J. Y., Lesh, R. A. & Bannan-Ritland, B. (2008). Enabling innovations in education and systematizing their impact. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Kenya Open Data, (2011). *Poverty rate by district based on data for 2005/6*. Retrieved from http://opendata.go.ke/-Environment-And-Natural-Resources/Poverty-Rate-by-District/i5bp-z9aq

King, K. P. & Gura, M. (2007). *Podcasting for teachers: Using a new technology to revolutionize teaching and learning*. Retrieved from http://library.books24x7.com.ezproxy.lib.ucalgary.ca/book/id_27095/viewer.asp?bookid=27095&chunkid=0000000001

Kisirkoi F. (2011) Effectiveness of TACs in Teacher Professional Development in Nairobi County. Retrieved from http://www.deta.up.ac.za/papers_presentations/Kisirkoi%201%20maputo%20tacs%20finally%20edited_paper.pdf.

Kisirkoi F. (2012) Effectiveness of teacher advisory centres (TACs) in teacher professional development in Nairobi County. *International Journal of Current Research* 4(4), 297 - 302.

Koh, E. & Lim, J. (2008). Collaboration technology 2.0 and education: Reflection, conceptualization, practice and research. In S. Hirtz & K. Kelly (Eds.). *Education in a Digital World - 2nd Edition*. Victoria, BC: Queen's Printer

Kopp, G. (2005). *Context and competencies in workplace learning: A case study in robotic neurosurgery*. Proceedings of the 4th International Conference on Researching Work and Learning. Sydney, Australia.

Lai, R. (2010). *Smart Q T7 and T7-3G Android 2.1 tablet and priced in China*. Retrieved from http://www.engadget.com/2010/07/14/smartq-t7-and-t7-3g-android-2-1- tablets-announced-and-priced-in/.

Lai, H. (2011). The influence of adult learners' self-directed learning readiness and network literacy online learning effectiveness: A study of civil servants in Taiwan. *Educational Technology and Society*, 14 (2), 98 – 106.

Lai, K. & Pratt, K. (2004). Information and communication technology (ICT) in secondary schools: The role of the computer coordinator. *British Journal of Educational technology*, 35 (4), 461 – 475.

Land, S. M., Hannafin, M. J. & Oliver, K. (2012). Student-Centered Learning Environments: Foundations, assumptions and design. Theoretical foundations of learning environments. New York: Routledge.

Larson, R. C. & Murray, M. E. (2008). Open educational resources for blended learning in high schools: Overcoming impediments in developing countries. *Journal of Asynchronous Learning Networks* 12 (1), 85 – 103.

Lave, J. & Wenger, E. (1991*). Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leach, J. & Makalima, S. (2006). *4D technologies for teachers: Investigating the use of ICT by the rural poor in eastern province, South Africa*. Presentation at the American Educational Research Asociation, San Francisco.

Leonard, D. C. (2002). *Learning theories A – Z*. Westport: Greenwood Publishing Group, Inc.

Leont'ev, A., N. (1978). *Activity, consciousness and personality*. Englewood Cliffs, New Jersey: Prentice-Hall Inc.

Lewis, P. (2010). The narrative turn. *In education* 16 (2). Retrieved from http://www.ineducation.ca/article/editorial-narrative-turn.

Lofland, J. & Lofland, H. L. (1995). *Analyzing social settings: A guide to qualitative observation and analysis*. Belmont: Wadsworth Publishing Company.

Maathai, W. (2009). *The challenge for Africa*. New York; Anchor Books.

MacKeracher, D. (2004). *Making sense of adult learning*. Toronto: University of Toronto press.

Malachowski, M. J. (2012). *ADDIE based five-step method towards instructional design*. Retrieved from http://fog.ccsf.cc.ca.us/~mmalacho/OnLine/ADDIE.html

Mars Group Kenya (2011). *Constituencies: Lugari*. Retrieved from http://www.marsgroupkenya.org/constituencies/?constID=110&task=about&page=3.

Mason, J. (1996). *Qualitative researching*. Sage: London.

Mbiti, J. S. (1969). *African Religions and Philosophy,* London: Heinemann

Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *In New directions for adult and continuing education, No. 89*. Jossy-Bass.

Merrill, D. (2002). First principles of instruction. *Educational Technology Research and Development 50(3)*, 43 – 59.

Middleton, J., Corard, S., Taylor, C. & Bannan-Ritland, B. (2008). The "Compleat" design experiment. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Miles, M. & Huberman, A. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage.

Ministry of Education, (2005). *Sessional Paper No.1 of 2005 on a Policy Framework for Education, Training and Research.* Nairobi; Government Printer.

Ministry of Education (2008). *Report on Kenya Ministry of Education Management Capacity*. Retrieved from https://www.eddataglobal.org/search/index.cfm?fuseaction=googleSearch

Ministry of Education (2009). *Strategic Plan 2009 – 2013*. Retrieved from http://www.education.go.ke/Documents.aspx?docID=1409

Ministry of Education, (2012). *Report of the task force on the re-alignment of education sector to the constitution of Kenya 2010: Towards a globally competitive quality education for sustainable development*. Retrieved from www.education.go.ke/Documents.aspx?docID=2047.

Mock, K. (2004). Teaching with tablet PCs. *The Journal of Computing Sciences in Colleges 20(1)*, 17 – 27.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement* 42 (5), 34 - 36

Moon, B. (2007). *Attracting, developing and retaining effective teachers: A global overview of current policies and practices*. Retrieved from http://unesdoc.unesco.org/images/0015/001516/151685E.pdf.

Moore, M. (2006). Continuing professional development: Fit for practice. In *Psychology therapies in primary care*. London; H. Kamac (Books) Ltd.

Mor, Y. (2010). *A design approach to research in technology enhanced mathematics education*. London: Unpublished PhD Dissertation.

Muindi, B. (2009, August 31). TSC bosses locked in promotion row. *Daily Nation*, p. 64

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. *Journal of Information Technology for Teacher Education*, 9(3), 319 -342.

Muyinda, P. B., Lynch, K. & Lubega, J. T. (2008). Mobile research supervision initiative (MRSI) at Makerere University: Lessons to learn. Retrieved from

http://cit.mak.ac.ug/iccir/downloads/ICCIR_08/Paul%20B.%20Muyinda,%20Kathy%20Lynch%20and%20Jude%20T.%20Lubega_08.pdf.

Nardi, B. A. (1992). Studying context: A comparison of activity theory, situated action models, and distributed cognition. *Proceedings of East-West International Conference on Human-Computer Interaction*. St. Petersburg, Russia.

Nation Reporter, (2010, December 20). Safaricom to review its SMS charges. *Daily Nation*. Retrieved from http://www.nation.co.ke/business/news/Safaricom%20to%20review%20its%20SMS%20charges/-/1006/1075714/-/12a5kttz/-/index.html

Neumeier, P. (2005). A closer look at blended learning – parameters for designing a blended learning environment for language teaching and learning. *ReCALL* 17 (2): 163–178.

Nieveen, N. M. (1997). Computer support for curriculum developers: a study on the potential of computer support in the domain of formatiove curriculum evaluation. Enschede: Published Doctoral Thesis University of Twente,

Norton, P. & Wiburg, K. M. (2003). *Teaching with technology: Designing opportunities to learn*. Belmont, CA: Wadsworth/Thomson Learning.

O'Connell, T. S. & Dyment, J. E. (2011). The case of reflective journals: Is the jury still out? *Reflective Practice*, 12 (1), 47 – 59.

Odini, C (1998). *Teachers advisory centers: Kenya*. Retrieved from http://www.cd3wd.com/cd3wd_40/HDLHTML/EDUCRES/DEP26E/EN/CH11.HTM#TOPOFP AGE

OER Africa, (2011). OER Africa – an introduction Kenya Methodist University, Meru. Retrieved from http://www.oerafrica.org/BMModules/tabid/356/mctl/Details/id/37443/Default.aspx

Onguko, B., B., N. (2005). *Reflective practice: Development of teacher reflective practitioners in Kenya*. Paper presented at the 11th Cambridge International Conference on Open and Distance Learning. Retrieved from, http://www2.open.ac.uk/r06/conference/papers2005.pdf

Onguko, B. (2010). *Design, implementation and institutionalization of mobile learning in higher education*. Paper presented at the 6th Pan Commonwealth Forum. Kochi, India. Retrieved from http://wikieducator.org/images/e/e4/Brown_Onguko.pdf.

Onguko, B. B., Ngatia, S. & Crichton, S. (2011). mLearning: Small technologies - massive contributions. In S. Hirtz & K. Kelly (Eds.). *Education for a digital world 2.0: Innovations in education Vol. 1*. Vancouver: Open School BC.

Otienoh, R. O. (2011). Teachers' lack of deeper analytical reflections: who is to blame? *Reflective Practice*, 12:6, 733-747.

Otienoh, R., O. (2010). The issue of large classes in Kenya: The need for professional support for primary school teachers in school contexts. *Journal of International Studies in Educational Administration, 38 (2)*, 57 – 72.

Otienoh, R., O. (2009). Reflective practice: The challenge of journal writing. *Reflective Practice, 10 (4)*. 477 – 489.

Palys, T. (1992). *Research decisions: Quantitative and qualitative perspectives*. Toronto: Harcourt Brace Jovanovich Canada Inc.

Pavlick, J. V. & McIntosh, S. (2011). *Converging media: A new introduction to mass communication*. New York: Oxford University Press.

Picciano, A. G. (2009). Blending with purpose: The multimodal model. *Journal of Asynchronous Learning Networks*, 13 (1), 7 – 18.

Pilloton, E. (2009). *Design revolution*. New York: Distributed Art Publishers, Inc.

Pink, S. (2007. Visual methods. In C. Seale, G. Gobo, J., F. Gubrium, & D. Silverman (Eds.).*Qualitative research practice*. London; Sage Publications Ltd.

Pontefract, C. & Hardman, F. (2005). The discourse of classroom interaction in Kenyan primary schools. *Comparative Education*, 41 (1), 87 – 106.

Prior, L. (2007). Documents. In C. Seale, G. Gobo, J., F. Gubrium, & D. Silverman (Eds.). *Qualitative research practice*. London; Sage Publications Ltd.

Ramírez, M. S. (2011). Academic networks for research and innovation: experiences of Open Educational Movement's area in a Latin-American context. *4th International Conference of Education Research and Innovation* Madrid, Spain. Retrieved from http://www.iated.org/iceri2011/ .

Rapley, T. (2007). Interviews. In C. Seale, G. Gobo, J., F. Gubrium, & D. Silverman (Eds.). *Qualitative research practice*. London; Sage Publications Ltd.

Reeves, T., C. (2006). Design research from a technology perspective. In van den Akker, J., Gravemeijer, K., McKenney, S. & Nieveen, N. (Eds.). *Educational design research*. London, Routledge.

Reiser, R. A. & Dempsey, J. V. (2007). *Trends and Issues in Instructional Design*.(2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Reitmaier, T., Bidwell, N. J. & Marsden, G. (2011). Situating digital storytelling within African communities. *International Journal of Human-Computer Studies*, 69, 658 – 668.

Republic of Kenya, (2006). *National Early Childhood Development Policy Framework.* Retrieved from http://www.education.go.ke/Documents.aspx?docID=866 .

Republic of Kenya, (2009). *The National Special Needs Education Policy Framework.* Retrieved from http://www.education.go.ke/Documents.aspx?docID=527 .

Rios, G. (2008). Creating a virtual expert presence in the hospital library. *Journal of Hospital Librarianship* , 8 (4), 457-463.

Robertson, D. N. & Merriam, S. B. (2005). The self-directed learning process of older, rural adults. *Adult Education Quarterly*, 55, 269 – 287.

Rohse, S. & Anderson, T. (2006).Design patterns for complex learning. Journal of Learning Design, 1 (3), 82 – 91.

Roth, W. & Lee, Y. (2007). "Vygotsky's neglected legacy": Cultural historical activity theory. *Review of Educational Research* 77 (2), 186 – 232.

Rothwell, W. J. & Kazanas, H. C. 1998). *Mastering the instructional design process*. San Francisco: Jossy-Bass Inc.

Ryen.A. (2007). Ethical issues. In C. Seale, G. Gobo, J., F. Gubrium & D. Silverman (Eds.). *Qualitative research practice*. London; Sage Publications Ltd.

Sandelowski, M. (1991). Telling stories: Narrative approaches in qualitative research. *Journal of Nursing Scholarship*, 23 (3), 161 – 166.

Schlichte, J.,Yssel, N. & Merbler, J. (2005). Pathways to burnout: Case studies in teacher isolation and alienation. *Preventing School Failure*, 50 (1), 35 – 40.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Schwartz, D. L., Chang, J. & Martin, L. (2008). Instrumentation and innovation in design experiments: Taking the turn towards efficiency. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York, Routledge.

Schumacher, E., F. (1973). *Small is beautiful: Economics as if people mattered.* New York; Harper & Row Publishers.

Seale, C. (2004). Coding and analyzing data. In Seale, C. (ed). *Researching society and culture.* London: Sage.

Seale, C. (2004). Validity, reliability and the quality of research. In C. Seale (Ed.). *Researching society and culture*. London: Sage.

Seale, C. (2007). Quality and credibility. In C. Seale, G. Gobo, J., F. Gubrium & D. Silverman (Eds.).*Qualitative research practice*. London; Sage Publications Ltd.

Selinger, M. (2006). Developing an understanding of blended learning: A personal journey across Africa and the Middle East. In C. J. Bonk & C. R. Graham (Eds). *The handbook of blended learning: Global perspectives, local designs.* San Francisco, CA: Pfeiffer.

Sherman, A. & Rokne, A. (2010). Electronic documentation of learning: Alternate reflective discussion formats. *In education* 16 (1). Retrieved from

http://www.ineducation.ca/article/electronic-documentation-learning-alternate-reflective-discussion-formats.

Showers, B. (1983). *Coaching: A training component for facilitating transfer of training*. Paper presented at the annual meeting of the American Educational Research Association, Montreal.

Siemens, G. & Tittenberger, P. (2009). *Handbook of emerging technologies for learning*. Retrieved from http://umanitoba.ca/learning_technologies/cetl/HETL.pdf

Sigal, M. (2011). You say you want a revolution? It's called post-PC computing. Retrieved from http://radar.oreilly.com/2011/10/post-pc-revolution.html.

Simiyu, J. W. & Macharia, J. (2008). E-Learning as an innovative strategy to increase enrolment in technical and vocational education and training institutions in Kenya. *International Journal of Educational Management*, 5, 127 – 133.

Sims, R. (2006). Beyond instructional design: Making learning design a reality. *Journal of Learning Design*, 1(2), 1-7.

Snelson, C. (2011). YouTube across the disciplines: A review of the literature. *MERLOT Journal of Online Learning and Teaching*, 7 (1), 159 – 169.

Song, L. & Hill, J. R. (2007). A conceptual model of understanding self-directed learning in online environments. *Journal of Interactive Online Learning*, 6 (1), 27 - 42

Stakes, R. E. (1995). *The art of case study research*. Thousand Oaks: Sage Publications.

Stegman, S. F. (2007) An exploration of reflective dialogue between student teachers in music and their cooperating teachers, *Journal of Research in Music Education,* 55(1), 65–83.

Taylor, E. W. (2008). Transformative learning theory. In S. B. Merriam (Ed.). *The third update on adult learning theory: New directions for adult and continuing education, no. 119.* San Francisco: Jossey-Bass.

Teacher Education in Sub Saharan Africa, (2011). *Key resources*. Retrieved from http://www.tessafrica.net/images/stories/static_files/kr_localenvironment.pdf

Teachers Service Commission, (2004). Staffing directorate: primary division. Retrieved from http://www.tsc.go.ke/insidestaffing.htm

Traxler, J. & Leach, J. (2006). Innovative and Sustainable Mobile Learning in Africa, *Fourth IEEE International Workshop on Wireless, Mobile and Ubiquitous Technology in Education – WMTE,* pp.98 - 102,

UNESCO, (1948). *Universal declaration of human rights*. Retrieved from http://portal.unesco.org/en/ev.php-URL_ID=26053&URL_DO=DO_TOPIC&URL_SECTION=201.html

UNESCO (1990). World Declaration on Education For All. Retrieved from: http://www.unesco.org/education/efa/ed_for_all/background/jomtien_declaration.shtml

UNESCO, (2000). *The Dakar framework for action*. Retrieved from http://unesdoc.unesco.org/images/0012/001211/121147e.pdf.

UNESCO, (2004). *EFA Global Monitoring Report 2005*. Retrieved from http://www.unesco.org/en/efareport/reports/2005-quality/

UNESCO, (2010a). EFA *Global Monitoring Report 2010: Reaching the marginalized. Retrieved from* http://www.unesco.org/en/efareport/reports/2010-marginalization/

UNESCO, (2010b). *The Right to Education*. Retrieved from http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/right-to-education/

United Nations, (2000). *United Nations Millennium Declaration*. Retrieved from http://www.un.org/millennium/declaration/ares552e.pdf.

United Nations (2010). *The Millennium Development Goals Report 2010*. United Nations: New York.

Unwin, T. (2005). Towards a framework for the use of ICT in teacher training in Africa. *Open Learning* 20 (2), 113 – 129.

Uwezo (2010). *Are our children learning. Annual Learning Assessment Report, Kenya 2010*. Uwezo, Nairobi, Kenya

van den Akker, J., Gravemeijer, K., McKenney, S. & Nieveen, N. (2006). Introducing educational design research. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.). *Educational design research*. London: Routledge.

van Kesteren, A. & Pieters, S. (2012). HTML5 differences from HTML4. Retrieved from http://dev.w3.org/html5/html4-differences/.

van Teijlingen, E. R. & Hundley, V. (2001). *The importance of pilot studies*. Retrieved from www.sru.soc.surrey.ac.uk/SRU35.pdf.

Vosloo, S. (2010). *Yoza excites African teenagers to love reading using mobile phones*. Retrieved from http://edutechdebate.org/meducation-initiatives/yoza-excites-african-teenagers-to-love-reading-using-mobile-phones/

Vygotsky, L., S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, Massachusetts, Harvard University press.

Waititu, M., M. & Orado, G., N. (2009). *Managing teachers and the instruction of mathematics and science: Lessons from the SMASSE experience in capacity developmen*t. Retrieved from http://info.worldbank.org/etools/docs/library/245737/day8%202b.%20PAPER%20Lessons%20from%20SMASSE%20OradoMaichael.pdf

Walker, D. (2006). Toward productive design studies. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.). *Educational design research*. London: Routledge.

Walsh, D. (2004). Doing ethnography. In C. Seale (Ed.). *Researching society and culture.* London: Sage.

Wanzare, Z., O. (2002). Rethinking teacher evaluation in the third world: The case of Kenya. *Educational Management Administration & Leadership, 30,* 213 – 229.

Wanzare, Z., O. (2007). The transition period: The early years of being a teacher. In T. Townsend & R. Bates (Eds.). *Handbook of Teacher Education,* 343–364. Retrieved from http://www.springerlink.com/content/m4164477704u91t2/fulltext.pdf

Watters, A. (2012). *The failure of one laptop per child*. Retrieved from http://www.hackeducation.com/2012/04/09/the-failure-of-olpc/.

Waudo, J., Juma, M., Herriot, A. & Mwirotsi, M. (2002). *Head teacher support groups initiative within the PRISM project in Kenya*. *ESSRR XVIII (1) 97-108.*

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*.

New York: Cambridge University Press.

Wenger, E., White, N. & Smith, J. D. (2009). *Digital habitats: Stewarding technology for communities*. Portland: CPsquare.

West, P. G. & Victor, L. (2011). The OER movement. In S. Hirtz and K. Kelly (Eds.). *Education for a digital world 2.0: Innovations in education Vol. 1*. Vancouver: Open School BC.

Wicklein, R. C. (2005). Appropriate technology: Value adding application for technology education. *The Technology Teacher*, 10 – 12.

Williams, P. (2010). Beyond control: Will blended learning subvert national curricula? In E. M. W. Ng. (Ed.). *Comparative blended learning practices and environments*. Hershey: IGI Global.

Williams, D., Coles, L., Wilson, K., Richardson, A.& Tuson, J. (2000). Teachers and ICT: Current use and future need. *British Journal of Educational Technology*, 31 (4), 307 – 320.

Willis, C. L. & Miertschin, S. L. (2004). *Tablet PCs as instructional tools or the pen is mightier than the board!* Retrieved from http://delivery.acm.org/10.1145/1030000/1029572/p153-willis.pdf?key1=1029572&key2=8477093921&coll=DL&dl=ACM&CFID=46280 77&CFTOKEN=59647856.

Wolfenden, F., Umar, A., Aguti, J. & Gafar, A. A. (2010). Using OERs to improve teacher quality: Emerging findings from TESSA. Paper presented at the 6th Pan Commonwealth Forum. Kochi, India.

York-Barr, J., Sommers, W. A., Ghere, G. S. & Montie, J. (2001). *Reflective practice to improve school: An action guide for educators*. Thousand Oaks: CorwinPress, Inc.

APPENDICES

Appendix A: Letter from Ministry of Higher Education, Science and Technology

Appendix B: Letter from District Education Office

Appendix C: Head Teacher Script

I am doctoral candidate at the University of Calgary in Alberta province of Canada. As part of my doctoral studies, I am required to engage in original research in an issue of concern such as professional development. My research will involve working with teachers to design and implement a professional development in a rural setting such as Lugari district in Western Kenya. The Ministry of Education in Nairobi and the district education office in Lugari district have both allowed me to work with your school in this research project. My research requires teachers who will volunteer to participate in activities including:

- Interviews
- Observation
- Semi-structured group discussion
- Professional development with handheld technologies and occasional face-to-face sessions

Appendix D:Teacher Script

I am doctoral candidate at the University of Calgary in Alberta province of Canada. As part of my doctoral studies, I am required to engage in original research. My research will involve working with teachers to design and implement a professional development in a rural setting such as Lugari district in Western Kenya. The Ministry of Education in Nairobi and the district education office in Lugari district have both allowed me to work with your school in this research project. You are invited to volunteer to be one of the participants in this study. If you agree to participate in this research, you will participate in activities including:

- Interviews
- Observation
- Semi-structured group discussion
- Professional development with handheld technologies and occasional face-to-face sessions

Unfortunately, you will not receive any payment for their contribution to my research, and you are free to withdraw from my study at any time without prejudice or penalty.

Please note, participation, or lack thereof, in this study will not affect your employment status in any way.

Appendix E: Ethics Approval Certificate

Appendix F: Consent form

Appendix G: Teachers PD Needs Interview Guide

Thank you very much for taking your time to participate in this interview. This interview will be used to identify your professional development needs for the intervention that will follow. It is therefore important to identify yourself and also share some professional information with me.

1. Your name
2. Your School
3. Your age range: 20-29: 30-39 : 40-49 : 50 – 59
4. Talk briefly about family
5. When did you go for pre-service teacher training?
6. Number of years in service
7. Your teaching subjects
8. How many lessons do you teach per week?
9. What motivates you in your teaching role?
10. When was your last professional development course/seminar/workshop?
    - Who were the providers of the seminar/workshop?
    - How long did the training take?
    - What topics were covered?
    - What skills did you learn?
    - How have you used those skills?

11. Comment on use of technology in education?
12. How do you use of technology for either personal or professional activities?

- What technologies have you used in teaching?
- How do you use these technologies?
- In what subjects did you use the technologies?

13. What are the current challenges for accessing professional development in your context?
14. What three topics by priority would you like training in?
15. What is your preferred learning style?

– Visual – Through use of sight.
– Auditory – through hearing
– Tactile/Kinesthetic – Through practically doing things.

Appendix H: PDTs' Entry Interview Guide

Thank you very much for taking your time to participate in this interview. This interview will be used to identify your experiences in teaching and facilitation of professional development for teachers.

1. Your name
2. Your School
3. Your age range: 20-29: 30-39 : 40-49 : 50 – 59
4. Talk briefly about family
5. Talk briefly about your professional qualifications?

6. Number of years in service
7. Number of years in providing professional development for teachers.
8. Your areas of expertise in professional development.
9. How often do you engage facilitating in professional development?
10. What professional development activity did you facilitate last

- What topics were covered?
- What role did you play?
- What facilitation approaches do you commonly use?

11. What is your motivation in facilitating professional development?
12. What are your views on use of technology in facilitating professional development?

- What technologies do you use frequently in your work?
- What technologies do you use frequently in facilitating professional development?
- How do you use these technologies in facilitating professional development?

13. By engaging in this research what new things do you hope to learn?
14. How would your involvement in this research impact on you professionally?
15. What in your view are the preferred learning styles for the teachers who participate in your professional development activities?

- Visual – Through use of sight.
- Auditory – through hearing
- Tactile/Kinesthetic – Through practically doing things.

Appendix I: Teachers Exit Interview Guide

1. What are some of the benefits you derived from your participation in this professional development?
2. Comment on your experiences working through the four units of the professional development.
3. What skills did you acquire as you engaged in the professional development?
4. What are your views on the support provided by the PDTs?
5. What were your experiences when collaborating with your colleague during this research?
6. What interest if any, was shown by your colleagues who were not part of this research?
7. Share with me your views on the difficulties you encountered in blended learning process?
8. How did you resolve any difficulties encountered?
9. Share your views on the solar power options for the tablet computer you used.
10. What were some of the work schedule challenges that you can share with me?
11. How did your involvement in this research fit in your home and community responsibilities?
12. What aspects in your opinion need improvement in the blended learning process?
13. What recommendations do you have for such blended learning approach for professional development?

14. Share with me any changes that may have occurred in your teaching practice?
15. Comment on your future plans on engaging in further professional development.

Appendix J: PDT Exit Interview Guide

1. Comment on blended learning approach for professional development?
2. How has your participation in this research impacted on you professionally?
3. What knowledge did you gain from your participation in the PD process?
4. What specific skills did you learn in the process of your participation in the PD?
5. Share with me some of the specific instances you thought you learned some new things.
6. What were your most exciting moments during instructional design?
7. What were your most exciting moments during implementation of PD?
8. What were the low moments in the instructional design?
9. What were the low moments during implementation of PD?
10. If you were to go through the same process again what would you do differently? Can you do this on your own?
11. What are your comments on professional development delivered on the tablet computer?
12. What improvements do you recommend for future PD through blended learning?
13. Comment on your way forward in delivery of professional development.

Appendix K: Six Steps on Tablet Operations and Content Familiarization

1. Hold the Tablet PC at white and black logo. Pull the stand out and let the PC stand on a desk

2. Familiarize yourself with the Tablet PC, identify the power on/off switch and switch on the device. The Computer is ready when the message: **"SD Card Mounted"** shows on the screen.

3. Pull out the stylus and use it to navigate programs. The top left hand corner will show a start icon of either an image of a penguin, a black SD card or the logo sign with four circles. You will always place the stylus on this icon to navigate through and to find programs.

4. To find the course: Place the stylus at the top left hand corner to find a drop-down menu. Place stylus on internet (***Next***) Midori Web Browser (***Next***) File (***Next***) Open (***Next***) SD Card (***Next***) PhD Research PD Content (***Next***) Open index.html (***Next***) Open. Use stylus to navigate through content by pointing on NEXT….

5. To exit/close the page, place stylus on the X at the top right corner of the Tablet PC.

6. To access audio and video files, place stylus on start icon at top left corner (***Next***) Sound and Video (***Next***) SMPlayer (***Next***) Open (***Next***) File (FILES: Activity based learning1.mp3/Cooperative learning.mp3/Cooperative Learning Discussion.mp4/Video Water Sources.wmv/VIDEO Perimeter and Area.wmv) (***Next***) Open.

Source: Artifact developed during instructional design