

**CHILDREN'S EMPOWERMENT THROUGH DIGITAL LEARNING  
- CASE STUDIES FROM RURAL TANZANIA**

by

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### **CHILDREN'S EMPOWERMENT THROUGH DIGITAL LEARNING - CASE STUDIES FROM RURAL TANZANIA**

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.



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## **ABSTRACT**

Education is an important foundation for human development and child empowerment. The scarcity of teachers is a significant threat to the quality of education. Technology-enabled learning is widely acknowledged as a means of mitigating this risk. However, there is a lack of clear guidelines on how to effectively implement e-learning in rural schools. The aim of this study is to investigate the impact of technology-enhanced education on children's empowerment in rural Tanzania and generate recommendations on how e-learning can positively impact learning environments and teaching styles. Two schools with four focus groups participated in this multiple-case study. A mixed methods approach was applied integrating quantitative (teacher survey) and qualitative (observations, interviews with teachers, group discussions with pupils) research elements. The findings of the empirical study substantiate the favourable impact of digital learning on children's empowerment, self-reliance, and self-confidence, their ability to collaborate and interact, and their performance in class.

## KEY WORDS

- Children empowerment
- Digital learning
- Technology-enabled learning
- Dialogic interaction
- Collaborative learning
- Information and Communication Technology for Education (ICT4E)
- Self-Organized Learning Environment (SOLE)
- Minimally Invasive Education (MIE)
- Flipped Classroom Model
- Design Science Research (DSR)
- Tanzania

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## ABBREVIATIONS AND ACRONYMS

AED	Academy for Educational Development
ASCILITE	Australasian Society for Computers in Learning in Tertiary Education
BECTA	British Educational Communications and Technology Agency
BLM	Blended Learning Models
DFID	Department for International Development (UK)
DSR	Design Science Research
EFA	Education for All
ESR	Education for Self Reliance
GER	Gross Enrolment Rates
GLP	Global Learning Portal
HDI	Human Development Index
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
ICT4E	Information and Communication Technology for Education
IICBA	International Institute for Capacity Building in Africa
MDG	Millennium Development Goals
MIE	Minimally Invasive Education
MoEVT	Ministry of Education and Vocational Training
MPI	Multidimensional Poverty Index
NAEYC	National Association for the Education of Young Children
NEPAD	New Partnership for African Development
OECD	Organization for Economic Co-operation and Development
OER	Open Educational Resources
OLPC	One Laptop per Child
PISA	OECD Programme for International Student Assessment
QDA	Qualitative Data Analysis
SACMEQ	Southern & Eastern Africa Consortium for Monitoring Education Quality
SDG	Sustainable Development Goals

SOLE	Self-Organizing Learning Environments
SRI	Stanford Research Institute
SSA	Sub-Saharan Africa
TIE	Tanzania Institute of Education
TIMSS	Trends in International Mathematics and Science Study
TPCK	Technological Pedagogical Content Knowledge
UGC	User Generated Content
UIFS / UIS	UNESCO Institute for Statistics
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
UPE	Universal Primary Education
USAID	United States Agency for International Development





# CHAPTER 1 – INTRODUCTION

This multidisciplinary research aims to explore ways of improving the quality of education for children in rural Tanzania. Through quality education, children will be empowered for their lives in their respective context. Low-quality education is a recognized problem of schools in Africa, particularly outside of the major cities. While some of the underlying problems, such as the lack of learning materials, can be easily addressed with financial support, one issue can be singled out as a major cause of long-term problems: the scarcity of teachers in rural schools. This problem cannot be solved by funding alone. There is a shortage of teachers throughout Tanzania. Moreover, there is a strong resistance by teachers to move to rural areas with weak infrastructure after completing their training at a teacher college in the city. Reflections on alternative solutions have shifted the focus to technology-enhanced education leveraging digital learning platforms. Technology will not produce more teachers, but it does help children learn more independently and it helps existing teachers better manage the masses of pupils they have to deal with in and outside of the classrooms.

## 1.1 DESCRIPTION OF THE RESEARCH PROBLEM

Poor quality education hinders future development and children's ability to gain mastery over their lives. Globally, more than half of children and adolescents do not achieve minimum proficiency in reading and Mathematics (UN 2015). These children will not be able to read or handle Mathematics proficiently by the time they complete primary education (UIS 2017:2). The problem is widely recognized by key development actors, but promising solutions are largely missing, especially for rural areas in Sub-Saharan Africa (SSA).

### **Problem Statement:**

The persistent lack of teachers and overcrowded classrooms in rural Tanzania result in a monologue teaching style where children chorus responses, disempowering children and preventing them from self-determined, interactive learning and self-expression.

Technology-enhanced learning has been frequently proposed to alleviate such issues. However, most publications remain vague in defining what is to be implemented and how. It is largely undefined *how* and to what extent digital media can promote the UN Sustainable Development Goals on *Quality Education*. While there are many papers that examine the *problem* of successfully integrating Information and Communication Technology for Education (ICT4E), there is little writing about successful technology-powered *solutions*. The impact of ICT4E on child empowerment, liberating pedagogy, self-expression, and self-motivated learning appears to be largely unexplored in rural Africa. As a result, there is no broad consensus on best practices for ICT4E in such a context. No specific research or guidelines seem to exist that focus on implementation details or best practices for self-determined and technology-enhanced education in Tanzania. There are only a few implementations of e-learning in rural schools. And where they do exist, there appears to be a lack of systematic assessments of their impact on children's empowerment and development.

This study has investigated how an innovative e-learning solution can help children in rural Tanzania master their lives and empower children by fostering self-motivated learning, creativity, and critical thinking.

## **1.2 BACKGROUND AND MOTIVATION OF THE RESEARCHER**

In 2016, my wife and I created a foundation (Bridge of Hope) that supports educational programs, mostly, but not exclusively in Tanzania. As a practitioner working on educational projects, I have observed how education quality is compromised by weak infrastructure. There is a constant lack of classrooms, a shortage of learning and teaching materials, missing access to clean water, and many other constraints, especially in rural areas. But the problem with the deepest impact seems to be the constant scarcity of teachers. Before starting educational projects in Tanzania, I was working in the high-tech industry for more than two decades, focusing on voice recognition technologies and artificial intelligence. Given my professional background, I started to wonder if and how technology could help mitigate educational issues due to lack of teachers. While technology may not be able

to replace teachers, it can certainly help existing teachers improve their teaching and learning environments by applying new concepts of self-determined and minimally invasive education. I discovered that there are many different attempts being made in different parts of the world that are worth exploring. So I examined dozens of learning programs and digital learning systems available for development projects with limited financial budgets. Although I could find a variety of decent e-learning solutions, I discovered that most digital learning systems are still in their infancy. Documentation of best practice and systematic evaluation is largely lacking. Therefore, I concluded that to derive good recommendations on how to implement an empowering digital learning system in rural Tanzania, it is crucial to conduct a thorough analysis and empirical study in the specific context of my praxis projects. Pilot projects have been implemented since 2021 to test the feasibility of different learning apps and e-learning systems. While the initial feedback indicates great satisfaction from both, teachers and students, my motivation for this thesis is to further evaluate the impact of digital learning beyond superficial satisfaction.

### **1.3 RESEARCH OBJECTIVES AND RESEARCH QUESTIONS**

The main objective of this research is to investigate the impact of technology-enabled education on children's empowerment and human development in rural Tanzania (Rukoma and Mbulu district) and to generate recommendations on how e-learning can positively impact learning environments and teaching styles in related schools.

Secondary objectives are:

- to explore specific ideas for self-organizing learning environments (SOLE) and interactive, self-determined learning to develop a framework of guidelines and best practices specifically for schools in rural Tanzania
- to study the implementation of ICT4E in the context of multiple case studies in rural Tanzania using a mixed methods approach in a design research project
- to derive recommendations for an effective ICT4E setup; such recommendations have to acknowledge the scarcity of teachers in rural

Tanzania and have to be field-proven as part of the design research in this study

- to describe the role of teachers in technology-enhanced learning that empowers children in supervised and in minimally invasive learning environments

Operational definitions of the above mentioned key constructs have been extracted from the theory and existing literature. But as we will see later, implementation guidelines and best practices for digital learning are largely missing in context of schools in Tanzania. Therefore, given the objective of deriving guidelines and recommendations, the underlying research questions begin with a *How?* The collection of the empirical data explicitly focuses on these *how*-questions.

Main research question:

- How can a digital learning system foster the empowerment of children and the perceived quality of education in schools in rural Tanzania?

Sub-questions:

- How is the digital learning system integrated into the school routine and what changes in learning styles and teaching practices can be observed in the case studies?
- How do teachers perceive technology-enabled learning during the intervention and what changes and challenges are they facing?
- What changes can be observed in the way children learn in an ICT4E environment and what is their perception of how this empowers them in their life context?
- How can the digital learning system be adapted within and after the intervention to take advantage of the experiences and feedback of teachers and students in the schools participating in the study?

These research questions are investigated and measured through a mixed methods study combining quantitative and qualitative research elements and a ten-week in-field research trial as outlined in detail in section 4.4 and Figure 4.7. Measurable indicators for children's empowerment are outlined in section 3.5.

## 1.4 SCOPE AND LIMITATIONS OF THE STUDY

### **Scope:**

This holistic multiple-case study was carried out in two districts (Rukoma and Mbulu) in rural Tanzania. The study investigated how the current learning environments and teaching styles can be improved for these specific cases by using the e-learning platform from World Possible. Related schools are embedded in broader area development programs supported by the “Bridge of Hope” foundation in cooperation with local partners including World Vision Tanzania. Pilot projects for digital learning have been in place since 2021. Pre-conditions vary largely between the participating schools (different teacher-pupil ratios, teaching in English vs. Kiswahili, connection to electricity grid vs. solar charging stations only, public vs. private schools). Investigating the impact of digital learning on child empowerment and the perceived quality of education in two very distinct school setups will help to draw meaningful conclusions for a broader range of schools. Within this thesis I have focused on the grassroots experience of 12 teachers and 40 pupils. A minimally invasive approach with limited guidance from teachers was chosen for the ten-weeks e-learning trial so that pupils are not steered in a predefined direction. The impact of digital learning on the experiences and the empowerment of pupils and teachers was investigated. While a holistic concept like empowerment is hard to measure, it is highly relevant from a development perspective. Therefore, children’s empowerment was explored based on relevant factors like self-determined, independent, interactive learning or critical thinking.

### **Limitations:**

Although a rich set of data collection methods has been applied in this mixed methods study (including teacher surveys, observations, statistical data from the digital learning server, qualitative interviews, and focus group discussions) the amount of data and sampling size are still limited. Qualitative research methods like teacher interviews and focus group discussions with pupils are well-suited for exploring the perspectives and experiences of the research participants. But 40 children and 12 teachers from two schools in rural Tanzania can by no means be regarded as representative of all Tanzania.

City schools were not included in the study. Results may be transferable to other rural areas in Tanzania to some extent, but they cannot be generalized.

Another limitation is due to the researcher. As a researcher from Germany, although visiting the projects in Tanzania regularly, I am still an outsider in these rural communities. My on-site time for own observations was limited to specific days during the initial setup of the empirical study and the end of the research trial. My Kiswahili is very basic so I had to rely on native speakers as interpreters, particularly in Rukoma. Even in Mbulu, where all interviews and focus group discussions were conducted in English, it is important to acknowledge that this is not the native language, neither for me nor for the research participants. The ability to express themselves in English represents a limiting factor.

There is a limitation in collecting feedback from minors. While they are the primary beneficiaries of the intervention, special considerations had to be applied for this vulnerable group.

Additionally, this study cannot investigate long term impacts of digital learning. This is important considering the nature of education as investment into the long term future and empowerment of children. The focus of this thesis will be on the subjective perception of teachers and pupils within the limited timeframe of the intervention.

## **1.5 DEFINITION OF KEY CONCEPTS**

### **Capabilities:**

The *Capability Approach* (also known as *Human Development Approach*) sees improving people's freedoms and capabilities as the central objective of development. Pioneers of this development theory were Amartya Sen and Martha Nussbaum. Nussbaum introduced a list of ten central human capabilities and defended these capabilities as moral entitlements of every human being (Nussbaum 2011:33-34). These ten capabilities are necessary for a dignified life. "Control over one's environment" is one of them and is closely tied to the notion of "empowerment". The *Capability Approach* is centred around people's freedoms or valuable opportunities (called: capabilities) "to lead the kind of lives they want to lead, to do what they want

to do and to be the person they want to be” (Robeyns 2005:95). Human development focuses on the formation of human capabilities and the use of these capabilities. Capabilities include life expectancy, improved health, access to resources needed for a decent standard of living, guaranteed human rights, political freedom, and many more. The most important capabilities in the context of this thesis are knowledge and education.

### **Digital Divide:**

There is a growing concern that the ongoing crises will widen the digital divide in education between those with access to technology and those without (eLearning Africa 2020:4). A „digital divide is marked not only by physical access to computers and connectivity but also by access to the additional resources that allow people to use the technology well” (Warschauer 2002:6). Consequently, Warschauer advocates for “Technology for Social Inclusion” (2002:7) rather than mere access to ICT equipment.

### **Empowerment:**

Empowerment is defined by the World Bank as “expansion of freedom of choice and action. It means increasing one’s authority and control over the resources and decisions that affect one’s life. As people exercise real choice, they gain increased control over their lives” (Narayan 2002:11). The origin of the term *empowerment* is closely linked to the social scientist Julian Rappaport who defined empowerment as the “process by which people, organizations, and communities gain mastery over issues which are of concern to them” (Rappaport 1987).

### **Information and Communication Technology for Education (ICT4E):**

ICT4E and its positive effect on learner-centered education and access to learning materials has become an increasingly important research topic over the past two decades (Barakabitze 2014:83). Access to ICT resources in schools has raised many hopes as an effective tool to support teaching and learning in classroom practice (Hennessy, Harrison & Wamakote 2010:41) and beyond. However, effective ICT4E is about more than access to technology. Changes in the role of the teachers and their teaching styles are an integral part of ICT4E (2010:45). UNESCO emphasizes ICT4E and its

important role in the teacher development strategy, particularly in Sub-Saharan Africa (IICBA 2016:15).

### **Minimally Invasive Education (MIE):**

MIE is a pedagogy that implies that learners work in self-organizing groups, have access to adequate resources and none or very little supervision from adults (Mitra 2021:139). The learning method used in MIE draws on the expertise of peers, siblings, and friends. Each learner is both a learner and a trainer (2021:148). MIE promotes learning by exploration.

### **Problem-posing education:**

The Brazilian educator and philosopher Paulo Freire proposes a “problem-posing education” as a humanizing and liberating praxis (Freire 2017:59) that regards dialogue and critical thinking as indispensable to the act of cognition that unveils reality (2017:56). Through problem-posing education the world is no longer “something to be described with deceptive words. It becomes the object of transforming action by men and women which results in their humanization” (2017:59). This will turn education into a “practice of freedom” as opposed to education as a “practice of domination” (2017:54).

### **Self-Organizing Learning Environment (SOLE):**

A Self-Organizing Learning Environment is a learning setup designed to support self-directed education. One of the pioneers of SOLE, Sugata Mitra, emphasizes the “spontaneous order” where “learning comes from the inside”. In self-organizing systems “learning is an emergent phenomenon, therefore you cannot make it happen. You can set the stage and allow it to come when it will” (Mitra 2006).

## **1.6 CHAPTER OVERVIEW**

Following this introduction, Chapter 2 explores the potential impact of digital learning on children’s empowerment in rural Tanzania. The chapter outlines how the Education for All (EFA) movement and the push for Universal Primary Education (UPE) have compromised educational quality in many African countries. The role of technology-enhanced learning to improve education quality and empower children will be discussed, and new approaches for self-



determined learning will be introduced. Lessons learned from existing e-learning platforms help analyze the potential of technology to empower children in the context of schools in rural Tanzania.

Chapter 3 outlines the theoretical framework for understanding the impact of digital learning on children's empowerment in rural Tanzania. Given the holistic and multidisciplinary nature of this thesis, multiple concepts including the *Framework of Empowerment*, Amartya Sen's *Human Development Approach*, Paulo Freire's *Liberating Pedagogy of the Oppressed*, Jerome Bruner's *Culture of Education*, and the concept of *Educational Constructivism* are introduced and explored. This chapter concludes with meaningful recommendations on how to improve digital learning to promote children's empowerment in rural Tanzania. It also discusses how the theoretical framework can be applied to the topic of digital learning and what indicators for children's empowerment can be derived.

Chapter 4 provides a detailed overview of the research design and methodology. The Design Science Research (DSR) paradigm and process model are introduced in depth. It explains why design research is appropriate for this dissertation, which aims to improve a digital learning system and foster children's empowerment in rural Tanzania. A holistic multiple-case study design allows for the collection and comparison of data from different contexts (e.g. private vs. public schools in rural Tanzania). A Mixed Methods approach has been applied integrating quantitative and qualitative research elements. The motivation for this mix of methods is to provide additional coverage and an expanded perspective on the research question. The study includes a teacher survey, a ten-week research intervention with four study groups of ten pupils each, followed by twelve teacher interviews and eight focus group discussions. This chapter also describes the data analysis approach that is applying the Grounded Theory and using MAXQDA as the data analysis tool.

Chapter 5 describes the key findings of the empirical study. The results of the teacher survey highlight what is considered important by the teachers, particularly the value of practical life skills for the future of the children. As the first step of the Grounded Theory, all qualitative data is analyzed by applying the open coding process, resulting in ten top-level categories. Key aspects of these top-level categories are then explored further in the axial coding phase.

Six specific phenomena of child empowerment are analyzed using the Coding Paradigm. Finally, the data and the results from these coding steps are unified at a higher level of abstraction through selective coding. The aim is to build a theory that provides answers to the research question. Guidelines and recommendations for the empowering use of digital learning in rural Tanzania are generated.

Chapter 6 discusses the research findings and compares them with the results of the literature review in Chapter 2 and the theoretical framework in Chapter 3. It outlines how digital learning fosters children's empowerment through practical knowledge, increased self-reliance, and self-confidence as well as through interactive and collaborative learning. The scaffolding theory of Jerome Bruner is used to explain one of the perceived contradictions. Answers to the research questions are provided. This includes a summary of recommendations and guidelines for a digital learning system that empowers children in rural Tanzania. This chapter also includes a critical reflection on the study, particularly with regard to the methodology and the role of the researcher. Moreover, recommendations for further research are provided here.

## CHAPTER 2 – LITERATURE REVIEW

### 2.1 EDUCATION FOR ALL – A PATH TOWARDS CHILDREN EMPOWERMENT AND HUMAN DEVELOPMENT?

The transformative power of education has been acknowledged by the *Education for All (EFA)* movement since the 1970s. The *World Conference on Education for All* held in 1990 paved the way for Universal Primary Education (UPE) to become one of the eight primary goals of human development as manifested in the Millennium Development Goals (MDG 2) and the *Dakar EFA Framework for Action*. Education remains a central goal of the Agenda 2030 for Sustainable Development. The preamble of the *Incheon Declaration for the Education 2030 Agenda* explicitly states that “our vision is to transform lives through education, recognizing the important role of education as a main driver of development” (UNESCO 2015b:7).

As we will see in section 3.1, education is critical for children’s empowerment by expanding their freedom of choice and action. The World Bank defines *empowerment* as “increasing one’s authority and control over the resources and decisions that affect one’s life. As people exercise real choice, they gain increased control over their lives” (Narayan 2002:11). Alsop enhances this concept of “empowerment as effective choice” and highlights the critical role of education for empowered people to participate effectively in local-level decision making (Alsop 2007:123).

This notion corresponds closely to the crucial role of education for human development in the Capability Approach. Nussbaum introduced a list of ten central human capabilities (Nussbaum 2011:33-34) that are required to live a dignified life. “Control over one’s environment” is one of them and is closely tied to the notion of “empowerment”. Capabilities include life expectancy, improved health, knowledge and education, access to resources needed for a decent standard of living, guaranteed human rights, political freedom, and more. The Human Development Index (HDI) combines three main dimensions including “Knowledge”, as constituted in the Education Index (mean years of schooling and expected years of schooling). According to Nussbaum “education plays a fertile role opening up options of many kinds” (Nussbaum 2009:12) fostering capabilities that help people to master their lives.

## 2.2 FROM 'EDUCATION FOR ALL' TO 'QUALITY EDUCATION'

The initial focus of the Education for All (EFA) framework and the MDGs were on broad, equitable access to education through Universal Primary Education (UPE). While many countries have made significant progress on this topic, the results of the UNESCO assessment of achievements in 2015 were still disappointing in other countries. For example, the school life expectancy increased only marginally in Burkina Faso, D.R. Congo, Mali, Burundi and other countries (UNESCO 2015a:60). The report explicitly mentions that almost half of the countries with very low Gross Enrolment Rates (GER) are located in Sub-Saharan Africa (2015a:63). Many children complete the compulsory primary school without acquiring basic literacy and numeracy skills, depriving them of their right to quality education (UWEZO 2019:54).

Low-quality education hinders future development and children's ability to gain mastery over their lives. Various publications by UN agencies have highlighted related issues. Globally, six out of ten children and adolescents are not achieving minimum proficiency levels in literacy and numeracy (as measured in SDG 4 Indicators 4.1.1 or 4.6.1) (UN 2015). These children will not be able to adequately read or handle mathematics by the time they complete primary school education (UIS 2017:2). The problem is widely recognized by key development actors, but promising solutions are largely lacking, especially for rural areas in Sub-Saharan Africa (SSA). The EFA Global Monitoring Report 2005, which focuses on "the Quality Imperative", concludes that "experimenting with alternative practices is necessary, especially as progress towards Education for All results in enrolment of children from communities that were formerly socially distant from the school system" (UNESCO 2005:78).

*Quality Education* is one of the key targets of the UN Sustainable Development Goals (SDG 4), which explicitly calls for "knowledge and skills needed to promote sustainable development and sustainable lifestyles" (Target 4.7) (UN 2015). However, sufficient resources are required to attain acceptable educational quality. And the increase of resources needs to be well implemented to show meaningful impacts (UNESCO 2005:78). There appears to be little consensus on what education quality means and how it

can be measured (Sifuna 2007:689). “Concerns to improve quality include the framing of the curriculum, the content and form of learning materials, the nature of the pedagogy, and teacher-pupil relations” (Aikman & Unterhalter 2005:4). Barrett and Tikly summarize the key components of educational quality, including cognitive achievements, improved scores in standardized tests, literacy and numeracy, life skills, meaningful choices, and social justice in form of parity of participation (Barrett & Tikly 2012:2). The three dimensions of educational quality are ‘inclusion’ (all learners have the opportunity to achieve specified learning outcomes), ‘relevance’ (learning outcomes are meaningful for all learners and their communities) and ‘participation’ (learning outcomes are determined through public debate) (2012:3-4).

Common indicators of educational quality use results from national examinations or international studies such as PISA (OECD Programme for International Student Assessment), TIMSS (Trends in International Mathematics and Science Study), or SACMEQ (Southern and Eastern Africa Consortium for Monitoring Educational Quality). In addition, independent household surveys such as Uwezo in East Africa can enhance the understanding of educational needs and quality levels. Moreover, Barrett & Tikly highlight the importance of qualitative judgments and classroom observations as quality indicators (2012:9). The focus on improved educational quality opens a discussion about the overall goals of education. For example, if critical thinking and creativity are deemed important, this will change the way, students are perceived, supported, challenged and assessed. This will not only require more resources, such as teachers and learning materials, it also calls for pedagogical changes. Newer concepts like competency-based curricula and learner-centered pedagogies have been requested many times also for developing countries (2012:12). And officially, they have been implemented in the most recent curricula changes (also in Tanzania). However, traditional classroom practices and the reality of schools in rural Africa have still been a major barrier to the implementation of reforms in the daily school routines (2012:12). As we will see in section 2.4, new and innovative solutions like technology-enhanced learning will only be accepted if the benefits are clear and transparent to the actors like teachers, pupils and the community.

## 2.3 EDUCATIONAL SYSTEM AND QUALITY CHALLENGES IN TANZANIA – DESIRE VERSUS REALITY

### 2.3.1 Education in Tanzania – a historical overview

Universal Primary Education (UPE) has a long-standing tradition in Tanzania originating from the *Education for Self-Reliance (ESR)* policy from 1967 that replaced the prevailing colonial education system. The aim of UPE was articulated in the Musoma Declaration of 1974 as a way of transforming the rural society and agriculture by producing graduates who can integrate education with work. The declaration regarded education as a basic human right (Sifuna 2007:694). ESR set the main purpose of the education system as preparing children for meaningful and productive lives and helping people develop themselves (Kassam 1994:5-6). Tanzania's first president Julius Nyerere was a pioneer in development and a creative educational thinker. In his book *Freedom and Development*, he emphasized that „people cannot be developed, they can only develop themselves“ (Nyerere 1973:2). He stressed the importance of education in enabling people to take charge of their own development (1973:3). Nyerere believed that the purpose of development is liberation and self-reliance. His educational philosophy starts from the premise that the goal of education “is the liberation of man from the restraints and limitations of ignorance and dependency. Education has to increase men’s physical and mental freedom to increase their control over themselves, their own lives, and the environment in which they live” (Nyerere 1978:27). This positive attitude towards education had a tangible and long-lasting impact on Tanzania. “Education is seen as the key to prosperity and for the future development of the family and the country. Expectations for the outcome from schooling of children are high” (Wedin 2005:573). Kassam concludes that

“Tanzania’s educational experiment, inspired and driven by Nyerere’s educational philosophy, has produced a mixture of successes and failures. [...] The policy of Education for Self-Reliance has not been fully implemented in the totality of its philosophic concepts as well as in its practice. A number of contradictions have arisen in the process of translating theory into practice” (Kassam 1994:8).

The centralized Tanzanian education system has undergone several curriculum changes over the past 60 years. The word ‘curriculum’ means “a

course of study or a plan that provides learning opportunities in the form of knowledge, skills, attitudes, and beliefs” (Kasuga 2019:22). The curriculum determines what is to be taught and how, the materials that are to be used and how educational achievements are assessed (2019:35). Curriculum changes reflect changes in the society of the country when “changes in the society bring about challenges, needs, and problems that require updated knowledge and skills to address them and hence curriculum changes become an inevitable phenomenon” (2019:27). The first curriculum change in Tanzania dates back to 1979, twelve years after the introduction of the Education for Self-Reliance (ESR) policy, and focused on diversifying the curriculum. Beyond the initial focus on agriculture, new commercial, technical, and home economics schools were introduced (2019:30). The curriculum reform steered by the Makweta Commission in 1997 addressed social and political changes caused by the shift from socialism to economic liberalism and the introduction of the multiparty politics in 1992. The resulting Tanzania Education and Training Policy (ETP) of 1995 describes the aim of education “to promote the acquisition and appropriate use of literacy, social, scientific, vocational, technological, professional and other forms of knowledge, skills, and understanding for the development and improvement of man and society” (MoEVT 2007:1). The policy replaced several subjects in the primary and secondary school curricula and required teachers to specialize already at the primary school level (Kasuga 2019:31). Also, information and computer science was introduced in this policy. Another major curriculum change was pioneered by the Ministry of Education and Vocational Training (MoEVT) through the Tanzania Institute of Education (TIE) in 2005. This replaced the prevailing ‘content-based curriculum’ with the new ‘competence-based curriculum’ to address the new requirements of the labor market in a globalized world. “Teachers are called upon using interactive, participatory teaching and learning techniques with good learning environment” to apply a learner-centred curriculum (2019:31). As in many other countries, the UNDP supported the formation of a so-called ‘eThinkTank’ in Tanzania to generate ideas and suggestions for the country’s transition to the information age and for the ICT policy and regulatory environment (Ang’ondi 2010:9). Based on this, the MoEVT launched the ICT Policy for Basic Education in pre-primary,

primary and secondary schools in 2007. The policy envisions a “well-educated and learning knowledge society” and hopes to achieve this goal by integrating ICT to enhance access, equity, quality, and relevance of basic education (MoEVT 2007:2). Teachers are required to have Technological Pedagogical Content Knowledge (TPCK) to master the teaching of the competence-based curriculum. By commissioning the TIE to develop this highly ambitious ICT curriculum, the government of Tanzania emphasized the importance of ICT in assisting learning and teaching in the classroom. The latest National ICT Policy for Tanzania from 2016 reiterates the government’s commitment

“to transform Tanzania into an information-rich knowledge-based society and economy, to ensure that Tanzania and its people fully participate in the information age and enjoy the social, cultural and economic benefits of the emerging information revolution” (Tanzania Ministry of Works, Transport and Communication 2016:44).

While the empowering effect of education is widely recognized and significant progress has been made towards *Education for All* in Tanzania, the country still faces many unresolved issues regarding the quality of education. Possible reasons for this are discussed in the following sections. Also, potential solutions and recommendations are derived and explored further.

### **2.3.2 Educational challenges in Tanzania**

While there have been quite impressive quantitative achievements in Tanzania, such as the increase of the gross enrollment rate in primary schools from 34% in 1970 to 94% in 2018 (World Bank 2022), key challenges remain in providing or maintaining *quality education*. Tanzania’s Multidimensional Poverty Index (MPI) of 0.273 in 2016 is still relatively high and education contributes 22.9% to the deprivation according to the latest Tanzania Human Development Report 2020 (UNDP 2020:7). Despite significant investment in ‘Education for All’ and UPE, assessments of educational outcomes in Tanzania show that learning outcomes remain low relative to expectations.

Weak infrastructure, such as lack of classrooms, desks, electricity, learning and teaching materials, hinders children’s development through quality education in Tanzania. While these infrastructure problems can be solved with adequate investment funding, the shortage of teachers is imminent. UPE has



confronted teachers with higher pupil-teacher ratios and a greater diversity of learners. “Teaching and learning have definitely been compromised by large classes and a shortage of teachers” (Sifuna 2007:696), often resulting in overcrowded classrooms with up to 100 pupils per teacher. As Tanzania continues to industrialize, the demand for educated youth will increase. New job opportunities will prevent young people from becoming teachers in rural areas, where demographic trends are leading to a rapidly growing young population with a high demand for more teachers. It is therefore to be expected that the teacher scarcity in rural Tanzania will not disappear over the next two to three decades – a major obstacle to high-quality education. This persistent shortage of teachers and the overcrowded classrooms in rural Tanzania often lead to a monologue teaching style with children chorusing responses, which disempowers children and prevents them from self-determined, interactive learning, and self-expression.

“The curriculum tends to encourage dependency on rote learning and memorization, instead of nurturing children’s practical life skills, resilience, creativity, talents and other non-cognitive and social skills. [...] Children in rural and remote areas are particularly affected by the scarcity of resources, with internet connectivity and the digital divide exposing even further the marginalization of Africa’s learners” (IICBA 2016:21).

### **2.3.3 Cultural influences on education in Tanzania**

Education and school learning do not exist in isolation – schools are locally situated within a wider cultural context. Learning and thinking are always situated in a cultural setting (Bruner 1996:4). According to Bruner, “education is a major embodiment of a culture’s way of life, not just a preparation for it” (1996:13). Consequently, it is important to take cultural influences into account about the way teachers teach and children learn.

One of the most important cultural dimensions shaping human behaviour and cultural differences is the dimension of individualism versus collectivism, where Tanzania has a relatively low Individualism Index Value, especially compared to countries in Northern Europe like Germany (Hofstede, Hofstede & Minkov 2010:97). The collectivistic culture is most evident in the rural areas of Tanzania. As a consequence of that, there are major differences in the way people learn and how they perceive education as a whole. Individualistic

societies, such as Germany, aim to prepare the individual for an independent, self-determined role in society, learning to cope with new, unknown, unforeseen situations, that the individual is expected to manage. The purpose of learning is to develop the personality, to be empowered to pursue personal goals, and to know how to learn, assuming that learning in life never ends, even after school and college (2010:118). In contrast, collectivist societies, such as Tanzania, “stress on adaptation to the skills and virtues necessary to be an acceptable group member” where “learning is seen as a one-off process reserved for young people, who need to learn how to do things in order to participate in society” (2010:118). The shame-orientation of collectivist cultures seeks to avoid loss of face at all costs and promotes a learning style in the crowd rather than self-reliant, independent learning. Putting pupils on the spot by directing straight questions to individual students can lead to a loss of face. Students will avoid the risk and may refuse to answer (Käser 1997:159).

Power distance is another important cultural dimension that influences teaching styles. Tanzania is a hierarchical culture with high power distance. Children grow up subordinate to their parents within the family hierarchy. This inequality “is perpetuated by the teacher-student inequality that meets the need for dependency that is firmly embedded in the student's consciousness. Teachers are treated with respect or even fear” (Hofstede, Hofstede & Minkov 2010:69). Hofstede concludes that the child’s mental programming is further developed at school. “In the classroom, there is supposed to be a strict order, with the teacher initiating all communication. Students in class speak up only when invited to. Teachers are never publicly contradicted or criticized” (2010:69). Children are often discouraged from asking questions or expressing their own opinions. However, Meyer speaks of “dual responsibility” in hierarchical cultures: “The leader’s responsibility for caring and teaching is just as strong as the follower’s responsibility to defer and follow directions” (Meyer 2014:132). Authority is derived from the leaders' ability to set themselves clearly apart (2014:122). This situation is the opposite in low-power-distance, egalitarian cultures, where an aura of authority comes from exemplary acting like one of the team (2014:122). The educational process is student-centered and encourages student initiative, critical thinking,

questioning, and arguing with the teacher. Students are expected to become independent of their teachers through education.

It can be argued that several typical interactional patterns in Tanzania such as frontal instructions and pupils' responses in chorus are the result of safety strategies of teachers and students "developed with the aim to save the face of teachers / pupils and to create an image of successful teaching / learning" (Wedin 2005:581). Both teachers and students struggle with the conditions they usually find in schools in rural Tanzania. Frontal teaching with chanting-like interaction of call-response type, where teachers encourage children's chorusing, is also the result of a reality of one teacher dealing with 80 or more children at a time. Lessons often follow a common form and homogeneous pattern of lecture, repetition, exercises, and correction.

"Pupils learn to obey teachers, as they would elders at home, at any cost. Official curricula and textbooks are highly normative and prescriptive and neither teachers' nor pupils' own initiatives are encouraged. [...] Teachers and pupils in co-operation managed to create an image of successful teaching and learning by using safe-talk and in the same time hiding the fact that not much learning was taking place" (Wedin 2004:143-144).

Wedin argues that students are socialized into a specific type of classroom interaction and are expected to understand this interaction pattern rather than cognitive learning (Wedin 2004:146). "One-way interaction with teacher initiative is used, which is not pupil sensitive. Teaching does not start from pupils' pre-knowledge" (2004:152). One result of this is that students are often able to memorize and repeat what is requested in the official curricula, but their cognitive understanding seems to be very poor. In this sense, "safety strategies play an important role, creating an image of successful teaching. Hiding failure becomes built into the system" (2004:159).

## **2.4 TECHNOLOGY-ENHANCED LEARNING TO IMPROVE EDUCATIONAL QUALITY**

### **2.4.1 The role of technology-based learning for education quality**

#### ***2.4.1.1 The importance of Information and Communication Technologies for Education (ICT4E)***

New innovative solutions are needed to mitigate the impact of teacher scarcity and to empower children to critical thinking and creative discovery. Technology-based learning has been frequently proposed to improve learning in and outside of the classroom. The Millennium Development Goal MDG 8 aims to make available the benefits of new technologies, especially Information and Communication Technology (ICT). Since then, ICT has become central to the development agenda to eliminate poverty (Unwin 2009:14). Children's experiences with technology and new interactive media are increasingly part of their life context and will continue to shape the world in which young children are developing and learning (NAEYC 2012:2-5). ICT also plays a catalytic role as a medium of knowledge and information helping to meet the growing need for skilled people in science and technology (Ng'ambi 2006:4). Consequently, one of the indicators of the Sustainable Development Goal on 'quality education' (SDG 4, Indicator 4.4.1) underscores the importance of ICT by measuring the "proportion of youth and adults with information and communication technology (ICT) skills" (UN 2015). The British Educational Communications and Technology Agency (BECTA) illustrates the role of technology as a "critical enabler of educational change" in the UK:

"Statistical links between the use of technology and learning outcomes have been identified in an increasing body of evidence, ranging from studies of home use of ICT by learners, to studies of the impact of specific technologies on learning, and analysis of the relationship between the development of school e-maturity and school improvement" (BECTA 2007:13).

The BECTA survey confirms the rapidly increasing availability of Information and Communication Technologies for Education (ICT4E), particularly equipment like laptops and interactive whiteboards, as well as the improved access and reliability of internet connectivity in schools. Such investment increases the organizational e-maturity, defined as "capability of

institutions to resource, lead and manage technology-related change and to develop a workforce to utilize technology effectively to deliver technology-supported learning across the curriculum” (BECTA 2007:14). New digital technologies enable teachers to find culturally and developmentally appropriate content including stories, games, music, and activities for every child that support active and conversational learning, exploration, and self-expression (NAEYC 2012:9). Selinger concludes that

“ICT has the potential for leapfrogging in development countries to accelerate the development of both the young and the adult generations, to empower them to access and use information, which was for long a barrier, to learn faster and eventually to stimulate local entrepreneurship for the benefit of their local communities” (Selinger 2009:242).

Significant progress can be observed in the East African Community in the endeavor to incorporate ICT into schools and school management systems (Hennessy & Onguko 2010:96). These investments in the ICT4E infrastructure are accompanied by high hopes, as stated by the Ministry of Education and Vocational Training in Tanzania (MoEVT) in its ICT Policy for Basic Education:

“The integration of ICT in education will empower learners, teachers, educators, managers, and leaders to use ICT judiciously and effectively for expanding learning opportunities and ensuring educational quality and relevance” (MoEVT 2007:2).

#### **2.4.1.2 Gaps in the ICT4E literature**

Despite this growth of Information and Communication Technologies for Education (ICT4E), publications remain vague in defining which technologies should be implemented and how. It is largely undefined to what extent ICT4E can foster the UN SDG 4. The BECTA survey indicates a positive impact of technology use on the motivation and attainment of students, if (and only if) the related technologies are properly embedded into learning and teaching practices (BECTA 2007:9). In this case, scores for student satisfaction and learner engagement can increase considerably. Sangra and Gonzales-Sanmamed examined how ICT contributes to the development of teaching and learning processes. While the study confirms that “ICT is facilitating learning because it helps to create better learning conditions by raising and promoting students’ attention skills” (Sangra & Gonzales-Sanmamed

2010:214), it also points to the neglected value of ICT for collaborative learning, which is unexploited in a teacher-centered learning environment (2010:215). The eLearning Africa Report illustrates that the biggest motivations to use ICT-enhanced learning are “to improve quality of teaching”, “to develop 21<sup>st</sup> century skills”, “to improve access of education in remote areas” and “to promote creativity and critical thinking” (eLearning Africa 2012:17).

While there are many papers reviewing the *problem* of successful ICT4E integration in depth (e.g. Barakabitze 2014:88-92; Brunello 2010:232; Hennessy, Harrison & Wamakote 2010:41-43; Hennessy & Onguko 2010:98; IDB 2012:28; Kraemer, Dedrick & Sharma 2009:70), there is only little writing about successful, field-proven technology-powered *solutions*. Transparent data on ICT infrastructure levels and the use of ICT in schools in Tanzania is missing (Wamakote 2010:24). The impact of ICT4E on child empowerment, liberating pedagogy, self-expression, and self-motivated learning appears to be largely unexplored in rural Africa, particularly Sub-Saharan Africa (SSA). As a result, there is a lack of broad consensus on best practices for ICT4E in such contexts.

#### **2.4.1.3 New pedagogical concepts in technology-enhanced learning**

New innovative solutions may focus not only on technological innovation but also on new pedagogical concepts. *Self-Organizing Learning Environments (SOLE)* have emerged as a learning setup designed to support self-directed education. One of the pioneers of SOLE, Sugata Mitra, emphasizes the “spontaneous order” where “learning comes from the inside”. In self-organizing systems “learning is an emergent phenomenon, therefore you cannot make it happen. You can set the stage and allow it to come, when it will” (Mitra 2006). *Minimally Invasive Education (MIE)* is a pedagogy that implies that learners work in self-organizing groups, have access to adequate resources, and little or no adult supervision (Mitra 2021:139). The learning method used by MIE draws on the expertise of peers, siblings, and friends. Each learner is both a learner and a trainer (2021:148). MIE fosters learning by exploration in Self-Organizing Learning Environments. Information and communication technologies for education (ICT4E) play a critical role in

SOLE, especially in light of the ongoing teacher scarcity in rural Africa. Given this particular relevance to the research problem of this thesis, SOLE and MIE will be elaborated in more detail later.

ICT4E and its positive impact on learner-centered education and access to learning materials has become an increasingly important research topic over the past two decades. There seems to be a broad consensus that education can be improved through technology and that “ICT assists in transforming a teaching environment into a learner-centered one” (Barakabitze 2014:83). Access to ICT resources in schools has raised many hopes as an effective tool to support teaching and learning in classroom practice (Hennessy, Harrison & Wamakote 2010:41). And “the impact is greatest where ICT is an integral and embedded part of the day-to-day learning experience” (BECTA 2007:13). Cavallo et al. describe how participatory, problem-based approaches with “use of technology in innovative ways” improve the learning environment and transform students into agents of positive change who critically engage with their community (Cavallo et al. 2004:2). Schools are to be transformed into “active learning environments” open to their communities and be starting points for rural transformation, where teachers and students are empowered to be creative agents for change and where leaders embrace a vision that will prepare their youth for the challenges of tomorrow (Hawkins 2002:43). However, Rubagiza, Were and Sutherland point out that

“a techno-centric perspective is often accompanied by what has been called a techno-utopian perspective, that is, a belief that digital technology will ‘almost inevitably’ increase personal freedom and capacities. Whereas technology can be used to transform human activity people have to learn to use it in a transformative way” (Rubagiza, Were & Sutherland 2011:39)

#### **2.4.1.4 Empowering digital learning**

Although the transformative power of ICT4E is widely recognized by key development actors, very little research has been published on *how* to design an empowering digital learning system in the context of rural Africa. An important study was published in 2015 by the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE), which concluded on 13 conditions for successful technology-enabled learning (Henderson 2015:137). These conditions relate to technical infrastructure and institutions,

educators and their use of digital technologies to support learning, as well as learners and their preferences, and whether they recognize and value the benefits of technology-enabled practices. The study emphasizes the long-term impact of technology-enhanced learning, highlighting the value of a culture of seed funding and grassroots development. Acceptance of failure is a legitimate process of changing practice (2015:140). While the results of the study cannot be simply applied to primary schools they give some indication of the conditions and benefits of technology-based learning in general. Another relevant paper is centered around the implementation and evaluation of ICT-based collaborative professional development programs in Rwanda. The Rwandan government envisions ICT as a key tool for transforming the economy, with an emphasis on the education sector to provide the necessary human resources (Rubagiza, Were and Sutherland 2011:37). The New Partnership for Africa's Development (NEPAD) E-School Initiative is aiming to provide ICT equipment such as computers and internet access to all schools in member nations within the NEPAD program and to “harness ICT technology for the improvement of the quality of teaching and learning in African primary and secondary schools” (2011:42). The analysis highlights that providing schools with ICT equipment and resources is “a starting point in a process of empowering young people to learn to use ICTs in a transformative way” (2011:43). However, the focus is not on mere access to technology but rather on “meaningful use of technology” (2011:40). Providing equipment is insufficient to promote educational change (Hennessy & Onguko 2010:96). ICT4E pioneers like Salman Khan stress the fact that the key question is *how* the technology is used.

“It’s not enough to put a bunch of computers and smartboards into classrooms. The idea is to integrate the technology into how we teach and learn; without meaningful and imaginative integration, technology in the classroom could turn out to be just one more very expensive gimmick” (Khan 2012:122).

What is important from an educational perspective is how young people transform access to ICT resources into ICT capabilities, enabling them to become full participants in the social, cultural and political future of the society (Rubagiza, Were & Sutherland 2011:43). Rubagiza, Were and Sutherland conclude that to develop the idea of an ICT capability set for young people,



the young people themselves should be consulted first. This can lead to a more playful and experimental way of using ICT in school. Usability aspects are central from the beginning in any human-machine-interaction design and cannot be retrofitted into a design later in the development cycle. Successful and meaningful interaction begins with simple and intuitive interfaces (Adebesin, Kotze & Gelderblom 2010:12). But only a few studies exist on usability evaluation of ICT devices and applications deployed specifically to narrow the digital divide (2010:5). And there appears to be no specific research focusing on implementation details or best practices for self-determined, minimally invasive education (MIE) in rural Tanzania. There are only a few implementations of e-learning in rural schools. And where there are, systematic assessments of their effect on children's empowerment and development seem to be lacking.

To summarize the literature review on the role of technology-enhanced learning in rural Tanzania, the *why* is clear and widely acknowledged, but the *how* is a big open question mark where only vague ideas exist. Consequently, Hennessy and Onguko conclude: "It is crucial for technologies to be integrated across the curriculum, and research into the optimal ways to achieve this integration in the East African context is sorely needed" (2010:99). This call for action is reiterated by the National Association for the Education of Young Children (NAEYC):

"Research-based evidence about what constitutes quality technology and interactive media for young children is needed to guide policy and inform practice and to ensure that technology and media tools are used in effective, engaging, and appropriate ways" (NAEYC 2012:11).

## **2.4.2 Major inhibitors for ICT4E**

### ***2.4.2.1 Ineffective implementations***

It's been pointed out already that the goal of Information and Communication Technology for Education (ICT4E) cannot be mere access to technology but rather the meaningful use of technology. The mere availability of information and communication technologies does not constitute any educational benefit. On the contrary, if poorly implemented and used, these technologies can turn the children into passive recipients of content, resulting in harmful and

disempowering habits (Leipner 2020:17). In his critique about the digital education in Germany, Leipner emphasizes that studies have shown that ICT4E is rated negatively when the technology does not support an interactive dialogue between pupils and teachers and when there is limited or no feedback from teachers through the system. A survey commissioned by the British Educational Communications and Technology Agency (BECTA) reveals that ICT usage in the UK is still largely focused on whole-class activities, display technologies, and information gathering (Kitchen, Finch & Sinclair 2007:9; BECTA 2007:15). Only a few teachers use ICT in lessons to foster creativity and collaboration (BECTA 2007:6). Three-quarters of teachers in the BECTA survey report they rarely or never use technology to support learners working together (2007:10). The use of technology to support curriculum-based learning in school often gives learners a passive role, which represents a less compelling experience compared to what pupils are used from communication technologies outside of formal education on their smartphones. “The focus needs to be on the development and transformation of learning and teaching for the 21<sup>st</sup> century” (2007:15). ICT4E that challenges the established teaching styles, where technology promotes independent and personalized learning, is still in its early stage, although being on the watch list for the coming years (Kitchen, Finch & Sinclair 2007:6). Learning platforms are still mostly used to push resources to learners rather than to allow learners to explore on their own (BECTA 2007:9). Adopting technology which requires cultural change is difficult.

“Delivering change to ensure that technology supports the extension and empowering of learning, as well as enhancing and enriching it, is challenging. For this reason, demonstrating transparent benefits from related technologies, and bridging the ‘natural’ use of technologies that support current practice with use that challenges current practice, are likely to be important strategies to deliver change” (BECTA 2007:12).

#### **2.4.2.2 Technical barriers**

Many schools, especially in the global South, are still struggling with technical barriers and technology-related challenges ranging from lack of adequate technical support to internet connectivity that does not meet all communication requirements, or a missing linkage between learning platforms

and school management information systems (BECTA 2007:14). Many more inhibitors for ICT4E in African schools can be found in the literature, including the lack of electricity and frequent power cuts, poor technology infrastructure, affordability of ICT technology, low bandwidth, costly internet connectivity, lack of contextually appropriate content, resistance from teachers, cultural issues, lack of ICT literacy, lack of technology leadership, sustainability issues such as lack of support and maintenance for digital equipment, and more (e.g. Barakabitze 2014:88-92; Hennessy & Onguko 2010:97-99). Sustainability issues of ICT4E projects are further elaborated by Brunello, who defines sustainability as “the permanence of a flow of benefits within the system after the development project has ended and the external funding is extinguished” (Brunello 2010:235). Investment in local capacity building is mandatory for ICT to be picked up and used effectively by teachers coming from a technologically sparse environment (2010:236).

#### **2.4.2.3 Usability concerns**

There is a growing concern that ongoing crises like COVID-19 will widen the digital divide in education between those with access to technology and those without (eLearning Africa 2020:4). But as noted above, effective ICT4E is more than access to technology. Technology does not deliver benefits automatically (BECTA 2007:13). A „digital divide is marked not only by physical access to computers and connectivity but also by access to the additional resources that allow people to use the technology well” (Warschauer 2002:6). Consequently, Warschauer advocates for “Technology for Social Inclusion” (2002:7) rather than mere access to ICT equipment. Adebessin, Kotze and Gelderblom also stress the importance of usability in bridging the digital divide, especially when the target user groups are inexperienced and underserved. Complex ICT interfaces can make it impossible for novice users to access content. “Inadequate design decisions by developers could negatively impact these user groups’ ability to take advantage of the potential social and economic benefits of new technologies” (Adebessin, Kotze & Gelderblom 2010:16). Another aspect is raised by Unwin: the wasteful lack of coordination between many different, often small scale ICT4E initiatives across Africa results in a frequent duplication of effort and

lessons are not sufficiently learned and shared (Unwin quoted in: Hennessy & Onguko 2010:97).

### **2.4.3 The role of teachers in ICT4E environments**

UNESCO emphasizes ICT4E and its important role in the teacher development strategy, particularly in Sub-Saharan Africa (IICBA 2016:15). Teachers' enthusiasm for technology cannot be taken for granted as "teachers will often be reluctant or fearful of new technologies, especially if the children show a greater aptitude for it" (Camfield, Kobulsky & Paris 2007:28). There is a great need for teacher training. "ICTs may be used to facilitate learning activities but their introduction needs to go hand-in-hand with teacher development that gives teachers and teacher educators the opportunity to experiment with the new technology outside of and then within the classroom" (Barrett & Tikly 2012:27). "The concept of e-learning integration into an educational system begins with the teacher and the way teachers teach" (Olson et al. 2011:2). Olson advocates a grassroots approach that promotes teacher networking and local communities of practice among teachers (2011:3). Teachers in Tanzania need to learn how to use technology *and* how to teach with technology. Both ICT and pedagogical skills need to be acquired (2011:38). When teaching and learning with ICT, the existing "chalk and talk" practice in Tanzanian schools can be replaced by new pedagogical principles that support knowledge construction, learning by doing, conversing, reflecting and exploring (2011:4) in a learner-centered environment. "Teachers need to be able to transform their classrooms from places where a static one-way flow of information from teacher to student occurs, into dynamic, student-centered learning environments in which learners interact with peers in teams" (Hawkins 2002:42). ICT plays a transformative role in enabling such new practices (Ng'ambi 2006:14). The empowering effect of ICT stimulating a new didactic style in Tanzanian schools is recognized but Ng'ambi also stresses the fact that the way teachers teach has remained largely unchanged and changing the traditional role of teachers as a source of information to facilitators of learning is yet to happen (2006:20). This observation is affirmed by the World Links for Development Program sponsored by the World Bank,

complaining about our “changed world with unchanged classrooms”. “While much has changed by the advances of science and technology, education and the way students learn and teachers teach have remained largely unchanged” (Hawkins 2002:38). The program emphasizes the importance of ‘information reasoning’ as a key aim of education, a process in which reliable sources of information are identified, effectively accessed, understood, contextualized, and communicated to colleagues (2002:38). While computer literacy represents a start, it is the integration of ICT into the wider curriculum where the real learning gains will be made (2002:41). A joint research team from the University of Cambridge and the Institute for Educational Development in East Africa concludes that ICT4E has the potential to revolutionize the quality of subject teaching and learning by modelling an interactive and participatory pedagogy (Hennessy, Harrison & Wamakote 2010:48). This holds only if digital learning is carefully integrated into the classroom setting.

“Learning is enhanced when teachers analyse and understand the potentialities of different ICT tools as they relate to the practices and purposes of their subject teaching and when these tools are deployed appropriately for their students. The teacher’s role, at best, involves a complex shifting of perspectives from the ‘more-knowledgeable-other’ to the ‘co-constructor of knowledge’ to the ‘vicarious participant’. Effective teachers orchestrate the use of ICT, the interactions around it, and their own interventions” (Sutherland, Robertson & John 2009:6).

Rather than teaching ICT as an isolated, theoretical subject in school (like in Tanzania), subject teachers should be trained to integrate ICT into learning in their areas. A “key message here is that teacher education is an absolutely essential area for development in East Africa if ICT use is ever to effectively support learning” (Hennessy & Onguko 2010:99). Changes in the role of the teachers and their teaching styles are an integral part of ICT4E (Hennessy, Harrison & Wamakote 2010:45), a theme which is often repeated in the ICT4E literature. Barakabitze concludes that “in order for any education policy or innovations to be successfully implemented it needs to be accepted by teachers” (Barakabitze 2014:92). Technology-enhanced learning will change the role of the teacher from an instructor (that portrays and delivers knowledge) to a facilitator of children’s self-determined and self-motivated learning. A study about requirements for teacher professional development in

Tanzania highlights the importance of on-the-job coaching and mentoring (Komba & Nkumbi 2008:70). Professional development has a significant impact on teacher's motivation. Teacher responses in the study illustrate that professional assistance has helped them to learn participatory methods of teaching and problem-solving methods according to the local environment (2008:76). The goal is that students and teachers will learn together and from each other. The teacher acts as an advisor who provides guidance and insights, helping the student to develop new ideas and approaches (Mayer 2021:4).

#### **2.4.4 Educational concepts for digital learning**

##### **2.4.4.1 *Self-Organizing Learning Environments (SOLE) promoting Minimally Invasive Education (MIE)***

The previous section has outlined how the role of the teacher is changing from an instructor to a facilitator of self-determined learning in ICT4E environments. Concepts for *Self-Organizing Learning Environments (SOLE)* go even further and suggest completely eliminating or at least limiting adult intervention in the learning process. This idea of learning without a teacher (or at least with highly limited teacher involvement) is particularly relevant in the context of rural Tanzania where the scarcity of teachers is acute. The concept has been implemented for example in the *One Laptop Per Child* project, which envisioned to provide an own laptop equipped with learning content and programs for every child on earth. We will review this project in more depth in the following section. Also, the *Whole in the Wall* project of Prof. Mitra in India and the *Digital Doorway* project in South Africa emphasize the concept of *Minimally Invasive Education (MIE)*, advocating a self-determined and unsupervised learning process among groups of children enabled through digital information technology. Mitra claims that "if given appropriate access, connectivity and content, groups of children can learn to operate and use computers and the Internet to achieve a specified set of the objectives of primary education, with none or minimal intervention from adults" (Mitra 2021:135). It is important to note that MIE does not undermine the role of the teacher. It does not replace teachers, but rather empowers them (Mitra

2021:71). The role of the teacher in MIE changes to that of a facilitator (SRI 2014:5) or a guide. “You go there, I will go with you” should become the new self-understanding of teachers in MIE (Mitra 2020a:30). The key task of a teacher is not to provide content, because the content is already there through ICT. Teachers should rather pose the right questions (Mitra 2006:14). And these questions need to be meaningful and interesting. ‘Big questions’ (Mitra 2020b:298) and age-specific questions (Mitra 2020a:32) are a central part of the SOLE pedagogy. Such self-directed learning generates independent thinking and shifts the emphasis from teaching solutions to teaching how to find a solution in a given context. This enables students to develop the skills needed to identify and solve problems on their own in practice (Mayer 2021:3). Or, as Mayer provocatively states: “If you can’t teach yourself, no one can” (2021:1).

#### **2.4.4.2 Dialogic interactivity powered by ICT technologies**

‘Minimally invasive’ does not mean ‘learning in isolation’. The concept of interaction with other people and with technology is central to any successful implementation of MIE. According to Barrett and Tikly, “research in Africa consistently highlights the need for pupils to be engaged in more cognitively demanding activities in lessons as opposed to spending the majority of lesson time listening to teacher-explanations punctuated by limited responses to teacher questions” (Barrett and Tikly 2012:26). This confirms the relevance of interactive learning in the African context. Kennewell et al. highlight the importance of active participation of pupils influencing the course of activity to improve learning (Kennewell et al. 2007:14). Different categories of interactivity can be distinguished depending on the nature of the teacher-student interaction (Beauchamp & Kennewell 2010). The level of interactivity ranges from teacher-led ‘*authoritative interaction*’, where students react to a limited choice of options prepared by the teacher, to ‘*dialogic interaction*’, where student ideas influence the course of activity and the teacher only provides an outline of the structure. Other forms of interactivity are ‘*dialectic interaction*’, where the teacher proactively considers student ideas, and ‘*synergistic interaction*’, where structure and information are collectively contributed and reflected by teachers and students. The use of ICT can foster

interactivity but technology alone does not automatically generate more dialogic interactivity (Kennewell et al. 2007:20). A significant portion of the related research has focused on analyzing the impact of interactive whiteboards in whole-class teaching. When an interactive whiteboard or a video projector is used as presentation technology only, where the teacher displays slide presentations or pre-loaded web content, the interaction is authoritative. All structures and information are provided by the teacher. In dialogic interaction, which allows creative thinking and exploring, ICT technology is used as a tool through which to interact (Beauchamp & Kennewell 2010:8), fostering student ideas to be explored and jointly thought through. Beauchamp and Kennewell conclude that “individual work with ICT resources is likely to become an important element of the movement for more learner influence over what is learned and how it is learned” (2010:10). Actually, ICT supports dialogic teaching by providing affordances for learner interaction (Kennewell et al. 2007:15). Pupils see particular value in ICT when the technology provides clear information and rapid feedback or supports participation and fun, such as games and quizzes (2007:19). Since dialogic interactivity is a key factor in improving learning and attainment, the development of technology-enhanced learning platforms should primarily focus on improving affordances for dialogic interaction (2007:22).

## **2.4.5 Lessons learned from existing e-learning projects**

### **2.4.5.1 A critical assessment of OLPC**

Several prominent ICT4E projects have introduced technology-enhanced learning in different countries of the global South. Controversial reviews can be found in the academic literature. The *One Laptop per Child (OLPC)* program was initiated by Prof. Nicholas Negroponte of the Massachusetts Institute of Technology (MIT) in 2005. The organization claims that since its inception, OLPC has provided more than three million educational laptops to children around the world, particularly in Rwanda, Peru and Uruguay, delivering “an educational ecosystem to create innovative learning experiences which enable children around the world to build their knowledge and encourage individual empowerment” (OLPC 2022). Based on Seymour



Papert's constructivist model of educational development, OLPC assumed that the mass distribution of educational laptops fundamentally challenges existing theories of education. Children are "learning to learn" and "learning by playing" (Camfield, Kobulsky & Paris 2007:21). OLPC implemented a top-down approach seeking large-scale purchases of laptops through the UN or national governments, with a minimum order of one million laptops. OLPC states five core principles (Cristia et al. 2012:6):

1. Children are the owners of the laptops
2. Beneficiary children are aged 6 to 12
3. Every child and every teacher receives a laptop
4. All laptops are connected to the Internet
5. Software is open source and free

These principles deserve a critical review as principles 1, 3 and 4 are fundamentally different from the approach taken in this thesis, where non-proprietary tablets are owned by the schools and the digital learning system works without the Internet. While OLPC managed to stimulate a lot of technological innovation for ICT4E, its proprietary hardware approach injected a potential threat to the electronics industry in emerging markets. Laptop and chipset manufacturers reacted and introduced competitive solutions such as the Intel ClassMate, the AMD PIC system, or entry-level laptops from Quanta and Dell. Ultimately, OLPC failed to deliver on its major promise of a 100\$-laptop and drastically lost momentum during the past decade (Kraemer, Dedrick & Sharma 2009).

"The OLPC vision is supportive of student-centric, constructivist learning, where the student learns by self-exploration instead of lecture. While this is generally supported as an ideal pedagogical method, the extremes to which OLPC pushes it ignores some important points in educational and institutional constraints faced by teachers in developing countries" (Camfield, Kobulsky & Paris 2007:23).

Key reasons for OLPC's failure include the following items:

- its top-down approach which failed to involve teacher representatives at all stages of decision-making, planning and implementation
- its persistent resistance to pilot projects in individual schools before committing to a large-scale project

- its technocratic educational paradigm which assumes that the mere presence of educational laptops will enable student's joyful self-empowered learning

A large-scale randomized evaluation of the OLPC program in Peru revealed that, while there was evidence of positive impacts on cognitive skills and competencies related to computer use, the results indicated limited effects on academic achievement (such as Mathematics or languages), reading habits, school attendance, and time spent on homework (Cristia et al. 2012:20).

#### **2.4.5.2 A critical assessment of the *Hole in the Wall* project**

Unlike OLPC, the *Hole in the Wall* project, which started in a slum in Delhi (Mitra 2003:367), builds upon the premise of Self-Organizing Learning Environments (SOLE) in a public space rather than in schools. As explained earlier, this concept emphasizes teamwork in fluid groups of children using large screens in public kiosks rather than individual laptops or tablets (Mitra 2006:11, 2020a:7). The underlying MIE principle assumes that “children do not need to be taught – they can learn by themselves” (Mitra 2006:135). The concept promotes self-motivation and self-determined learning in the age of information technology when ‘knowing’ and memorizing become obsolete (Mitra 2020a:48). The *Hole in the Wall* project has shown that over time, children moved from games to communication with others, to searching for information (Selinger 2009:233). Mitra’s *School in the Cloud* project analyzed how the transition occurred from reading, writing, and arithmetic in traditional schools to comprehension, communication, and computing in the digital age (Mitra 2020a:140).

“In order to prepare children to take the right actions in life, they need knowledge of the past that they can use, and they need the ability to imagine a future. Then they need to combine the two inputs – from the past and the future – and choose the right action. Then they will write their own reality. This is education” (Mitra 2020a:171).

The concepts of SOLE and MIE have been discussed in detail in the previous section as they are central to the theoretical background of this thesis. But here, unlike the *Hole in the Wall* project, these concepts are being piloted and investigated in a school context rather than in a public space. As

we will see in Chapter 5, it can be argued if the concept of MIE really fits all contexts. While some of the academically stronger students strongly endorsed the independence they get through MIE, other pupils of the focus groups highlighted their desire for teacher guidance. This raises a concern about the applicability of the MIE concept. We will conclude on this question in Chapter 6.

#### **2.4.5.3 The Digital Doorway project**

Inspired by the *Hole in the Wall* and the *School in the Cloud* projects a similar initiative called *Digital Doorway* has been launched jointly by the Department of Science and Technology (DST) and the CSIR Meraka Institute in South Africa to enable new ways of unassisted learning by discovery (Digital Doorway 2022). This project confirms the relevance of MIE in South African education (Gush, Cambridge & Smith 2004:6). Children learn from each other and experiment by trial and error gaining knowledge and confidence at a rapid pace (Smith, Cambridge & Gush 2003:100). Stillman et al. illustrate that the Digital Doorway project is expected to be extended to a wider agenda of social and community development with economic impact by introducing *Living Labs* that foster collaboration for community building and community problem-solving (Stillman et al. 2010:6). Such socio-technology interventions empower the local community (2010:8). Children are encouraged to explore and become “catalysts and evangelists” in this environment (2010:14).

#### **2.4.5.4 E-learning approaches in Tanzania**

Economic benefits and societal impacts of e-learning are also elaborated in Olson’s analysis of e-learning impacts and best practices in Tanzania (Olson et al. 2011:19-25). According to Olson, e-learning is still in its infancy in Africa, often focused on small, experimental pilot projects with little documentation of impacts and lessons learned (2011:iii). However, Olson et al. (2011:iv-v) conclude that e-learning in Africa has the potential to:

- a) address the shortage of teachers by providing high-quality teaching materials such as videos and interactive software including quizzes and games
- b) address the shortage of learning materials

- c) promote 21<sup>st</sup> century skills such as critical thinking, problem-solving, communication, collaboration, and creativity
- d) foster students' information and communication technology skills

It is still difficult to determine the actual impact of e-learning programs because of the newness and diversity of such programs and because of the complexity of the factors affecting outcomes (2011:v). Olson et al. conclude in their executive summary that in Tanzania, a transformation of the educational system itself is needed to improve the quality of education. E-learning programs assist with this transformation (2011:vii). Research also suggests that e-learning approaches improve students' learning if and when more traditional teacher-centered teaching is blended with technology, and when technology encourages student interaction with content (2011:41).

#### **2.4.5.5 The importance of the Khan Academy**

One of the world's largest initiatives to provide free Open Educational Resources (OER) is the *Khan Academy*, a non-profit organization founded in 2006. It enables a self-paced, self-directed learning model by providing thousands of instructional videos linked to online exercises. Founder Salman Khan summarizes his mission statement as "providing free, world-class education for anyone, anywhere" (Khan 2012:7). "Students should be encouraged, at any stage of the learning process, to adopt an active stance toward their education. They shouldn't just take things in; they should figure things out" (2012:56). Children should learn to solve problems in new and creative ways and they should be given the freedom to determine where and when they learn. According to Khan, self-pacing is essential for active, self-motivated learning. A study conducted by SRI Education in 2014 revealed the positive impact of the *Khan Academy* on student's confidence and ability to learn independently at their own pace (SRI 2014:13), whether it is used to facilitate self-directed learning, small-group instruction, or teacher-led whole-class instruction in the classroom. In 2016, Manus Consulting published an evaluation report, which highlights the positive effect of tablet-based learning with *Khan Academy* on student's mathematical performance (Manus 2016:23). The significant effectiveness of tablet-based interventions on

improving mathematical attainments has also been confirmed in an evaluation study in Malawi, led by Prof. Pitchford of the University of Nottingham (Pitchford 2015). Outcomes were significant even after a short period of eight weeks using the e-learning system (Pitchford 2014:32). Due to its important role in self-motivated learning, the *Khan Academy* also plays a significant role in the empirical study of this thesis by providing access to its Math learning videos during the ten-week trial.

#### **2.4.5.6 Ubongo as major local OER initiative in Tanzania**

Another important collection of Open Educational Resources (OER) is provided by *Ubongo*, a non-profit social enterprise in Tanzania and one of Africa's leading producers of kids' 'edutainment'. *Ubongo's* vision is "to equip Africa's next generation with the educational foundation, critical skills, and positive mindsets to change their own lives and communities for the better" (Ubongo 2020:3) and help children in Africa to reach their potential (2020:15). *Ubongo* realizes this vision by engaging children through localized and multi-platform educational content. This includes TV and radio broadcasts, acknowledging that over 80% of learners in Africa do not have regular access to the internet (2020:29). *Ubongo* emphasizes local content in English and Kiswahili, localized cartoon characters, captivating storytelling, fun and music to empower children for their own lives and communities (2020:31). The positive influence of age-appropriate, culturally sensitive educational media on the cognitive, social and emotional development of young children has been observed in the context of *Kilimani Sesame*, a television program for children aged three to seven (Borzekowski & Macha 2010). This program was derived from a multimedia pilot project in Tanzania with *Sesame Street*, the most researched children's program worldwide. The impact of learning with *Ubongo Kids* videos on the mathematical capabilities of children in Tanzania has been researched by *EdTech Hub*, a global research partnership program. A cross-sectional analysis of over 38,000 Tanzanian children suggests that exposure to *Ubongo Kids* is positively and significantly related to mathematics capabilities. *Ubongo Kids* exposure was measured to be more impactful than an additional year in age (Watson, Hennessy & Vignoles 2020:646). Moreover, an additional cost-effectiveness analysis has shown a strong

performance of *Ubongo Kids*, predominantly attributable to its scale. The program achieves a high total impact at a low per-child cost (2020:652). Such cost-effectiveness results are unrealistic for programs that are not delivered through mass media. Another examination of the impact of educational cartoons on children in Tanzania is based on *Akili and Me*, a locally produced educational program from *Ubongo* that reflects the lives of young children in Africa through culturally relevant videos featuring African cartoons and music. This study provides robust evidence that exposure to *Akili and Me* significantly improves children's scores on drawing skills, shape knowledge, number recognition, counting, and English skills (Borzekowski 2018:57). This impact on early child development is measurable even after a relatively short intervention period of four weeks. The study illustrates the beneficial effects of video-assisted educational programs on vulnerable children in a low-income country like Tanzania when their social background matches that of the program's character and situation. A similar study in Tanzania in 2020 reaffirms the reliability of these findings, demonstrating the great impact of *Akili and Me* on literacy and numeracy skills and significant gains for the outcome of socio-emotional and health measures (Borzekowski et al. 2020:24). Given its recognized performance in Tanzania, the *Ubongo Kids* videos are also used to explore self-directed learning in the empirical study of this thesis.

#### **2.4.5.7 Other relevant Digital Libraries for Education**

Educational content is a focus area in the ICT4E literature. Meaningful content is essential to any ICT4E project. Open Educational Resources (OER) "can contribute to making education more equitable by supporting the assembly, creation and dissemination of high-quality reusable, affordable resources" (McGreal, Miao & Mishra 2016:3). Organizations like the Hewlett Foundation helped funding major OER initiatives. OER offers much more than just cost savings. "Well-designed, customizable, openly licensed materials can engage students and energize educators in ways that enable more responsive teaching and better learning" (Hewlett 2022). It is important to note that a lot of OER content and educational digital libraries are available for offline use, making knowledge available to people with no or limited Internet access. A

good example is *Kiwix*, an offline reader for online content such as *Wikimedia* including *Wikipedia*, *Project Gutenberg*, or *TED Talks*. The *Kiwix* software package as well as the content are free for everyone to use. Similarly, *Greenstone Digital Library Software* is a suite of open-source tools for building and distributing digital library collections, providing a way to organize and publish information either online or via offline media. A lot of universal OER content like *Khan Academy* or *Wikimedia* is available. However, a shortage of local language and contextually appropriate materials for African children is noted. Initiatives like *Ubongo* and *African Storybook* are trying to fill this gap, “to develop and refine the tools that make it possible for local schools, projects and community libraries to write, adapt, translate and print the local language stories they need for their literacy development activities and programmes” (Welch & Glennie 2016:209). Several designs of affordable Digital Libraries like *World Possible*, *SolarSPELL*, and *Offline-pedia* have emerged (Minniti, Salazar & Vega 2019:7). A broad range of OER can be found in the literature, ranging from universal to locally specific content, available online or as a download for offline use. It can be concluded that appropriate and contextually relevant content constitutes a prerequisite for any successful ICT4E project. Many digital libraries including *Khan Academy* and *Ubongo* are available under the ‘Creative Commons Non-Commercial License’ agreement, the most widely used open licensing framework for OER internationally.

#### **2.4.5.8 The importance of User Generated Content (UGC)**

In addition to such collections of digital libraries, which are available right from the start of an e-learning project, the digital learning system should be capable of allowing teachers to upload their own, user-generated content (UGC, e.g. teaching videos, pdf-documents related to the current topics, exercises, etc.) during the operation of the system. This ‘open system’ feature will not only promote the availability of relevant content but also improve teacher acceptance and buy-in to the concept of digital learning. In this context, Olson’s call for a grassroots approach fostering teacher networking and local communities of practice among teachers (Olson et al. 2011:3) is highly relevant. As teachers become accustomed to collecting and sharing

relevant learning materials, lesson plans, and teaching notes they will be able to network with other teachers, benefit from their experiences, and learn from each other.

“Any teacher-training program should help teachers see past the technology to the pedagogical and educational gains that use of the technology will bring to the classroom. Furthermore, teachers need to be transformed from information consumers, using the Internet to access resources, into information producers, adapting the information for their particular cultural and educational reality. Some countries have established online networks that enhance their curriculum, get peer reviews of lesson plans they have created, and exchange ideas and good practices with other teachers of their subject” (Hawkins 2002:42).

An example of such a network is the Global Learning Portal (GLP) funded by USAID and managed by the Academy for Educational Development (AED). GLP’s mission is to provide a connection for teachers and educational administrators around the world to collaborate and share educational materials (Camfield, Kobulsky & Paris 2007:16). The Global Learning Portal Network (GLPNet) is a free and easy-to-use website created for educators from around the world to access exemplary educational resources and services as part of the effort to improve global education and support the ‘Education for All’ initiatives (AED 2005). The GLP project was time-limited and expired in 2005, but it illustrated how a demand-driven, locally-generated project can provide relevant content produced dynamically by the community members (Camfield, Kobulsky & Paris 2007:20). A local community of practice among teachers from different schools is also a relevant theme for the e-learning projects associated with this thesis.

#### **2.4.6 The *RACHEL* e-learning system**

Rather than developing a new innovative digital learning system, an existing e-learning solution (*RACHEL* by *World Possible*) was tested and used in this study. *RACHEL* (Remote Area Community Hotspot for Education and Learning) is a portable, battery-powered server that contains offline copies of digital libraries, educational websites, and learning programs in offline format. *RACHEL* provides free access to offline content from Wikimedia (including offline Wikipedia), Khan Academy, Ubongo Kids, African Storybook, Project Gutenberg, TED Talks, SolarSPELL, OLPC, and more (see Figure 2.1). The



concept is based on an open-source architecture, allowing new modules and programs to be loaded over time. The system also allows teachers to upload their own localized content. As all content is copied to the local RACHEL server, there is no requirement for an Internet connection, which would be a huge burden for any rural school. Children access the content and learning apps with a tablet connected to the *RACHEL* Wi-Fi network. Technically, any smartphone, laptop, or other Wi-Fi-enabled device can access the *RACHEL* content as well.



Figure 2.1: *RACHEL* Content Libraries

This chapter has outlined how the Education for All (EFA) movement has raised concerns about educational quality, particularly in Sub-Saharan Africa (SSA) and more specifically in Tanzania. While the desire and the political will are there, the reality reveals many challenges in Tanzania's educational system. Teacher scarcity and the resulting limitations in classroom practices have been highlighted as a major concern in rural Africa. It has been outlined how technology-based learning can improve education quality and foster the empowerment and development of children in countries like Tanzania. In particular, Self-Organizing Learning Environments (SOLE) and the concept of Minimally Invasive Education (MIE) have been introduced and reviewed in the context of existing educational programs as these concepts play an important role in the empirical study of this thesis. As ICT4E changes some of the underlying pedagogical views and interaction patterns, the role of the teachers also changes and deserves special attention in order to understand teachers' perceptions during the empirical study. Finally, lessons learned from existing e-learning platforms and Digital Libraries for Education have been reviewed, especially as they relate to software modules that are leveraged in the digital learning platform used in this study.

After having set the framework for the impact of digital learning on child empowerment in rural Tanzania we will now delve deeper into the theoretical framework of this thesis.

## CHAPTER 3 – THEORETICAL FRAMEWORK

A solid understanding of the impact of digital learning on children's empowerment in rural Tanzania requires a holistic, multi-disciplinary theoretical framework. Consequently, the theoretical framework of this study is based on multiple concepts including the *Framework of Empowerment*, Amartya Sen's *Human Development Approach*, Paulo Freire's *Liberating Pedagogy of the Oppressed*, Jerome Bruner's *Culture of Education*, and the concept of *Educational Constructivism*. These concepts help to understand the impact of learning in general on children's empowerment and human development. They also put digital learning into a broader context. Situated at the interface between human development, information technologies, and new pedagogical concepts, this thesis requires a cross- and multi-disciplinary approach to make meaningful recommendations on how to improve digital learning to foster children's empowerment in rural Tanzania.

### 3.1 HUMAN DEVELOPMENT AND THE ROLE OF EDUCATION WITHIN THE FRAMEWORK OF EMPOWERMENT

The origin of the term *empowerment* is closely linked to the social scientist Julian Rappaport who defined empowerment as the "process by which people, organizations, and communities gain mastery over issues which are of concern to them" (Rappaport 1987). According to Rappaport, it is easier to characterize the absence of empowerment (e.g. being alienated, powerless, helpless) than define it positively, because empowerment "takes on a different form in different people and contexts" (Rappaport quoted in: Zimmermann 1990:169). Zimmermann explicitly includes 'skill development' as an important factor of empowerment, which illustrates the link between education and empowerment (Zimmermann 1990:174). The World Bank defines empowerment as the 'expansion of freedom of choice and action'. "It means increasing one's authority and control over the resources and decisions that affect one's life. As people exercise real choice, they gain increased control over their lives" (Narayan 2002:11). Education is critical for child empowerment by expanding their freedom of choice and their control over decisions concerning their life. Beyond control over resources and decision-

making processes, psychological empowerment includes the aim to discover one's identity and "the ability to trust in one's personal abilities in order to act with confidence" (Oladipo 2009:121). Strengthening self-confidence is particularly important in the context of children's empowerment and therefore, deserves special attention. Alsop characterizes empowerment as the enhancement of "an individual's or group's capacity to make purposive choice and transform that choice into desired outcomes" (Alsop 2007:120). She enhances this concept of "empowerment as an effective choice" based on "tackling the differences in capabilities that deny actors the ability to make transforming choices" (2007:121). Alsop also highlights the critical role of education for empowered people to participate effectively in local-level decision-making by leveraging new skills, confidence, and knowledge gained through formal education (2007:123). Education results in raised consciousness and better access to information allowing people to translate their assets into effective agency. Increased levels of education and self-confidence are both important assets and indicators for empowerment (2007:133).

This notion corresponds closely to the crucial role of education for human development in the *Capability Approach* (also called *Human Development Approach*) which puts the improvement of people's freedoms and capabilities as the central objective of development. According to the United Nations Development Programme (UNDP), human development is more than economic growth, it is all about choices, capabilities, and opportunities that are valuable to people's lives.

"Human development is all about people – expanding their freedoms, enlarging their choices, enhancing their capabilities and improving their opportunities. It is a process as well as an outcome. Economic growth and income are means to human development but not ends in themselves – because it is the richness of people's lives, not the richness of economies, that ultimately is valuable to people" (UNDP 2016:25).

Pioneers in this development theory were Amartya Sen and Martha Nussbaum. Nussbaum introduced a list of ten central human capabilities and defended these capabilities as moral entitlements of every human being (Nussbaum 2011:33-34). These ten capabilities are required to live a dignified life. "Control over one's environment" is one of them and is closely tied to the

notion of '*empowerment*'. People's freedoms and valuable opportunities (called: '*capabilities*') are at the center of the *Capability Approach*. The goal is that people are enabled "to lead the kind of lives they want to lead, to do what they want to do and to be the person they want to be" (Robeyns 2005:95). Human development focuses on the formation of human capabilities and the use of these capabilities. Capabilities include life expectancy, improved health, access to resources needed for a decent standard of living, guaranteed human rights, political freedom, and many more. The most important capabilities in the context of this thesis are knowledge and education. The UNDP *Human Development Report* publishes national levels of human development by leveraging the *Human Development Index (HDI)*. This index combines three major dimensions including '*Knowledge*', constituted in the *Education Index* (mean years of schooling and expected years of schooling). Nussbaum also lists "senses, imagination and thought" as central human capabilities, "cultivated by an adequate education" (Nussbaum 2009:7) and highlights the special importance of education for women's control over their environment (2009:9). "Education plays a fertile role opening up options of many kinds" (2009:12) fostering capabilities that help people to master their lives.

This illustrates how education, gaining mastery over one's life, human development, and children's empowerment are linked together. D'Alessandro and Dosa highlight the interconnection between empowerment and Information and Communication Technology (ICT) by stating that "child and family empowerment will be both the driving force and ultimate outcome of information sharing technologies" (D'Alessandro & Dosa 2001:1131). They observed the empowering effects of access to relevant patient information in the context of medical care. It can be transferred to other areas of life, including basic education with access to broad sets of content. The positive impact of education and ICT on the *Human Development Index HDI*, particularly in Africa, has been reported by Ng'ambi in the context of a university leaders' forum in South Africa, considering ICT readiness as a central component to increase human capacity (Ng'ambi 2006:12).

### 3.2 FREIRE'S "LIBERATING PEDAGOGY OF THE OPPRESSED"

Throughout history and across the globe education has been (mis-)used by the ruling classes to establish and maintain power structures and dependencies. Children and adolescents have been prepared for their role in society. For example, 'education for all' was introduced in Germany during the 19<sup>th</sup> century to impart the knowledge necessary for an increasing number of factory workers. Similar intentions can be identified in developing countries, where schools were established by the colonialists to cement oppressive power structures. For example, Kassam outlines in an article about Tanzania's educational philosophy (which was strongly influenced by Tanzania's first president Julius Nyerere) that "according to Nyerere, colonial education was based on the assumption of a colonialist and capitalist society, and was therefore designed to transmit the values of the colonizing power and to train individuals for the service of the colonial state" (Kassam 1994:3). In contrast, Nyerere called for an education for liberation and self-reliance, and a promotion of lifelong learning. This positive attitude towards education is still noticeable in Tanzania today.

One of the most foundational works on critical pedagogy in former colonies was published by the Brazilian educator and philosopher Paulo Freire in 1970. Freire pilloried the common teacher-student relationship that converts students into a 'listening object' to be "filled with contents of the teacher's narration – contents which are detached from reality" (Freire 2017:44). The educated individual is adapted to better 'fit' the world in the name of the preservation of culture and knowledge – a world that the oppressors have created and that is not to be questioned (2017:49-53). Such *banking education* alienates human beings from their decision-making and changes them into objects (2017:58). It dehumanizes and turns women and men into automatons (2017:47). Freire suggests a *problem-posing education* as a humanizing and liberating praxis that regards dialogue and critical thinking as indispensable to the act of cognition that unveils reality (2017:56). Through problem-posing education the world is no longer "something to be described with deceptive words. It becomes the object of transforming action by men and women which results in

their humanization” (2017:59). Freire’s theory considers education as “cultural community action for freedom” – “an act of knowing and reflecting critically on the process which motivates people to learn to read and write” (Morris 2008:61). This will turn education into a “practice of freedom” as opposed to education as a “practice of domination” (Freire 2017:54).

An important concept in Freire’s pedagogy is the *generative themes* to “investigate people’s thinking about reality and people’s action upon reality” (Freire 2017:79). Generative themes trigger reactions and dialogues about students’ view of the world. Freire mentions the anthropological concept of culture as one of these themes, clarifying the role of people in transforming the world rather than just adapting to it (2017:94). Freire’s literacy campaign leveraged generative themes to provoke dialogues. His liberating pedagogy of problem-posing education has also been introduced in natural sciences. In cooperation with German’s Goethe Institute, Hans Schmidt extensively explored alternative teaching styles including the creation of hands-on experiments in science classes using local low-cost materials. *Generative experiences* through science experiments that explain everyday observations can trigger students’ interest and dialogues (Schmidt 1993b:23). Schmidt illustrates the potential impact of generative experiences on children’s empowerment by stating that students who start asking why things happen in nature may also start raising questions about causes of poverty, social injustice, and oppression (Schmidt 1993a:18).

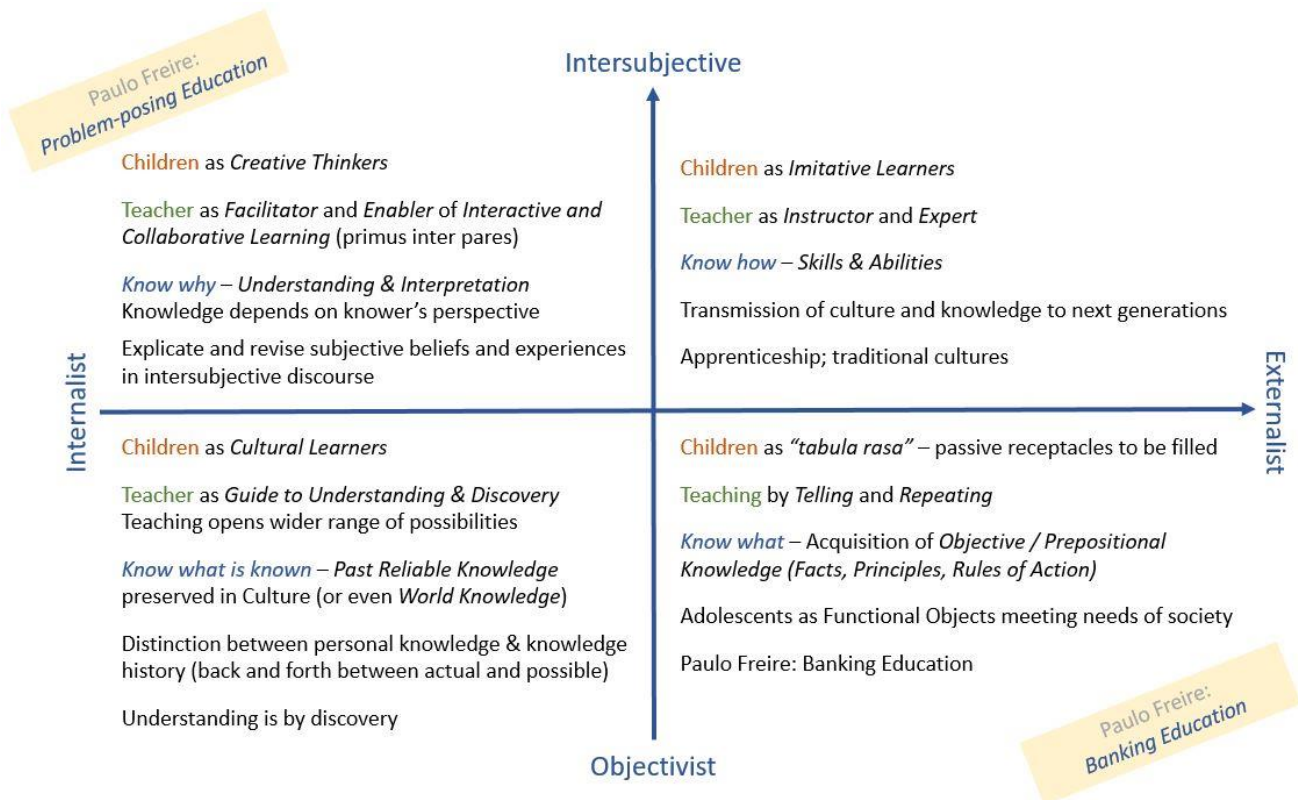
It is important to note that Freire’s approach is not easily articulable to Sen’s Human Development Approach and the theory of empowerment. As we have seen in section 3.1, the focus of the Human Development Approach is on people’s individual choices and freedoms. Knowledge and education are central capabilities for people to live a decent life within the prevailing system. In contrast, Freire talks about freeing oneself from oppression by transforming banking education into an education for liberation. The goal is to change the prevailing system rather than arranging with the system. Freire calls for more fundamental changes of the educational system rather than adapting and optimizing the current curricula.

### 3.3 BRUNER'S "CULTURE OF EDUCATION"

Freire's "*Pedagogy of the Oppressed*" combines philosophical, political, and educational theories. Liberation happens through a new culture of education. One that creates a partnership between teacher and student, empowering the student to enter into a dialogue. One such new culture of education was introduced by Jerome Seymour Bruner, one of the pioneers of cognitive and developmental psychology. Culture provides the basis for creating and transforming meanings (e.g. symbolic system, the evolution of languages, and linguistic expressiveness), and consequently, learning and thinking are always situated in a cultural setting (Bruner 1996:4). Bruner defines "culture as a way of knowing" and "education is a major embodiment of a culture's way of life, not just a preparation for it" (1996:13). Education and school learning do not stand isolated – schools are locally situated in a broader cultural context. Bruner proposes that the starting point of any new practice of education in the classroom should be the folk pedagogy: beliefs and assumptions that those engaged in teaching and learning already have (1996:46). Educational practices in classrooms are premised on a set of folk beliefs and what teachers think about learners' minds (1996:49). Influenced by the Russian psychologist Lev Vygotsky, Bruner developed the '*scaffolding theory*' in 1976, a social constructivist theory about learning. Bruner believed that children need active support from teachers, but while they are more dependent on adult support in the beginning, they can become more and more independent in their thinking and knowledge acquisition over time. Therefore, the intervention from the teacher or other adults can gradually fade, similar to scaffolding needed for the construction of a building, but gradually removed as the work gets completed. Scaffolding can also happen through interaction with other knowledgeable children within the classroom. In his theory of education, Bruner presents four dominant models of learners' minds, each emphasizing different educational goals (1996:53). *Externalist theories* emphasize what adults can do for children from outside to foster learning, whereas *internalist theories* focus on the child's action and reflection (1996:63). Through *intersubjective learning* humans attain subjective abilities and knowledge, whereas *objectivist theories* generalize knowledge. This



leads towards four different views of teaching and learning: *imitating*, *instructing*, *discovering*, and *collaborating* (1996:50). Freire's '*liberating pedagogy of the oppressed*' and Bruner's '*culture of education*' are summarized in Figure 3.1 with regards to their imagination of learning, knowledge, role of teachers and views about children:



**Figure 3.1: Bruner's four dimensions of learning**

Source: based on Bruner 1996. The Culture of Education. Page 44-65.

It is important to note that according to Bruner any theory of education should leverage all four perspectives of learning and create a fusion of skills and cultivated abilities, accumulation of factual knowledge, subjective interpretation of knowledge, and reliable knowledge from the past (1996:65). As a result of that, teachers will have to cover multiple roles depending on the learning situation. As outlined in section 2.3 the focus of traditional education in Tanzania has been on externalist theories where children are predominantly viewed as imitative learners and passive recipients of adult knowledge. Consequently, the promotion of intrinsic initiative and personal responsibility has been neglected. Technology-based learning can bridge this gap by providing the means for self-reliant, independent learning. Information

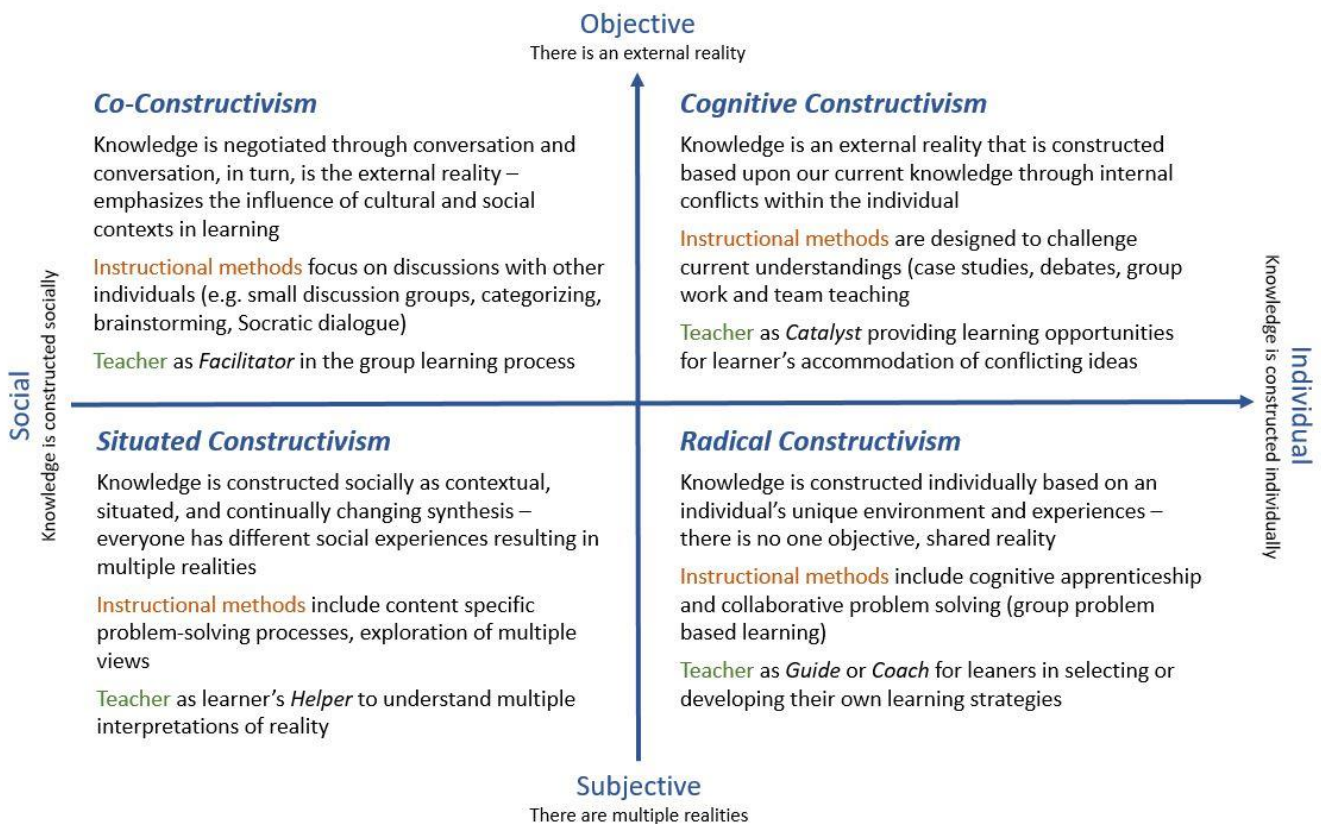
and Communication Technology for Education (ICT4E) can also pave the way for teachers to transform from mere instructors to facilitators and enablers of interactive and collaborative learning.

### **3.4 THE CONCEPT OF “EDUCATIONAL CONSTRUCTIVISM” FOR TECHNOLOGY-BASED LEARNING**

Jean William Fritz Piaget (1896 – 1980), a Swiss psychologist known for his work on child development and the education of children, introduced the theory of constructivism, which assumes that students can produce knowledge and create meaning based on their experiences (Flick 2019:103). Constructivism is a “process of accommodation and assimilation” constructing new knowledge from past experience (Selinger 2009:215). ‘Learning by doing’ should be promoted. Consistent with Bruner’s theory, *educational constructivism* emphasizes the role of the learner rather than the teacher. According to Piaget, learning is by self-initiated discovery when solving challenging problems. It needs to be largely self-directed and ascribed to the students’ interpretation of events and facts (UNESCO 2005:69). Students “actively construct their own knowledge and understanding rather than simply absorbing ideas spoken at them by teachers and instructors” (Smith, Cambridge & Gush 2003:96). Good teaching strategies need to enable students “to construct their own meaningful and conceptually functional representations of the external world” (Duffy & Jonassen 1992:11). Figure 3.2 gives an overview of different categories of constructivist learning theories and common epistemological constructivism positions.

According to educational constructivism, teaching should not be viewed as a mere transmission of knowledge, and the role of a teacher is changing to that of a coach, a guide, or a partner. “The educators’ role is not to simply provide information; they must create the conditions within which learning can take place” (Kanuka & Anderson 1999:14). In such learner-centered learning environments, new knowledge is built upon the foundation of previous experiences and learnings in an active process of the individual learner.

Educational constructivism fosters collaborative learning and social interaction. Vygotsky highlights that knowledge is constructed in the context of the environment in which it is encountered through a social and collaborative



**Figure 3.2: Four dimensions of constructivist learning theories**

Source: based on Kanuka & Anderson 1999. Using Constructivism in Technology-Mediated Learning.

### 3.5 APPLICATION OF THE THEORETICAL FRAMEWORK

Human development is about people – expanding their freedoms, enlarging their choices, enhancing their capabilities, and improving their opportunities (UNDP 2016:25). As illustrated in this section, quality education plays a critical role in this expansion of capabilities and opportunities that empower people to master their lives and live the life they want to live. Due to the holistic and contextually oriented nature of the concept of human development, it is hard to measure (child) empowerment. This thesis focuses on observed and perceived changes in children’s learning behavior and self-confidence within a short period of the research intervention. The following

eight indicators are deemed critical for measuring children's empowerment in the present study:

- Factual knowledge and practical skills
- Digital literacy
- Self-reliance and ability to learn self-determined
- Children's motivation to attend school
- Readiness for teamwork and ability to learn interactively
- Level of critical thinking and engagement in discussions
- Communication skills and self-expression
- Social competence and participation in the community

The continued shift from teacher-centered, such as frontal lecturing, to learner-centered learning environments requires more flexible, effective, active, and student-centered teaching strategies that mitigate the limitations of the traditional lecture approach in overcrowded classrooms (Ibiloye 2021:2). Ibiloye introduces several Blended Learning Models (BLM) as modern education design where traditional in-person classroom sessions and digital learning are combined to give students more control over time, place, path, and pace of their learning (2021:1). The so-called '*Self-blended or Individual Rotation Model*' allows students to work through learning stages on their own, self-determined schedule. This model is leveraged by Learning Management Systems such as Moodle, which provide students with an individual 'playlist' of resources and tasks. It works well for different ages including elementary school education (2021:4). The *Khan Academy* is a good example of such a *Self-blended Rotation Model*. Persky and McLaughlin report on the successful integration of the '*Flipped Classroom Model*' in the education of health professionals, introducing problem-based learning and case-based learning in a real-world context (Persky & McLaughlin 2017:1). The *Flipped Classroom Model* is a pedagogical approach in which students obtain foundational materials outside of class as preparation for in-class activities. ICT technologies and digital media (e.g. short instructional videos and online exercises) are frequently used to deliver the pre-class materials to students, fostering self-paced, self-directed, and self-regulated learning (2017:3). Bruner's *scaffolding theory* is applied in this model, as it supports the

transition from basic concepts learned theoretically prior to class towards complex ideas and application during the classroom lessons. While the teacher initially prepares and selects all the learning materials, students are invited to develop, test, and correct their own ideas during in-class time (2017:6). Long and passive lecturing should be avoided or minimized in the classroom, active and collaborative learning is promoted. Technology-based learning can help introduce this model by providing the materials to learn the basic concepts via e-learning in a self-directed way. Computer-based video lessons free up valuable class time replacing teacher monologues and reserving the classroom time for collaborative dialogues rather than lecturing. The *Khan Academy* has also been used by teachers to implement the *Flipped Classroom Model* to free up scarce class time. Lecturing videos are leveraged for preparation, class time is used for problem-solving exercises under the supervision of the teacher. “Lecture at home, homework in class” (Khan 2012:116) is the new motto. Different from traditional homework, students have the benefit of having the teachers and their peers around when they are problem-solving. This is the heart of the *Flipped Classroom Model*. “The use of technology had, somewhat ironically, made a traditionally passive classroom interactive and human” (2012:116). Independent, on-demand learning is a much more active process than in-class lectures, because students can decide what they need to watch and when, or if they have to repeat something they didn’t catch the first time. With that, students take responsibility for their learning (2012:117). “Teachers can then carve out face time with individual students who are struggling; they can move away from rote learning and into the higher tasks of mentoring, inspiring, and providing perspective” (2012:36). By implementing this model, the teachers are truly changing their role from instructor to facilitator and guide.

To promote active and collaborative learning in the classroom, Freire’s concept of generative themes represent a good method to provoke dialogues by reflecting children’s view about their reality and possible actions upon this reality (Freire 2017:79). Digital media can be used to trigger such reflection and stimulate actions to question and transform the status quo. As mentioned before, the key task of a teacher is not to provide content, because content is already there through ICT. Teachers should concentrate on bringing up

relevant generative themes and posing the right questions. Questions that are meaningful and interesting for the children. Mitra's proposal of a 'big questions' concept (Mitra 2020b:298) can be used to trigger group discussions and collaborative learning, which then promotes self-motivated learning and independent thinking. ICT-based access to knowledge databases and digital libraries supports this variant of minimally invasive education. The 'big questions' concept must focus on open-ended questions – questions that don't have a single correct and fixed answer. Questions like "What is the value of a human?" or "Why is there war?" can arouse children's curiosity and encourage them to explore further – even the younger children. Such learning by discovery can help children to think about their current reality, dream about their desired reality, and act towards it. The concept of 'big questions' has also been incorporated in the study intervention of this thesis.

Kanuka and Anderson point out that while not all instructional methods translate well to technology-mediated learning, some of them work especially well in digital environments. They highlight in the context of three examples (debates, case studies, and brainstorming) how technology can facilitate and foster contextual and interactive learning (Kanuka & Anderson 1999:15-18). An additional benefit of technology is based on the belief that the interaction of individuals using language is critical in all different forms of educational constructivism. Therefore, teachers should incorporate learning activities that help learners to improve their communication skills. "Specifically, educators should include activities that enhance learners' confidence and ability to express viewpoints" (Kanuka & Anderson 1999:14). Technology can help children learn how to confidently express themselves by recording short video messages, where children explain their environment and their viewpoints to other children, potentially children around the globe that they may never meet in person. Such application will not only foster children's communication skills but also promote intercultural exchange and critical thinking, which helps learners understand different interpretations of reality. This concept even works in schools with severe teacher scarcity as children self-reliantly produce content that will be shared with other children. The digital learning system used for the study of this thesis supports two applications fostering such

video-based self-expression and message sharing (called 'Kids Talk' and 'Touchable Earth'). These applications are used to facilitate school partnerships between schools in Germany and Tanzania.

Chapter 3 has outlined a holistic, multi-disciplinary theoretical framework to understand the impact of digital learning on children's empowerment in rural Tanzania. Multiple concepts including the *Framework of Empowerment*, Amartya Sen's *Human Development Approach*, Paulo Freire's *Liberating Pedagogy of the Oppressed*, Jerome Bruner's *Culture of Education*, and the concept of *Educational Constructivism* were introduced and explored to make meaningful recommendations on how to improve digital learning to foster children empowerment in rural Tanzania. The concept of *Educational Constructivism* has been highlighted as the pedagogy of choice for technology-based learning. The understanding of knowledge, the preferred instructional methods, and the role of the teacher have been reviewed and discussed in this context. Finally, and very importantly, it has been discussed how the theoretical framework can be applied to the topic of digital learning, e.g. the Flipped Classroom Model as introduced in the Khan Academy. Also, indicators for children's empowerment have been summarized in this chapter as they play an important role in the empirical study.

After having set the theoretical background and framework of this thesis we will now review the research design and methodology.

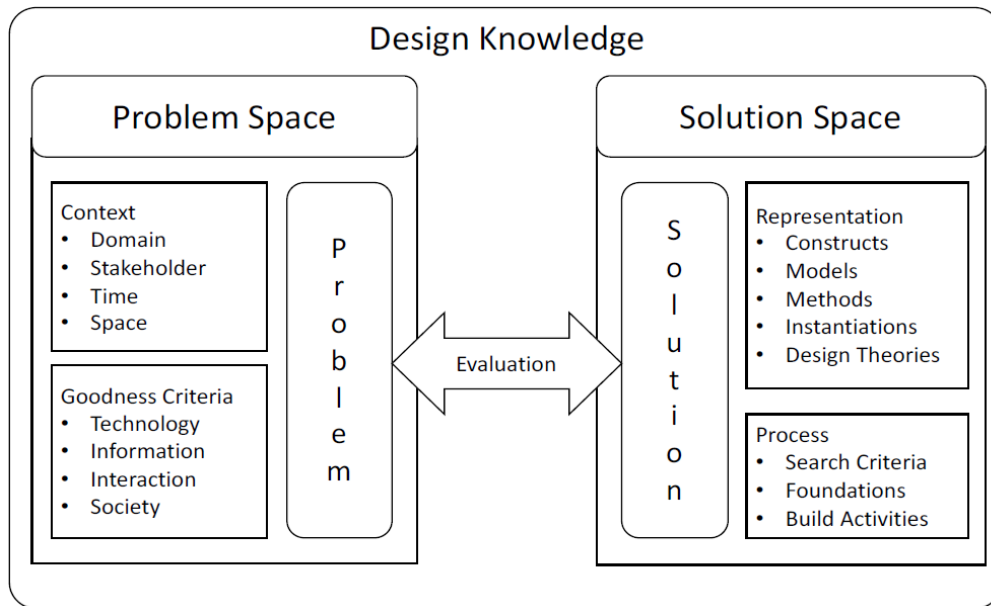
## CHAPTER 4 – RESEARCH DESIGN AND METHODOLOGY

### 4.1 DESIGN SCIENCE RESEARCH – PARADIGM

It has been highlighted earlier that there are only a few publications about successful technology-powered solutions that address the ongoing problem of teacher scarcity in rural Africa. The impact of digital learning on child empowerment and self-motivated learning seems largely unexplored in such a context. As a result of that, there is no broad consensus on implementation details or best practices for self-determined and technology-enhanced education in Tanzania. To address this knowledge gap, the present study has investigated how innovative e-learning solutions can help children in rural Tanzania master their lives and empower children by fostering self-motivated learning, creativity, and critical thinking. Section 1.3 summarizes the objectives and research questions of this thesis. What stands out is the fact that almost all of the research questions start with a “*how*”. *How* can a digital learning system foster the empowerment of children and the perceived quality of education in schools in rural Tanzania? Given the lack of knowledge and guidelines for digital learning in Tanzania in the current literature, the author has concluded that a field test is required to acquire new knowledge in a real-world context and derive guidelines for best practices. As Vaishnavi and Kuechler (2004:4) explain “Design Science Research is research that creates this type of missing knowledge using design, analysis, reflection, and abstraction”. The creation of new knowledge through the design of novel or innovative artifacts and the analysis of the artifact’s use and performance through reflection and abstraction are the two primary elements of Design Science Research (DSR) (2004:1). “Learning through building artifacts” is the defining feature of DSR (2004:6). Vom Brocke, Hevner and Maedche describe the nature of DSR as a problem-solving paradigm. “Simply stated, DSR seeks to enhance technology and science knowledge bases via the creation of innovative artifacts that solve problems and improve the environment in which they are instantiated” (vom Brocke, Hevner & Maedche 2020:1). Hevner et al. highlight that “in the design-science paradigm, knowledge and understanding of a problem domain and its solution are achieved in the building and



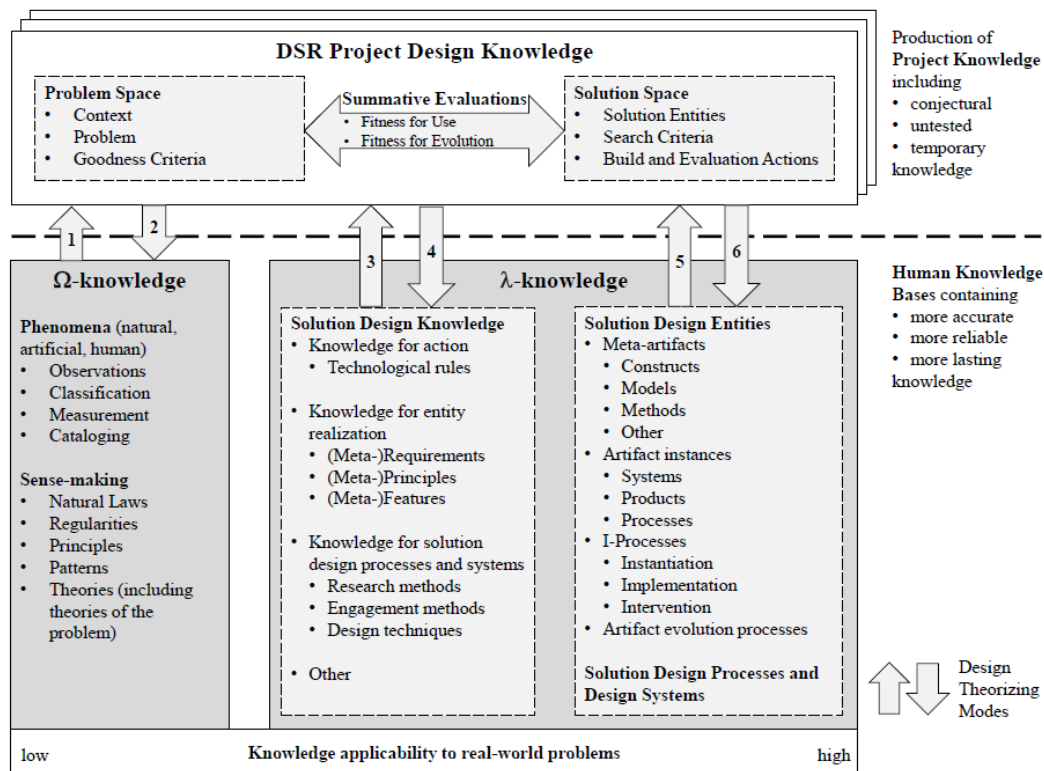
application of the designed artifact” (Hevner et al. 2004:75). While both problem space knowledge and solution space knowledge exist independently, it is through iterative construction and evaluation of the artifact in the design cycle and putting these spaces in relation to one another, that new DSR knowledge is generated (vom Brocke, Hevner & Maedche 2020:10). The resulting Design Knowledge Framework is illustrated in Figure 4.1:



**Figure 4.1: Design Knowledge Framework**

Source: vom Brocke, Hevner & Maedche 2020:10

Different from natural sciences where primarily descriptive and explanatory knowledge (so-called  $\Omega$ -knowledge) is generated, DSR-oriented research activities primarily contribute applicable, prescriptive knowledge (so-called  $\lambda$ -knowledge) as shown in Figure 4.2 below:



**Figure 4.2: Knowledge Utilization, Production, and Contribution in DSR**

Source: Drechsler & Hevner 2018:8

In this thesis, Design Science Research (DSR) has been chosen as the research paradigm because of its close link to a problem-solving approach, such as solving the problem that traditional teaching styles prevent children from self-determined, interactive learning and self-expression. DSR uses the creation of artifacts to solve problems (Vaishnavi & Kuechler 2004:11). It is “about *how* to do something to meet a certain objective without fully answering *why* the prescribed actions should work” (2004:20). Consequently, DSR has an intrinsic goal orientation and deals with *how* to achieve such goals (Walls, Widmeyer & El Sawy 1992:41). This differentiates DSR from natural and social science. “Whereas natural sciences and social sciences try to understand reality, design science attempts to create things that serve human purposes” (Simon 1996:55). DSR is “the purposeful seeking of a solution to a problem” (McPhee quoted in: Peffers et al. 2007:48) and differs from natural science:

“A *natural science* is a body of knowledge about some class of things – objects or phenomenon – in the world (nature or society) that describes and explains how they behave and interact with each other. A *science of the artificial (design science)*, on the other hand, is a body of knowledge about the design of artificial (man-made) objects and phenomena – artifacts – designed to meet certain desired goals.” (Simon quoted in: Vaishnavi & Kuechler 2004:3)

Goals are meaningless in natural science theories and social science theories may only deal with goals as an object of a study (Walls, Widmeyer & El Sawy 1992:40), whereas DSR is actively pursuing goals. “In some sense it is as if the design science researcher creates a reality through constructive intervention” (Vaishnavi & Kuechler 2004:10). Design is “a set of hypotheses and ultimately can be proven only by construction of the artifact it describes” (Walls, Widmeyer & El Sawy 1992:38). Design theories will not just be explanatory (“what is”), predictive (“what will be”) or normative (“what should be”), design will integrate all three aspects and show how to achieve a goal. Research methods and tools are largely taken over from natural and social science theories.

“Since the artifacts which result from the design process are constructed of elements from the natural and social worlds, they are subject to the ‘laws’ which govern those worlds. Therefore, design theories may borrow from natural and social science theories.” (Walls, Widmeyer & El Sawy 1992:41).

DSR fosters what Denning points out as the ultimate value of research: innovation through generating new ideas, new practices, new products, or new business (Denning 1997:133). In this thesis, especially the generation of new practices (e.g. best practices on how e-learning can foster self-determined learning) and the generation of new business (in this context: defining the roles of people like teachers and identities like schools) are most relevant. DSR has been used as the framework to evaluate information systems in similar contexts, for example the Digital Doorway System in South Africa (Adebesin, Kotze & Gelderblom 2011).

The Design Science Research paradigm is unique and differentiated from the Positivist research paradigm (as common in natural science) and the Interpretive research paradigm (as common in many social sciences). Vaishnavi & Kuechler (2004:9) present an overview of the philosophical assumptions of these three major research perspectives (see Table 4.1).

Basic Belief	Research Perspective		
	Positivist	Interpretive	Design
<b>Ontology</b>	Single reality; law-like	Multiple, socially constructed realities	Multiple, contextually situated alternative world-states (realities)
<b>Epistemology</b>	Objective; detached observer of truth	Observer subjectivity; empathetic	Knowing through making; iterative circumscription reveals meaning; context-based construction
<b>Methodology</b>	Observation; experimental; quantitative / statistical	Qualitative; interactional; participative	Developmental; impact analysis of artifact on composite system
<b>Axiology</b>	Objective, universal truth that can be predicted	Contextual, situated understanding	Control; creation; progress

**Table 4.1: Philosophical assumptions in different research paradigms**

Source: based on Vaishnavi & Kuechler 2004:9 and Adebisin, Kotze & Genderblom 2011:310

Ontologically, DSR assumes multiple, contextually situated alternative world-states that are socio-technologically enabled. “Design science research, by definition, changes the state-of-the-world through the introduction of novel artifacts. Thus, design science researchers are comfortable with alternative world-states.” (Vaishnavi & Kuechler 2004:9). This is an obvious contrast to the positivist ontology. However, the assumption of a few alternative world-states is also fundamentally different from the multiple, subjective realities in interpretive research.

Epistemologically, the design science researcher generates new knowledge through the iterative process of development and circumscription. Different from natural sciences, DSR seeks to create “what is effective” rather than understanding “what is true” (Hevner et al. 2004:98). DSR is grounded on the concept of “knowing through making”, where knowledge is an “objectively constrained construction within a context” (Vaishnavi & Kuechler

2004:9). “Iterative circumscription” is highlighted as an essential part of the design research that iteratively determines or reveals meaning and reality (2004:8). Utility relies on truth and the discovery of truth may require the application of its utility (Hevner et al. 2004:98). Truth and utility are inseparable. It can even be argued that truth (justified theory) and utility (effective artifacts) are two sides of the same coin (2004:77). Truth informs design and utility informs theory (2004:80). Hevner highlights the pragmatic nature of DSR due to its emphasis on relevance, where pragmatism “is a school of thought that considers practical consequences or real effects to be vital components of both meaning and truth” (Hevner 2007:91).

Axiologically, the design science researcher values creative manipulation and control of the environment in which the designed artifact is instantiated (Vaishnavi & Kuechler 2004:9).

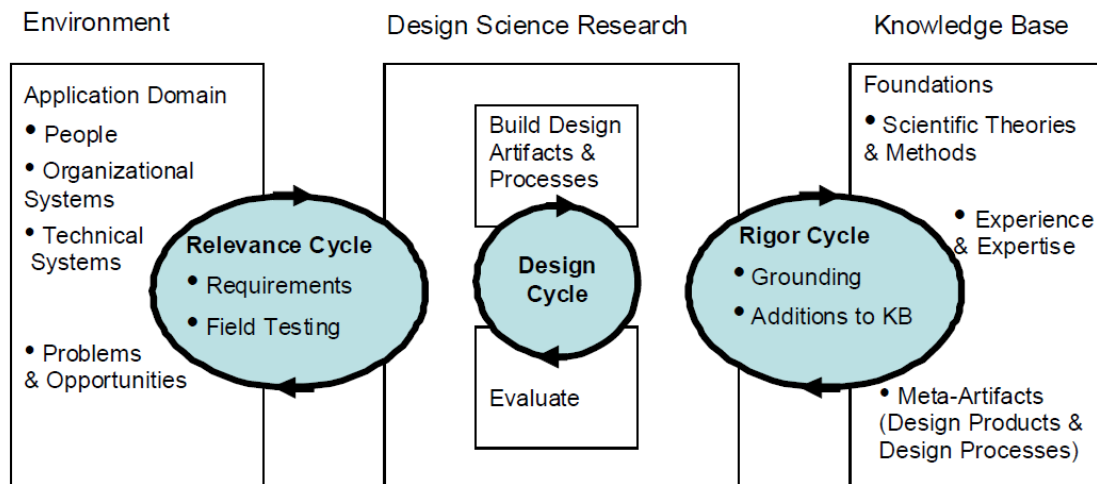
## **4.2 DESIGN SCIENCE RESEARCH – METHODOLOGY**

Hevner et al. describe DSR as

“fundamentally a problem-solving paradigm that seeks to create innovations which define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished” (Hevner et al. 2004:76).

The conceptual DSR framework combines three closely related cycles of activities:

- the *Relevance Cycle*
- the *Rigor Cycle*
- the central *Design Cycle*



**Figure 4.3: Design Science Research Cycles**

Source: Hevner 2007:88

The *Relevance Cycle* describes the contextual environment of the research project. This environment defines the problem space in which the phenomena of interest reside (vom Brocke, Hevner & Maedche 2020:3). The environment is composed of people, organizations, and existing or planned technologies. To define the problem space, the environment is separated into the inner environment (set of components that make up the artifact and their relationships), the outer environment (total set of external forces and effects that influence the artifact, and the interface between the two (Vaishnavi & Kuechler 2004:3). Goals, tasks, problems and opportunities within the environment define the needs as they are perceived by stakeholders within the organization in which context the research takes place. Through the Relevance Cycle, the research problem is framed. Good design and DSR begin by identifying problems and opportunities in an actual application environment. However, the Relevance Cycle does not only provide application context and requirements for the research, it also defines acceptance criteria for the ultimate evaluation of the research results (Hevner 2007:89). It bridges the gap between problem space and solution space.

The *Rigor Cycle* provides existing knowledge, experiences and expertise, and existing artifacts and processes (so-called “meta artifacts”) that define the state-of-the-art in the application domain of the research project. The existing knowledge base provides the raw materials from and through which DSR is accomplished. It is composed of foundations and methodologies from prior

research. Rigor is achieved by appropriately applying existing foundations and methodologies (vom Brocke, Hevner & Maedche 2020:3). If a solution to a problem is already part of the existing knowledge base, it represents “routine design” which is to be differentiated from DSR (Hevner et al. 2004:81). The goal of DSR is to generate new and true knowledge which extends to the knowledge base and creates new best practices.

The *Design Cycle* is the heart of any DSR project. This cycle of research activities iterates between the construction of an artifact and its evaluation. Different types of ICT technology artifacts can be distinguished: constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems) (Hevner et al. 2004:77). The focus of the artifact of this thesis has been on models (defined processes and best practices approach for e-learning in schools in rural Tanzania) and instantiations (prototyping in case studies leveraging and adapting a digital learning system). The Relevance Cycle provides requirements, methods are derived from the Rigor Cycle (Hevner 2007:90). The existing knowledge base is often insufficient to design adequate solutions for new problems. Therefore, the researcher relies on intuition, experience, and trial-and-error methods to construct an artifact that is implemented as a solution to the problem in the respective environment. Through instantiation of the artifact, the researcher continues to learn about the problem, the environment, and the possible solutions (Hevner et al. 2004:99). Constructing and evaluating innovative technology artifacts enable design science researchers to better understand the addressed problem and the feasibility of the proposed solution (Nunamaker et al. in: Hevner et al. 2004:77). During the Design Cycle a balance between the construction and the evaluation of the evolving design artifact shall be maintained (Hevner 2007:91). This build-and-evaluate loop is typically iterated several times until an artifact is generated that is deemed ‘good enough’. Throughout a DSR study, diverse research methods are applied. This includes many methods that are well established in social science research, such as literature reviews, observations, surveys, interviews, or focus groups (vom Brocke, Hevner & Maedche 2020:5). Already in the early days of DSR it

has been concluded that design theories must be subject to empirical validation (Walls, Widmeyer & El Sawy 1992:46).

Peppers et al. (2007:51) clarify that action research methods and the grounded theory approach are ways to conduct research in system development and design science. Vaishnavi and Kuechler endorse this view when observations in the Design Cycle are interpreted and become the basis for new theories and abduction while a new interventionist cycle begins. “In this sense design science research is very similar to the action research methodology of the interpretive paradigm” (Vaishnavi & Kuechler 2004:10). As part of the design research in this thesis, action research has been chosen as a method to “identify a specific practice-based problem, and then to undertake research in order to identify the means through which to resolve it” (Henn, Weinstein & Foard 2009:66). Possible solutions to mitigate the impacts of teacher scarcity in rural Tanzania can hardly be derived from a literature review as “professional learning is not just an intellectual process (a process of acquisition and application of knowledge), but also a process of practical action in which knowledge is enacted in reflecting and developing a specific action” (Altrichter 2005:11). It requires context-specific research, where teachers and students in the projects will reflect their experiences and progress. “Action research promotes change, thinking and understanding change by involving those directly affected in altering current practice or developing new practice” (Ayot, Thuku & Ondigi 2015:33). Action research “aims at the participants’ empowerment and self-confidence about their ability to create ‘grounded theory’” (Ryan 2008:45). Design research allows adaptations of the intervention based on observations and qualitative research. Similar to Henderson’s approach (Henderson 2015:137) recommendations and conditions for successful technology-enabled learning were derived specifically for the context of rural Tanzania.



### 4.3 DESIGN SCIENCE RESEARCH – PROCESS MODEL

Several practice rules and step-by-step process models have been developed and published within the design science research community. This includes:

- the Design Science Research Framework from Alan Hevner
- the seven DSR Guidelines (describing characteristics of well-carried out design research) according to Alan Hevner
- the Design Science Research Process Model (DSR Cycle) according to Vijay Vaishnavi and Bill Kuechler
- the DSR Methodology (DSRM) Process Model according to Ken Peffers

The conceptual *Design Science Research Framework from Alan Hevner* combines three closely related cycles of activities (Relevance Cycle, Rigor Cycle, and Design Cycle) and has been introduced in the previous section. Hevner extended this DSR Framework by introducing seven guidelines as fundamental principles of DSR which are summarized in Table 4.2:

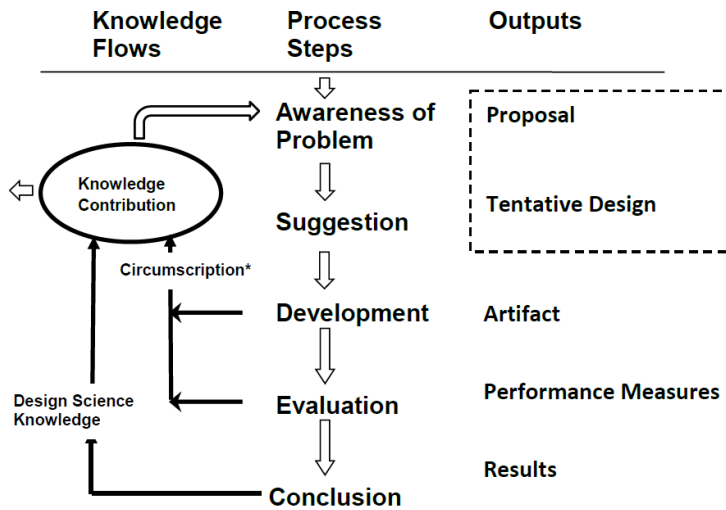
Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

**Table 4.2: Design Science Research Guidelines**

Source: Hevner et al. 2004:83

While these seven guidelines cover all major elements of the design research, it does not provide a good outline of the DSR process. The *Design Science Research Process Model (DSR Cycle)* according to Vijay Vaishnavi and Bill Kuechler is a better way to illustrate the structure of the design research process (Vaishnavi & Kuechler 2004:11-15). As illustrated in Figure 4.4 it is a five-step process starting with the *Awareness of the Problem* (in line with Hevner's Relevance Cycle), where the research problem and criteria for evaluating the proposed product of the research effort are described. The following *Suggestion* step creatively envisions new functionality based on a novel configuration (in line with Hevner's Rigor Cycle). This "Tentative Design" is further developed and implemented in the *Development* phase. The developed artifact may include concepts, models, methods, and processes, or instantiations. During the *Evaluation*, the performance is measured and the construction of the artifact is evaluated according to the criteria derived in the Awareness / Proposal phase. There are typically several iterations of the Development and Evaluation step until the utility of the artifact (e.g. technical performance or social impact) is confirmed. "The results of the evaluation often suggest a new design, frequently preceded by additional research to understand the reasons why the behavior and impacts of the artifact deviated from the expected, theoretical performance" (Vaishnavi & Kuechler 2004:13). A specific research effort or cycle ends with the *Conclusion* phase when the results are deemed "good enough". Results are consolidated, summarized, written up, and published.

"In the conclusion stage, the researcher reflects on what was learned, what worked, and what did not work to solve the problem. Furthermore, in the process of communicating the results and contributing to the larger knowledge base, abstraction enables the researcher to draw broad and generally applicable conclusions based on the knowledge gained from the research effort" (Vaishnavi & Kuechler 2004:14).

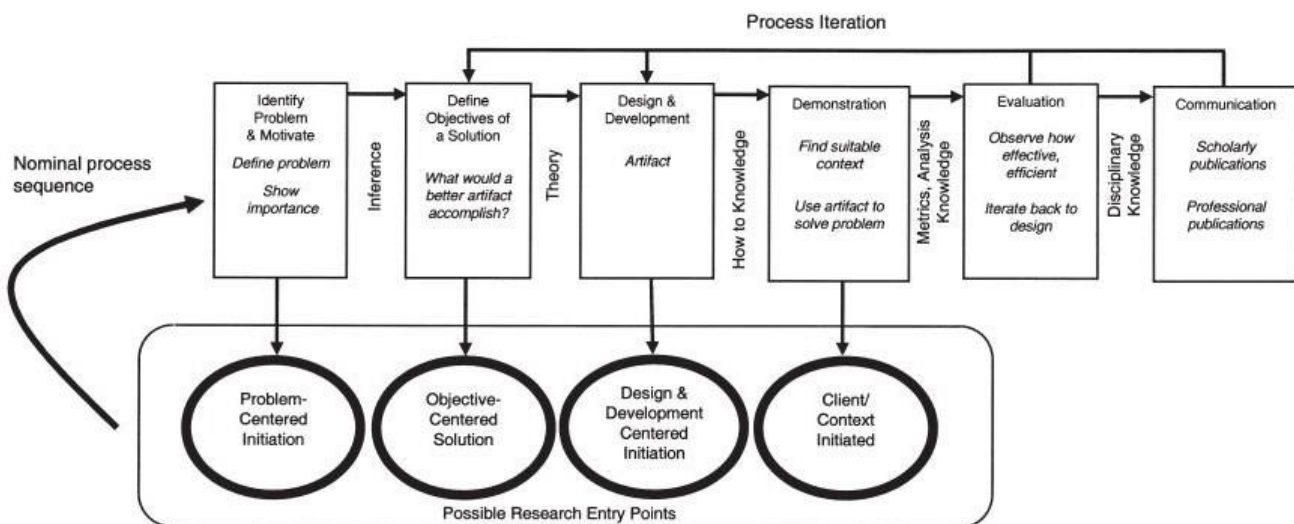


**Figure 4.4: Design Science Research Process Model / DSR Cycle**

Source: Vaishnavi & Kuechler 2004:11

The process model from Vaishnavi and Kuechler has been leveraged for example by Adebessin, Kotze and Gelderblom to evaluate the usability and accessibility of the Digital Doorway project in South Africa (Adebessin, Kotze & Gelderblom 2011; Adebessin & Kotze 2012).

The most frequently used process model is the DSR Methodology Process Model according to Ken Peffers. This process model is very similar to the one introduced by Vaishnavi and Kuechler. As shown in Figure 4.5 it consists of six steps of research activities and four possible research entry points (Peffers et al. 2007:52-56; vom Brocke, Hevner & Maedche 2020:5-7):



**Figure 4.5: Design Science Research Methodology Process Model**

Source: Peffers et al. 2007:54

The DSR process is defined as a sequence of six research activities, some of which are repeated through several iterations. The research activities are as follows (Peppers et al. 2007:52-55):

- *Activity 1: Problem Identification and Motivation*  
Define the specific research problem as the basis for the development of an artifact and justify the value of a solution
- *Activity 2: Define the Objectives for a Solution*  
Deduce solution objectives (quantitative or qualitative) from the problem definition and the knowledge base of what is possible and feasible
- *Activity 3: Design and Development*  
Create the artifact (constructs, models, methods, instantiations) and determine the desired functionality and architecture of the artifact
- *Activity 4: Demonstration*  
Demonstrate the use of the artifact and its problem-solving through experimentation, simulation, case study, proof, or any other appropriate mean
- *Activity 5: Evaluation*  
Observe and measure how effectively the artifacts solve the problem and constitute an effective solution in the given context; depending on the assessment, the process may iterate back to Activity 2 or 3
- *Activity 6: Communication*  
Communicate the problem and its importance, the artifacts and their utility and effectiveness to the relevant stakeholders

Peppers' DSR Methodology Process Model is structured in a nominally sequential order. However, this does not mean that all research activities will be covered in every DSR project or research effort. Peppers lists four common research entry points depending on the nature and focus of the research project (Peppers et al. 2007:56):

- *Problem-centered initiation*  
Basis of the complete nominal sequence process
- *Objective-centered solution*  
Triggered by an existing industry or research need that is to be addressed by the artifact
- *Design & Development-centered approach*  
If an artifact already exists but hasn't been formally thought through as a solution for a specific problem space in which it will be used
- *Client-/Context – initiated solution*  
Observation of a practical solution that has been applied in a given context; the researcher works backward to apply rigor to the process retroactively

Peppers' process model has been used as a methodology in this thesis because it provides an easy-to-understand, well-defined, visual representation of the research process. It is adaptive to different research entry points for case studies where not all research activities are performed, at least not all with the same emphasis within the specific research effort. The focus areas of this thesis are summarized in Table 4.3.

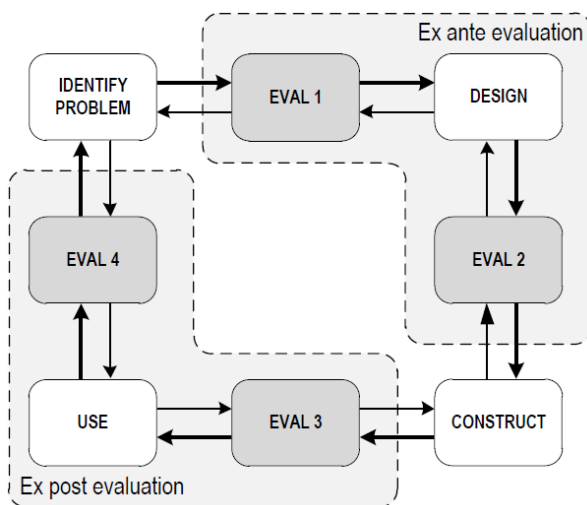
Although all six research activities have been included in this thesis, not all of them were carried out with the same intensity and emphasis. In particular, the construction and iterative adaptation of the research artifact, which is often the central part of DSR, has been lighter in this thesis. Rather than developing a new innovative digital learning system, an existing e-learning solution (*RACHEL* from *World Possible*, see section 2.4.6) was instantiated in the context of a research intervention (trial phase).

Research Activity Phase	Description of the activities in this thesis
Activity 1: Problem Identification and Motivation	Framing of the research problem (teacher scarcity and traditional teaching styles disempower children and prevent them from self-determined, interactive learning and self-expression) through thorough literature study
Activity 2: Define the Objectives for a Solution	Defining opportunities and objectives of a digital learning solution to empower children in rural Tanzania (through literature review and development of the theoretical framework as well as leveraging existing prototyping experiences)
Activity 3: Design and Development	Instantiating an existing e-learning solution ( <i>RACHEL</i> ) in the context of a research intervention (trial phase) in rural Tanzania
Activity 4: Demonstration	Multi-case study including ten-weeks trial in two schools in rural Tanzania (Rukoma & Dongobesh)
Activity 5: Evaluation	Empirical study to analyze and measure the impact and effectiveness of the artifact (e-learning trial) in the given context of Rukoma and Dongobesh; some iterations and feedback loops through action research during the research intervention
Activity 6: Communication	Communicate the research findings and conclusions to the relevant stakeholders (e.g. participating parties, UNISA, and the research community); summarize best practices derived from this research study

**Table 4.3: Description of Research Activities and Process Model of this thesis**

Design theory distinguishes between ‘design as a product’ and ‘design as a process’ (Walls, Widmeyer & El Sawy 1992:42; Hevner et al. 2004:78). In this study, the technology (the digital learning system) was taken over as existing product/artifact, whereas the design process of instantiating the artifact was done in the context of a prototype and user trial. A special focus of this thesis has been on Activity 5, the Evaluation. The impact and effectiveness of the artifact (e-learning trial) have been analyzed and measured through empirical studies in the given context of rural schools in Rukoma and Dongobesh in order to derive best practices for e-learning implementations in rural Tanzania that maximize children’s empowerment. DSR Evaluation can be differentiated between *ex-ante evaluations* (conducted before the instantiation of any artifact) and *ex-post evaluations* (that occur after the instantiation of any artifact) (vom Brocke, Hevner & Maedche 2020:9; Sonnenberg & vom Brocke 2012:7). Sonnenberg and vom Brocke illustrate four different DSR evaluation types (Sonnenberg & vom Brocke 2012:13-17) (see Figure 4.6):

- Eval 1: Evaluating the problem identification for applicability, importance, novelty, and feasibility
- Eval 2: Evaluating the solution design for feasibility, accessibility, simplicity, clarity, completeness, and consistency
- Eval 3: Evaluating the solution instantiation for ease of use, fidelity with real-world phenomena, robustness, and suitability
- Eval 4: Evaluating the solution in use for effectiveness, efficiency, generality, internal and external consistency, and impact on artifact environment and user



**Figure 4.6: DSR Evaluations**

Source: Sonnenberg & vom Brocke 2012:13

The focus of this thesis has been on Eval 3 and Eval 4, where the majority of the empirical research has taken place after a research intervention in the form of a ten-week trial. As a result of this emphasis on ex-post evaluation, a primary research entry point in this thesis was the *Client-/Context – initiated solution*, observing how the practical solution has been applied in the given context of rural schools in Tanzania and how it has impacted the empowerment of the children participating in the study.

Some iterations and feedback loops were implemented through action research during the research intervention. The complete set of recommendations and best practices guidelines derived from the empirical study and evaluations may serve as input for future research efforts and

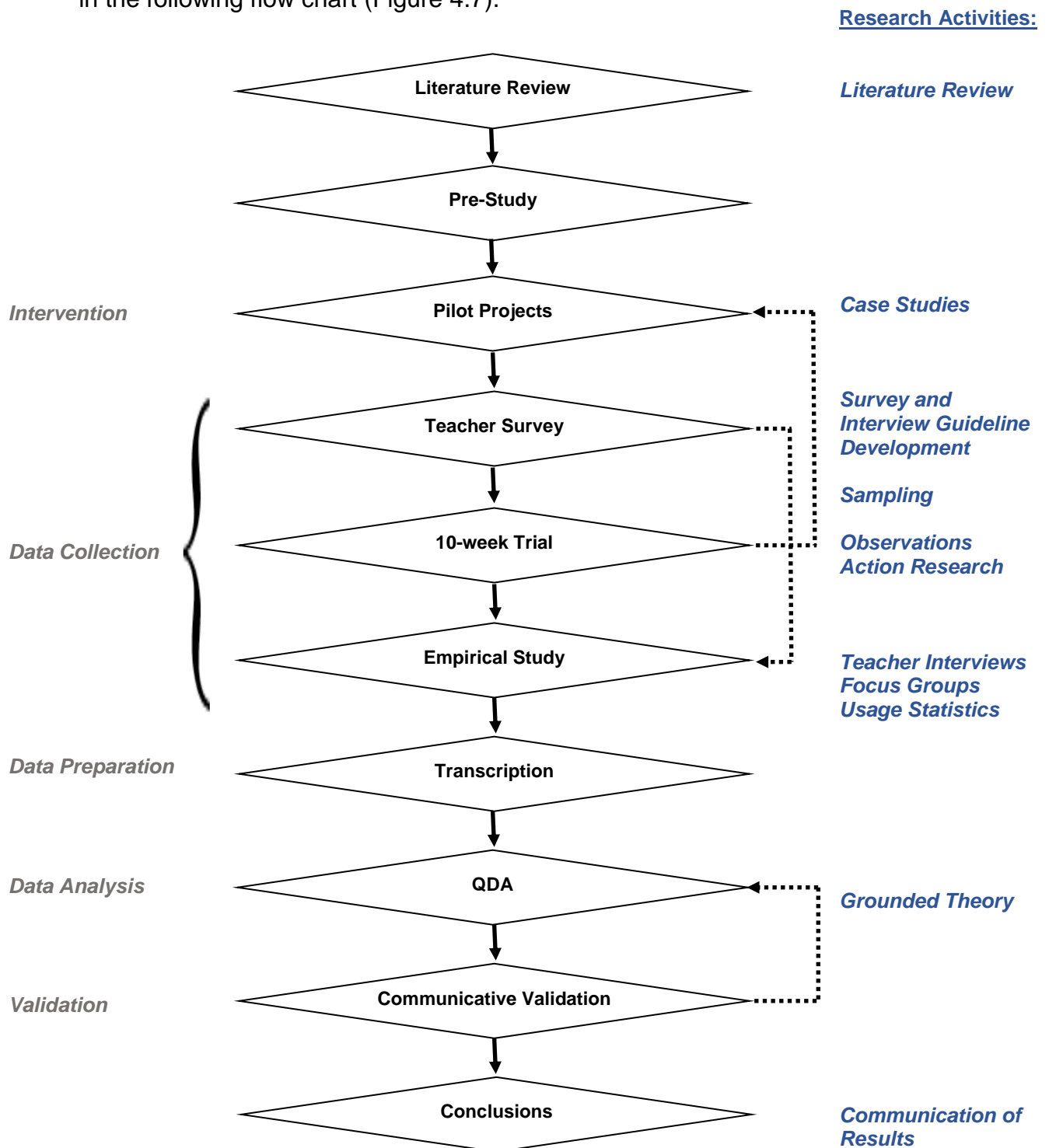
praxis implementations in similar contexts. The timing of a single Master thesis does not allow multiple build-and-evaluate design cycles. However, given the knowledge gap of how innovative e-learning solutions can help children in rural Tanzania to master their lives and empower children, the evaluation activity of this study has revealed a lot of new findings contributing to the knowledge base for new research and praxis projects in the future.

#### **4.4 FLOW CHART OF MIXED METHODS RESEARCH ACTIVITIES**

As mentioned earlier in this section, Design Science Research (DSR) borrows a lot of the common research methods and tools from natural and social science theories. Throughout the DSR study in this thesis, diverse research methods are applied. This includes many methods that are well established in social science research, e.g. literature reviews, observations, surveys, interviews, or focus groups (vom Brocke, Hevner & Maedche 2020:5). A *Mixed Methods* approach has been applied in the context of a *holistic Multiple-Case Study* design (Yin 2018:48). This setup enables the collection and comparison of data and evidence from different contexts (e.g. private vs. public schools in rural Tanzania). Given the nature of the multiple case studies, the different input from the various cases (different groups of students in two different schools) has been compared and checked for interrelations.



The research design as a flow of research elements and activities is illustrated in the following flow chart (Figure 4.7).



**Figure 4.7: Flow chart of research activities**

The first part of this thesis included a thorough literature study, particularly about the opportunities and challenges of Information and Communication Technologies for Education (ICT4E) and Self-Organizing Learning Environments (SOLE) in Africa. Given the scarce knowledge about *how* technology-enabled learning can foster children's empowerment in such contexts, an action research intervention was integrated into this design research to try out what impact different e-learning programs can have on different groups of pupils within a short period of ten weeks ("instantiation of the research artifact"). As described in section 4.2, action research has been chosen as the method to "identify a specific practice-based problem, and then to undertake research in order to identify the means through which to resolve it" (Henn, Weinstein & Foard 2009:66). The action research method provided a feedback loop allowing some adaptation of the technical and pedagogical setup during the research intervention. Trials with randomized focus groups were conducted to investigate the impact of digital learning in rural Tanzania (see section 4.5.1).

The primary research interest of this study is the empowerment of children in rural Tanzania. They are the target group of the transformation process, which is initiated through independent, self-motivated, interactive learning and critical thinking. However, an equally important focus of the study is on the teachers as a secondary target group. As explained in the literature review, teachers are central actors in the children's transformation process and can foster or block new pedagogical concepts for independent thinking and interactive learning. The teacher interviews included the topic, if and how the role of the teacher has changed during the intervention.

In the design research, a *Mixed Methods* approach has been applied integrating quantitative and qualitative research elements. Given its growing importance in the research community, Mixed Methods is sometimes also referred to as "the third methodological paradigm" (Rädiker & Kuckartz 2018:9). A variety of different definitions of Mixed Methods exist. John Creswell, one of the thought leaders in research methodologies, defines Mixed Methods research as "a research design (or methodology) in which the researcher collects, analyzes, and mixes (integrates or connects) both quantitative and qualitative data in a single study or a multiphase program of

inquiry” (quoted in: Kuckartz 2014:30). The resulting research design corresponds to the outline introduced by Miles and Huberman where an initial quantitative survey is followed by a qualitative field study and conclusions are validated by experiment (Flick 2019:43). It is not a matter of overriding or subordinating qualitative or quantitative elements. Rather, the Mixed Methods approach has been selected so that qualitative interviews complement and deepen the knowledge gained from the pilot phase and the teacher survey. Conclusions are implemented and validated in real-life contexts within the existing e-learning pilot projects – in line with the fundamentals and goals of design research. Method triangulation is very common in Mixed Methods to provide more than one perspective for examining the research question.

Creswell et al. have created an overview of different Mixed Methods designs based on four dimensions (implementation, priority, integration, theoretical perspective) (Kuckartz 2014:66). One design that fits well to this thesis is what Creswell calls “*explanatory design*”. It starts with a quantitative data collection (teacher survey) followed by qualitative teacher interviews and focus group discussions that foster a deeper understanding of the research problem and the proposed suggestions and solutions. The motivation for this mixing of methods is to provide additional coverage and an expanded perspective for the research (2014:69). The purpose of this “*complementary*” mixed methods approach is to supplement knowledge and understanding by illustrating and comparing results from different research methods (Rädiker & Kuckartz 2018:183). Complementarity constitutes one of five core mixed methods purposes according to Greene, Caracelli and Graham (2008:127). The research design can also be differentiated depending on the sequence and the priority level of the quantitative versus the qualitative methods. This thesis emphasizes the qualitative methods (observations during the trial, teacher interviews, and focus group discussions with pupils) over the quantitative data collection (teacher survey, statistical usage data from the digital learning system). This corresponds to what Kuckartz labels as “quant → QUAL” sequential design (Kuckartz 2014:78+162) where the qualitative study (QUAL) holds a clear priority position and the quantitative study has more the function of a pre-study or extended data collection. Qualitative data

analysis (QDA) software packages like MAXQDA ease the mixed methods data integration challenge and provide different relevant interfaces and points of integration (Rädiker & Kuckartz 2018:182). Such integrations can happen based on data during the data analysis phase or based on results via so-called *Joint Displays* during the conclusion phase (2018:184).

The quantitative survey was based on a structured questionnaire to collect a broad set of data from teachers about their point of view regarding “good learning” and child empowerment, and how tablet-based e-learning has helped them to accomplish desired outcomes. Qualitative teacher interviews and pupil focus group discussions were designed as semi-structured guideline interviews (Helfferich 2011:36). Teacher interviews followed the principles of problem-centered interviews according to Witzel (Flick 2019:210) and helped to deepen specific aspects raised by the survey. Problem-centered interviews are meant to establish an egalitarian dialogue between the researcher and research participant in which the research question or the ‘problem’ is refined jointly. This approach gives equal rights to the previously accumulated theoretical and empirical knowledge of the researcher and the individual knowledge and personal experiences of the participant. During the qualitative research, insights into motivations and expectations about digital learning as well as related concerns and risks were explicitly addressed and discussed. Special focus was given to the main research question of *how* technology-enabled learning has fostered children’s empowerment during the intervention. Moreover, research participants were explicitly encouraged to talk about problems and risks associated with digital learning in their context. Given the goal of developing best practice guidelines for digital learning in rural Tanzania, the question was emphasized how the current e-learning system could be improved.

## 4.5 DATA COLLECTION STRATEGY

### 4.5.1 Sampling

To investigate the impact of digital learning on children empowerment in rural Tanzania teachers and pupils from related schools were consulted after a ten-week research intervention. Key criteria for the sampling of this trial phase were access to school and prior experience in digital learning. Pilot e-learning projects using the *RACHEL* system described in section 2.4.6 were already in progress in nine different schools in several districts of rural Tanzania (see Table 4.4). Related schools are embedded in broader area development programs supported by the “Bridge of Hope Foundation” in cooperation with local partner organizations (World Vision Tanzania in Rukoma/Rubale; LEA Ministry in Mbulu; African Inland Church in districts around Mwanza). Consequently, school access and prior experience could be guaranteed in all these projects. All these schools have started to use the digital learning system sporadically already well before the study, allowing a fast and smooth start into a more systematic trial. Among these nine possible school candidates, two primary schools were selected for the design research intervention (ten-week trial): the Karama Primary School in Rukoma and the LEA Primary School in Dongobesh. Primary schools have been selected because research activities and interventions for digital learning are rarer in primary schools than in secondary schools. Plus, primary schools are the focus of World Vision Tanzania. Therefore, the author concluded that the study can have a broader impact when focusing on primary schools. Only one secondary school in Dongobesh was included in the teacher interviews.

In order to collect data and evidence from different contexts (especially schools with different teacher-pupil ratios) two private (LEA Primary in Dongobesh and Siday Primary in Mbulu) and two public schools (Karama Primary in Rukoma and Nyakaju Primary in Rubale) have been selected for teacher interviews. Major differences can be observed between private and public schools in Tanzania. First of all, the teacher-pupil ratio is typically much better in private schools (see Table 4.4). Consequently, data from public schools is particularly relevant for this study, as there is an obvious scarcity of teachers. Primary education is provided for free in Tanzania for many years.

And more recently, the administration of the former president Magufuli eliminated the school fees for public secondary schools as well. Private schools are charging school fees that typically exclude low income households from access to private schools, unless there are funding opportunities through external scholarships. This is the case in all LEA schools and Siday Primary School in the sample. Sponsors from Czech, Slovakia and Germany allow children from several poor communities access to these private schools.

Another important difference is the language of instruction. While Kiswahili is used in all public primary schools in Tanzania, all private schools of this sample have opted to use English as language of instruction, even in pre- and primary schools. This has a significant impact on the outcome of this study and issues related to the language of instruction are discussed in more detail in section 5.3.5.

No city school has been included in this study because of its focus on rural Tanzania.

Place / District	School	Orga	No. of Teachers	No. of Pupils	Teacher /Pupil Ratio	Start of Pilot Project	Part of study?
Rukoma / Bukoba	Karama Primary School	Public	7	537	1:77	Oct 2021	yes
Rubale / Bukoba	Nyakaju Primary School	Public	11	901	1:82	Dec 2022	yes
Dongobesh / Mbulu	LEA Primary School Dongobesh	Private	18	550	1:31	Jan 2021	yes
Dongobesh / Mbulu	LEA Dongobesh Secondary School	Private	13	190	1:15	Jan 2021	yes
Mbulu	LEA Siday Primary School Mbulu	Private	24	408	1:17	Feb 2022	yes
Hydom / Mbulu	LEA Eliet Primary School	Private	15	324	1:22	Jun 2022	no
Geita	AICT Rich Hill Primary School	Private	17	480	1:28	Oct 2022	no
Bunda	AICT Nyamakonbu Primary School	Private	11	338	1:31	Oct 2022	no
Nassa	Simba wa Yudah	Private				Oct 2022	no

**Table 4.4: Sampling of the participating schools**

For the ten-week research intervention, the above-mentioned *RACHEL* e-learning solution has been selected. The trial was conducted from early February to the end of April 2023 (with two weeks of Easter break). A total of forty pupils in four focus groups (two groups per school, ten pupils per group) participated in the study. The sampling strategy corresponds with what Kuckartz calls “purposive sampling” (Kuckartz 2014:85), where the selection of the research participants (pupil focus groups) is randomized on the one hand, but according to some judgment criteria on the other side (e.g. equal amount of girls and boys). “Purposive sampling” includes the “theoretical sampling” of the Grounded Theory, where research participants are selected by the criteria of minimal and maximal contrast. The background of this “theoretical sampling” is the desire to capture data from what is considered typical cases as well as from extreme cases with maximal deviation from the typical norm. The following rules were applied (see Table 4.5):

- Focus on classes Standard 5 and 6 because they do not have to worry about national exams in 2023
- Sample size: ten pupils per study group supported by one or more teachers
- Participants were selected randomly applying the following criteria:
  - o Equal (or balanced) amount of boys and girls (according to the current gender distribution in these schools)
  - o A good portion of the group should originate from poorer families. Criteria were whether or not the children are part of the RC (Registered Children) group (e.g. children that were selected jointly by World Vision Tanzania and the community to participate in a child sponsorship program).

**LEA Primary School Dongobesh**

Total: 20			
Std 5: 10		Std 6: 10	
Girls: 5	Boys: 5	Girls: 6	Boys: 4
RC: 1	RC: 1	RC: 2	RC: 0 *

\* 2 RC were invited and opted not to participate in this study

**Karama Primary School Rukoma**

Total: 20			
Std 5: 10		Std 6: 10	
Girls: 5	Boys: 5	Girls: 5	Boys: 5
RC: 2	RC: 2	RC: 2	RC: 1

**Table 4.5: Sampling of the pupil focus groups in the research intervention**

- The research focus was on the study groups only. Different from Randomized Controlled Trials (RCT) that have been used in similar contexts, for example by Pitchford (2015:3) to measure the effectiveness of tablet-based development of early mathematical skills, no empirical study was planned with the control group (children without systematic access to the digital learning system). However, after the intervention during the interviews, teachers were asked to review the progress of the study group compared to before.

Regarding sampling for the interviews, twelve teachers were selected that

- a) supervised the e-learning system within the ongoing pilot projects and
- b) agreed to participate in the ten-week research trial

All corresponding teachers were eager to participate in the research, although this meant some extra working hours for them. Two of the randomly selected pupils opted to not join the research program and were replaced by two others (also randomly selected). During the research intervention, a significant amount of pupils asked to be added to the program, which was not possible in the ongoing trial.



#### 4.5.2 Design Research Intervention (instantiation of artifact)

The research intervention focuses on the impact of digital learning in unsupervised, minimally invasive learning environments on children's empowerment. Because there is a lack of well-documented field research, a ten-week trial (instantiation of artifact) has been conducted from early February to the end of April 2023 (with two-week of Easter break). Although all research participants were somewhat familiar with the *RACHEL* e-learning system from previous pilot tests, their previous access to the system was sporadic rather than systematic. So we agreed to the following rules of engagement for the trial with all participating schools and teachers:

- Study groups get (almost) daily unsupervised access to the e-learning system for at least one hour in addition to the normal class lessons.
- Participation in this extra time is voluntary.
- Teachers are explicitly requested to stay in the background and support Minimally Invasive Education (MIE). In particular, they were asked to refrain from teaching extra lessons to the study groups. When questions arise, individually or within the group, pupils shall seek answers among themselves before any teacher intervenes.
- Teachers were requested to observe and document important findings in weekly observation reports.
- Participants of the focus groups were free to do whatever they liked and to spend their time on whatever content they preferred.
- The initial feedback revealed that the students were seeking some guidelines and instructions. As illustrated in the previous section, the action research method provides feedback loops allowing some adaptation of the technical and pedagogical setup during the research intervention. This was leveraged in this study to provide some better guidance to the research participants:
  - o Primary focus was set on Mathematics as this is a topic where many pupils are struggling. Links to learning materials were provided according to the Tanzanian standard curriculum. Mathematics was a good test if digital learning fosters understanding and application of theories.

- Civics and Moral education were selected as a secondary focus to allow and practice group discussions leveraging content from the e-learning system. Links to learning materials were provided according to the Tanzanian standard curriculum. Civics was a good test if digital learning fosters critical thinking and self-expression in group discussions.
- In Karama Primary School additional Mathematics learning videos in Kiswahili were uploaded because the children were struggling with English video content.

Convincing the teachers of all these rules of engagement before the trial was of critical importance. As we will see later, their initial confidence in children's ability to learn on their own was very diverse. Some teachers had to see a demo session with the focus groups before they could believe that such self-determined learning is possible at all. Such demo sessions were a central part of the kick-off meetings prior to the start of the trial. A game called "Black Stories" was used as an "ice breaker". Children had to find answers to difficult questions ("big questions" – see section 3.5) by asking yes/no questions to the game master. The demonstration of the "big questions" concept was important to arouse the curiosity and confidence of teachers and pupils that children can learn independently and are able to self-reliantly create an understanding of complex concepts.

#### **4.5.3 Collection of empirical data**

As explained in section 4.4, a *Mixed Methods* approach has been applied in the design research of this thesis integrating quantitative and qualitative research elements. The *holistic Multiple-Case Study* design enables the collection and comparison of data and evidence from different contexts (e.g. private vs. public schools in rural Tanzania) and different perspectives (e.g. teachers and pupils). The motivation for this mixing of quantitative and qualitative research elements is to provide additional coverage and an expanded perspective on the research question. The following empirical data has been collected in this study:

- *Before* the intervention, a quantitative survey based on a structured questionnaire collected feedback from teachers about their point of view regarding “good learning” and child empowerment, and their perception of how tablet-based e-learning can help them to accomplish desired outcomes. Participation was voluntary and anonymous. For Karama Primary School the survey was translated into Kiswahili. All other schools distributed the English questionnaire. The questionnaire contains eight open-ended questions and six quantitative questions with a fixed scale. Only a minimum of quantitative background information was collected (sex, age, years of experience as a teacher). The English version of the questionnaire can be found in Appendix F. Kiswahili responses from Karama School teachers have been translated into English before loading into MAXQDA for data analysis.
- *During* the intervention, teachers participating in the study groups were asked to record their observations in weekly observation reports (see Appendix D). Given the emphasis on minimally invasive education, interaction with the study groups should be limited and the focus was explicitly on observing the children’s interaction and learning progress. A total of 20 observation reports were collected predominantly from LEA Primary School teachers.
- *After* the intervention, feedback from the related teachers and pupils was collected through a mixed methods approach:
  - The initial teacher survey was repeated with five teachers who participated in the study at LEA Primary School. The results were analyzed for changes compared to before the trial.
  - Qualitative (guideline) interviews were conducted with seven teachers participating in study groups of the ten-week trial (five from LEA Primary School and two from Karama Primary School) and five teachers with deep e-learning experience from previous pilot projects (one from LEA Secondary School in Dongobesh, one from Siday Primary School in Mbulu, three from Nyakaju Primary School in Rubale). The goal of these teacher interviews was to discuss their experiences and observations using e-learning with

their pupils and to think critically about the impact on children's empowerment. The English version of the interview guidelines can be found in Appendix J. The interview language was English in Dongobesh and Mbulu and Kiswahili in Rukoma and Rubale. Kiswahili interviews were conducted by a social worker from World Vision who works in Rukoma for a broader Area Development Program. Teacher responses have been translated to English at the end of each question. While the audio recording contains both the Kiswahili responses from the teachers and the English translations from the social worker, only the English translation has been transcribed and loaded into MAXQDA for data analysis.

- Eight focus group discussions with the pupils of the study groups reviewed the experiences and specific aspects of the intervention from the pupil's perspective. Group discussions have been favoured over individual interviews with pupils because group discussions allow the exploration of dynamics that go beyond the opinions of the individuals (Flick 2019:252). The focus group discussions were divided into Standard 5 girls, Standard 5 boys, Standard 6 girls, and Standard 6 boys to keep the number of pupils between four and six in each of the group discussions. The focus group discussions were done in English at LEA Primary School, but a local social worker (pastor) was present in case the children asked for further explanations in Kiswahili. Focus group discussions at Karama School were done completely in Kiswahili, conducted by one female social worker (for the girls' groups) and one male social worker (for the boys' groups). A third female social worker took notes in all sessions. All three of them work with World Vision in the broader Rukoma Area Development Program. All focus group discussions with the children started with an Ubongo card game as an "ice breaker". Starting with some games before going into the focus group discussions made the children feel more comfortable and relaxed. The English version of the focus group discussion guidelines can be found in Appendix M. At the end of each focus group discussion the social workers summarized the

pupil responses to all the questions in English. The transcripts that are loaded into MAXQDA contain a summary of the social worker's notes and the English summaries of the pupils' responses.

- The *RACHEL* e-learning system provides some anonymous usage statistics that have been used to analyze usage patterns and most frequently accessed content during the ten-week trial.

All the collected empirical data has been transcribed, anonymized, translated to English, checked for consistency and spelling errors, and loaded into MAXQDA for further data analysis.

#### 4.5.4 Transcription guidelines

Transcriptions for all twelve teacher interviews and eight focus group discussions were made using a simplified transcription rule set based on Dresing and Pehl (2018:21-22) as well as Kuckartz (Rädiker & Kuckartz 2018:44-45). The following transcription rules apply:

- Each contribution is written down in its own paragraph starting with the unique identifier of the speaker and the related time stamp [h:mm:ss].
- All English interviews and focus group discussions are transcribed verbatim.
- For all Kiswahili interviews, the English translation of the social workers are transcribed verbatim.
- For all Kiswahili focus group discussions, a summary transcript is created containing a summary of the social worker's notes and the English summaries of the pupils' responses.
- Repetitions, stuttering, and inaccurate pronunciations will not be transcribed.
- Fillers like *ehm*, *aha*, etc. will not be transcribed.
- Word and sentence breaks will be marked by a dash (e.g. "*He sugges- he considered using the system*"; "*He started to talk about – but he changed the topic*").
- Long breaks are marked by (...), shorter breaks by (.)
- Signals of understanding (e.g. *mhm*, *aha*, *ja*) will only be transcribed if it has been the only meaningful reaction at this point.

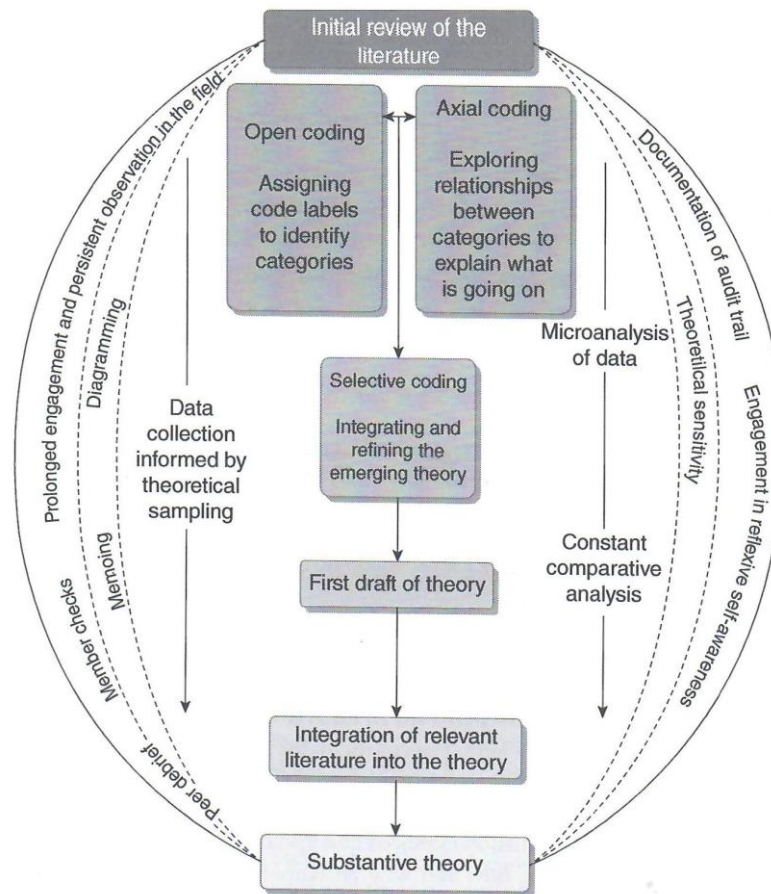
- Special emphasis is represented by CAPITAL LETTERS.
- Short interjections by the other person are integrated into the speech flow in brackets (e.g. “*I assume this is what you meant (LEA-NT: yes) so let’s talk about this in more detail*”).
- Unintelligible utterances are marked as (*unintelligible*) with a time stamp if these utterances occur in the middle of a paragraph. If appropriate, the reason for this disturbance is noted for larger unintelligible sections (e.g. “*When I think about how the interaction between the children has changed over time I can conclude that (unintelligible, school bell ringing) [0:13:27] which I think is very important to consider in future.*”)
- Nonverbal utterances of the speakers are marked in brackets (e.g. (*laughing*), (*coughing*) etc.)
- Nonverbal noises are marked in double brackets (e.g. ((*door slam*)), ((*mobile phone ringing*)), etc.)
- If the transcription is unclear but strongly suspected it is marked by a question mark (e.g. “*The time we had with the e-learning system was (not sufficient?). I would hope we get more time in the future.*”)
- In the case of punctuation, dots are used more frequently in the interest of better legibility.
- Any personal information has been deleted or anonymized.
- All transcripts are saved as *rtf*-file.

After finishing all data collection and data preparation parts, transcripts, observation reports, and survey results were loaded into MAXQDA for further analysis.

## 4.6 DATA ANALYSIS APPROACH

As described in section 4.5, the data collection is predominantly qualitative. The study used the Grounded Theory for data analysis and inductive theory building. *Grounded Theory* is a systematic methodology that helps the construction of theories through the collection and analysis of data (inductive reasoning). This means that theory building is grounded in data (Corbin & Strauss 2015:6). By choosing Grounded Theory the researcher steps beyond the known and “enters into the world of participants, to see the world from

their perspective, and in doing so to make discoveries that will contribute to the development of empirical knowledge” (2015:14). Figure 4.8 shows a schematic representation of the core elements of the Grounded Theory and the strategies used to enhance rigor (2015:344):



**Figure 4.8: Core elements of the Grounded Theory**

Source: Corbin & Strauss 2015:344

After loading transcripts, observation reports, and qualitative and quantitative survey results into MAXQDA the data analysis process of this study started with the coding. *Coding* is the process where qualitative data is broken down into manageable analytic pieces to arrive at possible meaning and develop concepts (Corbin & Strauss 2015:221). When interpreting and coding qualitative data, different coding processes are differentiated: open, axial, and selective coding. These processes shall not be misunderstood as completely separable procedures and completely separated phases in time (Flick 2019:387). While open coding marks the start of the data analysis, selective

coding comes to the forefront towards the end of the analysis process. However, the researcher may use and combine them and jump back and forth between them as necessary (2019:388).

*Open coding* identifies, reflects, and abstracts data and phenomena. It can be defined as “breaking data apart and delineating concepts to stand for interpreted meaning of raw data” (Corbin & Strauss 2015:239). The aim is a better understanding of the qualitative data and its meaning. The resulting code system may contain hundreds of different codes, which then need to be structured and grouped together. Codes can be abbreviated abstractions of a concept or concepts using the actual words of research participants (in-vivo codes). The code system together with the respective code memos plays a central role in the theory-building process of the Grounded Theory (Rädiker & Kuckartz 2018:68). In line with the principles of the Grounded Theory the data analysis of this study started with an open coding process. Instead of preloading categories, codes were derived inductively from the qualitative data. The first round of coding was a *broad-brush coding* (2018:73), coloring text paragraphs according to five categories:

- Yellow: Self-reliant learning (187 codes)
- Red: Empowerment (74 codes)
- Green: Benefits from e-learning (241 codes)
- Blue: Interaction (71 codes)
- Magenta: Requirements, Risks & Challenges (269 codes)

A second round of coding was a line-by-line *micro coding* (Rädiker & Kuckartz 2018:74), adding over a hundred new individual codes from all the transcripts (12 teacher interviews and 8 focus group discussions), observation reports (20 reports) and qualitative survey results (37 teachers participated). A summary of the resulting unstructured code system is listed in Appendix Q. The number of coded segments per code ranged from 1 to 151, indicating the need for aggregating or merging some of the codes on the one hand and differentiating or dividing some codes on the other hand. So the next step of the data analysis process was another round of open coding aiming at structuring the code system and defining a manageable amount of top-level categories. The resulting structured code system is documented in Appendix



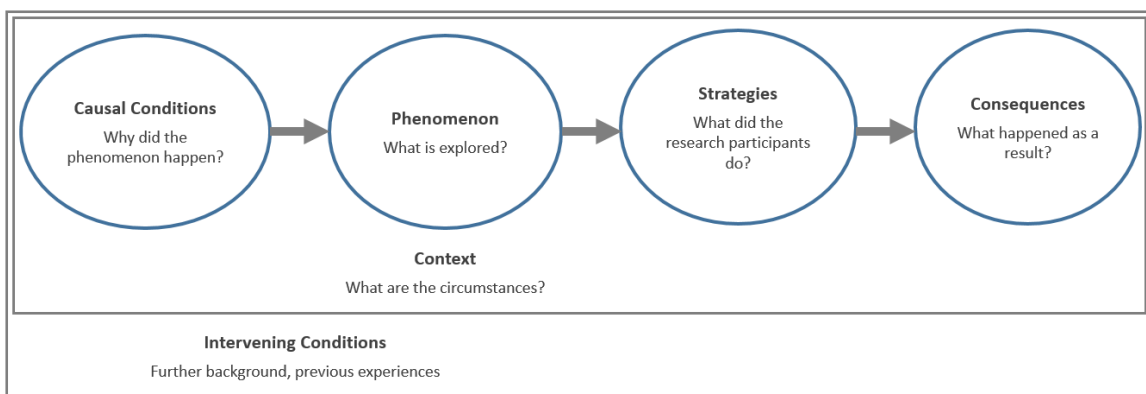
Q. These codes were further analyzed using several of the MAXQDA tools including Word Clouds, Code Matrix Browser, Code Explorer, Subcode Statistics, Document Portrait, Codeline, Smart Coding Tool, and others. After finishing the open coding and summarizing its findings, the next step in the data analysis process has been carried out, the axial coding.

*Axial coding* is the process of relating codes to each other, either through inductive or deductive thinking. Corbin and Strauss highlight the importance of a thorough *comparative analysis* in this context (Corbin & Strauss 2015:240). During axial coding and through the exploration of code correlations, such categories will be extracted from the available codes and code memos that are particularly relevant to the research question (Flick 2019:395). To find and illustrate relationships between different codes and sub-codes Corbin and Strauss propose a *Coding Paradigm* that contains six components as shown in Figure 4.9 (Flick 2019:394; Delve 2023):

- *Phenomenon* – the central idea or the observed event, the incident about which a set of actions or interactions are directed (“What is the phenomenon that is explored?”)
- *Causal conditions* – what influences or causes the observed event or phenomenon (“Why did this phenomenon happen?”)
- *Strategies* – purposeful, goal-oriented actions and interactions associated with the central phenomenon (“What did the research participant do because of the phenomenon?”)
- *Context* – the characteristics belonging to or associated with the central phenomenon or the location of events (“What are the circumstances in which the phenomenon is observed and in which the research participants act and interact?”)
- *Intervening conditions* – conditions or features that shape, facilitate, or constrain the strategies that are implemented within a specific context (“Is there further background information or are there previous experiences that help to understand the strategies chosen by the research participants? What caused or hindered a reaction?”)

- *Consequences* – results or outcomes of actions and interactions that are part of the strategies (“What happened as a result of the research participants’ action?”)

A new category is centered around an explored phenomenon. The relationship between the different subcategories (components) of this new category can be summarized as follows: the phenomenon occurs because of causal conditions. In reaction to this phenomenon, the research participants create strategies that lead to consequences. All of this takes place within a given context and is influenced by intervening conditions.



**Figure 4.9: Coding Paradigm according to Strauss and Corbin**

Source: Delve 2023

The findings of the axial coding have been summarized by applying the Coding Paradigm to some specific phenomena observed in the responses to the teacher survey, the research intervention, the teacher interviews, and the focus group discussions. The phenomena that were chosen are deemed either representative or highly relevant for the understanding of the research question.

*Selective coding* is the third step of the coding process and unifies the data and results from the previous coding steps on a higher level of abstraction. According to Strauss and Corbin, this step focuses on the central phenomenon of the study (Flick 2019:397). By delving deeper into the properties and dimensions of the core categories from open and axial coding and their relationships with each other, a cohesive theoretical framework is constructed that explains the central phenomenon. Different categories are unified and arranged around one central category. A new theory is derived

from this abstraction level and built out during further data analysis. Finally, the new theory ought to be evaluated and validated based on the empirical data.

## **4.7 ETHICAL CONSIDERATIONS**

Each step of the research process is accompanied by ethical considerations, from the definition of the research objectives, determination of the sampling, and conduction of the empirical research to the distribution of results (Northway in: Flick 2019:63). Special ethical considerations apply to this thesis because there is direct human participant involvement in the research intervention, the survey, the interviews, and the group discussions. The involvement includes adult teachers as well as minors (pupils from primary schools) participating in this design research. These pupils are considered a vulnerable group. In some cases, they are even part of what World Vision defines as most vulnerable children (MVC), which are children from households in extreme poverty, orphans, or children living under hardship conditions. The ethical risk has been minimized because the topics covered in the questionnaire and guidelines are not controversial to put participants under psychological or social stress. It is important to note, that the empirical research does not measure the academic performance of the study group which could bring children in an awkward position of shame. Academic performance measured through an academic test may put children under a certain stress level, even if it is not related to their official grades in school. As any academic test may cause psychological stress, this study abstains from such tests. The focus is on different perceptions of technology-enabled learning and how this can positively impact children's empowerment. Some fun games and quizzes were introduced to the four focus groups as an ice breaker. The desire that children should enjoy the extra learning time during the research intervention has been fully confirmed by the feedback from both teachers and pupils.

It is acknowledged that not being selected as part of one of the study groups and not having more regular access to tablet devices can cause desires and social anxiety. This is the reason why groups are randomly

selected. It is important to note that the digital learning system is already established in both schools where the research intervention took place. As a result of that, no child is permanently excluded from access to the e-learning system. Extended access for the study groups was limited to the ten weeks of the intervention. After that, all children are treated equally. It is also important that the future ownership of the digital learning system does not depend on any result of the study. Both schools already own the digital learning server and several dozens of tablet devices.

Interviews and focus group discussions were conducted in the official school language (Kiswahili in Rukoma, English in Mbulu). Kiswahili interviews and discussions were moderated and summarized in English by social workers from World Vision. In Mbulu, a local pastor was present as a person of trust in all focus group discussions. No teachers or other school staff participated in the focus group discussions to maximize the trust and comfort of the participating children so that children could talk freely without being scared of consequences. Critical comments about the intervention were encouraged several times during the discussion, not suppressed. One specific goal of the study is to identify areas of improvement in the existing digital learning system. In order to reveal such areas of improvement, children were encouraged to share what was difficult or disturbing in the current setup.

All data has been anonymized to secure privacy and confidentiality. The identity of the children participating in the study groups is not relevant to this research. With regards to sampling, apart from a few conditions that have been defined upfront (see section 4.5.1), participants of the study groups were selected randomly so that influences to take advantage were eliminated.

A teacher bias towards positive statements about the digital learning system to receive funding or equipment was eliminated – the schools already own all the equipment that they need to operate the digital learning system, irrespective of the outcome of the research study. An enhanced learning environment leveraging technological innovation to address the huge issue of teacher scarcity constitutes a major benefit for the participating schools. Another immediate benefit is the daily access to e-learning in school. In line with Warschauer's definition of the "digital divide", the benefits for children are not restricted to mere access to e-learning technology. The focus of the

intervention is on the transformation and social inclusion using Information and Communication Technology (ICT), especially with marginalized groups (Warschauer 2002:7). Consequently, the perception of children from the MVC group is particularly relevant to this study. Their participation is indispensable to the research as requested in Part 2 §3.8.2 of UNISA's Policy on Research Ethics (UNISA 2016:16).

Participation of both, teachers and pupils of the study groups was based on their free given, specific, and informed consent according to Part 2 §3.2 of UNISA's Policy on Research Ethics (UNISA 2016:14). Parental or guardian permission has been obtained for all minors that participate in the study (refer to Appendix B for the consent form). This was no major obstacle as parents have been involved regularly in the participatory approach of the broader area development programs. The consent forms include the participant's right to privacy, anonymity, and confidentiality. It also highlights the voluntary character of participation and the right to withdraw at any time (Helfferich 2011:191). Two children who were originally randomly selected for the trial opted to not participate. None of the participating 40 children and 12 teachers has withdrawn. All participants' rights have been discussed and signed before starting the empirical research. To ensure that all participants (and their parents or guardians) were well informed about the reason and the procedure of the research, a handout was created in English and Kiswahili (see Appendix C). Given the involvement of (public) schools in Tanzania, a research permit was required from the regional ministry of education (see Appendix A). Additional governmental permits may be required if research results will be published in magazines.

#### **4.8 VALIDITY AND RELIABILITY OF THE STUDY**

Validity and reliability concerns are taken for data collection as well as for data analysis. To achieve a maximum level of validity, special considerations have been given to the fact that the main objective of this research is an investigation of the impact on children's empowerment. Because empowerment constitutes a holistic concept that is hard to measure, relevant factors like self-determined, independent, interactive learning, or critical

thinking have been monitored. The mixed methods approach was introduced in order to collect data from multiple sources and gain knowledge from different perspectives (Kuckartz 2014:52). While this may not increase the validity of a single source, it does for the overall study.

The reliability of the research is increased through the multiple case study approach. This allows a comparison of data from different study groups in different case studies. Previous experiences from existing pilot tests have contributed to understanding the requirements for digital learning systems in the related contexts. The tools' development process, in particular the compilation of the teacher survey and the guidelines for the teacher interviews and focus group discussions, benefited from the experiences during the introduction of digital learning in the schools of the study sample. This includes a pre-study and several reviews and discussions with the teachers about how they use the e-learning system and what improvements they would like to see. The tools used in the empirical study consolidated these discussions more systematically, improving the validity of the tools development process.

Definitions of categories and initial results were reviewed with teachers and the school leadership as an additional validation step (communicative validation) (Flick 2019:495).

Teachers' understanding of their traditional role in rural areas may prevent them from accepting new concepts like Minimally Invasive Education (MIE). But it is also acknowledged that teachers may be hesitant to criticize the digital learning approach because they may be afraid of offending the donor or losing future funds by doing so. This bias is mitigated by explicitly provoking critical feedback and addressing challenges in the surveys and interviews.

Special considerations were made regarding the language barrier to increase the validity and reliability of the study. As outlined in section 5.3.5, the importance of contextually appropriate e-learning content in Kiswahili is mission critical to optimize the impact on children empowerment especially in public schools in rural Tanzania, where Kiswahili is the official language of instruction. Although most of the content on the digital learning server is in English, this requirement has been addressed during the action research

phase. Mathematics learning videos in Kiswahili were added to the server at the beginning of the research trial. Moreover, local teachers have been trained to upload their own local content. This feature of the digital learning system is used extensively by teachers of the study sample to add specific content (e.g. videos or text documents) in the actual context of the school.

Chapter 4 has outlined the research design and methodology. Design Research has been selected as the research paradigm because of its great fit with the research objectives. The aim is to answer the research question of *how* a digital learning system can foster the empowerment of children and the perceived quality of education in schools in rural Tanzania. Peffers' DSR Methodology Process Model has been used as methodology in this thesis because it provides an easy-to-understand, well-defined, visual representation of the research process. Given the lack of knowledge and guidelines for digital learning in Tanzania in the current literature, a mixed methods study has been set up including field tests to acquire new knowledge in a real-world context and derive guidelines for best practices. The resulting data collection strategy includes a teacher survey, observations during the ten-week research intervention, qualitative teacher interviews, and focus group discussions. It has been described in detail in this chapter. Moreover, the data analysis approach based on the Grounded Theory has been introduced. The resulting summary of findings will be summarized in Chapter 5.

## **CHAPTER 5 – RESULTS OF THE STUDY**

After illustrating the research methodology in Chapter 4, the findings and results of the empirical study are presented in this chapter. MAXQDA and a variety of its visualization tools have been used for data analysis and presentation of results. The structure of this chapter will follow the timeline of the data collection process and the subsequent data analysis steps as shown in section 4.4. Before starting with the presentation of the results it is important to remember the main research question and the primary objective of this study. How can a digital learning system foster the empowerment of children and the perceived quality of education in schools in rural Tanzania? The main objective of this research is to investigate the impact of technology-enhanced education on children's empowerment and human development in rural Tanzania and to generate recommendations on how e-learning can positively impact learning environments and teaching styles in related schools. A diverse set of empirical data has been collected from teachers and pupils in two regions before and after a ten-week research intervention.

### **5.1 KEY FINDINGS FROM THE TEACHER SURVEY**

The teacher survey was based on a structured questionnaire to collect a broad set of data from teachers about their point of view regarding “good learning” and child empowerment, and how tablet-based e-learning has helped them to accomplish desired outcomes. The questionnaire combined eight open-ended qualitative and six quantitative questions. Details of the results for each of the questions can be found in Appendix G. Each survey response is stored in MAXQDA as a separate document in the document group “Teacher Survey” (Documents 1001 – 1037). The initial upload contained the qualitative data of the teachers' free text responses. Data from the quantitative questions together with the quantitative background information (sex, age, years of experience as a teacher) is added as document variables in MAXQDA's Data Editor. MAXQDA supports a variety of mixed methods tools including the activation of documents based on the quantitative data stored in the document variables.



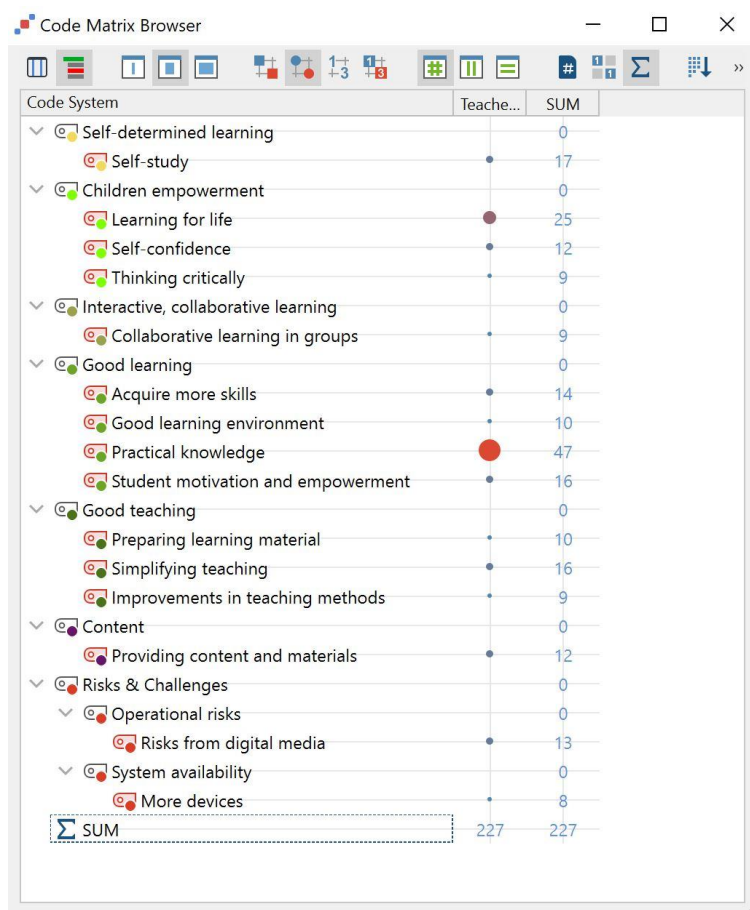
### 5.1.1 Focus area “Practical knowledge”

A dominant theme in the teachers’ responses is the importance of practical skills that apply to the children’s normal lives and environment. The importance of practical life skills from the teacher’s perspective has already been revealed in the early phase of the data analysis, e.g. in the Word Cloud of all survey responses in Figure 5.1:



Figure 5.1: MAXQDA Word Cloud of teacher survey

A deeper analysis using the MAXQDA Code Matrix Browser confirms this observation. The 15 codes that are used most frequently in the teacher’s survey responses are listed in Figure 5.2. “Practical knowledge” is leading this list with 47 mentions, followed by “Learning for life” which has been mentioned 25 times. Together these two codes constitute almost 20% of all 377 coded segments of the teacher survey. This is remarkable because the notion of “practical” does not come up explicitly in any qualitative question and only one question (Survey Question No. 4: How can children in school be well prepared for their life?) points towards “learning for life”.



**Figure 5.2: Code Matrix Browser – Top 15 codes of the teacher survey**

25 of the 37 teachers responding to the survey explicitly refer to “practical knowledge” or “practical skills” in their responses. The code “Learning for life” refers to statements like “Know how to solve problems in their life” (Doc. 1008, Pos. 3), “Good learning for a child is when the education [...] will help to fulfill his or her goals” (Doc. 1013, Pos. 2), “The children in school be well prepared for their life, for their future life, like practical skills, self-confidence” (Doc. 1021, Pos. 6), “To build knowledge that enables him to manage his life” (Doc. 1030, Pos. 5). Many teachers acknowledge that education, if related to practical skills that are important for pupils’ life and environment, empowers children to solve problems, fulfill goals, gain self-confidence and manage their lives.

Further analysis using MAXQDA’s Code Explorer (see Table 5.1) shows how “practical life skills”, “preparing and learning for life” and “empowerment” are intertwined:

Code	Most frequent code co-occurrences	No. of co-occurrences
Practical knowledge	Prepare for life	14
	Important skills and abilities	13
	Good learning	9
	Benefits from e-learning	7
Learning for life	Empowerment	17
	Prepare for life	13
	Important skills and abilities	7
	Good learning	5
	Practical knowledge	3

**Table 5.1: MAXQDA Code Explorer – Code co-occurrences**

A third of all coded segments of the teacher survey (122 of 377) relate to the category of “Good learning” (see Figure 13.1 in Appendix G), indicating the goodwill of teachers to provide an empowering education to their pupils even though the reality of daily school routine may look very different. While many teachers did not experience much "good learning" in their childhood, they express a deep desire to make a difference for their pupils today.

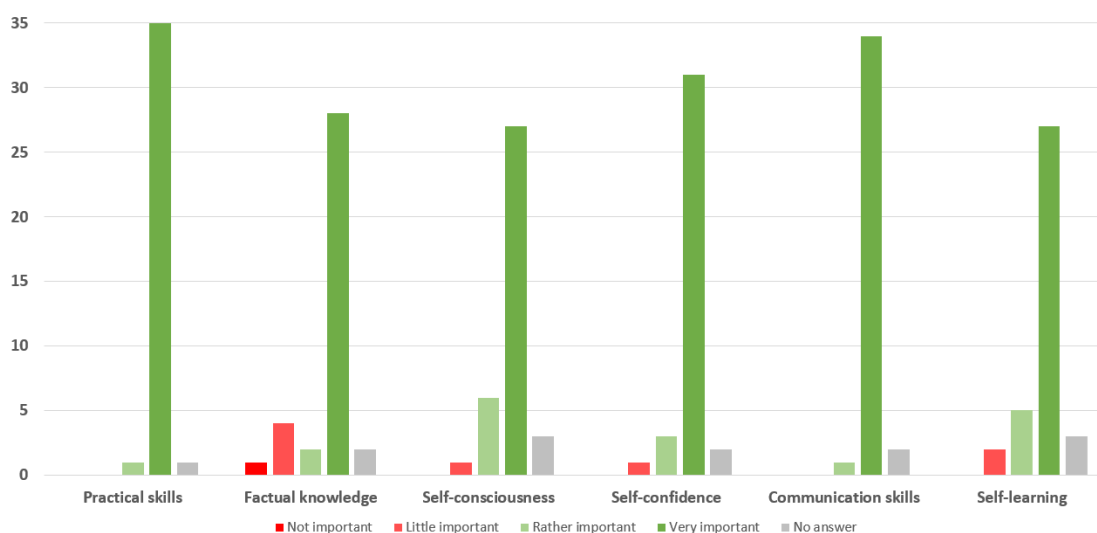
### **5.1.2 Focus area “Good learning”**

“Good learning” can have many different meanings. Acquiring “knowledge” and “skills” can be identified as key motivations from teachers’ perspectives, but they also emphasize the importance of empowerment and a good learning environment (Figure 5.3).

Subcode Statistics		
Code	Segments	Percentage
Acquire more skills	14	11,5
Better learning performance	1	0,8
Build reasoning skills	0	0,0
Capturing student's attention	0	0,0
Fostering creativity	5	4,1
Good learning environment	10	8,2
Learning about cultures	3	2,5
Learning at own pace	2	1,6
Learning by doing	2	1,6
Learning by exploration and discovery	6	4,9
Most critical skills	5	4,1
Practical knowledge	47	38,5
Promoting learning	6	4,9
Student motivation and empowerment	16	13,1
Teachers learning from students or e-learning	5	4,1
TOTAL	122	100,0

**Figure 5.3: MAXQDA Subcode Statistics: Number of coded segments per subcode in the category “Good learning”**

When asked about “what is most important to empower children for their life” (Survey Question No. 5), teachers tend to highlight the importance of a broad set of goals rather than biasing on specific items. All proposed options are largely rated as “very important” (Figure 5.4):

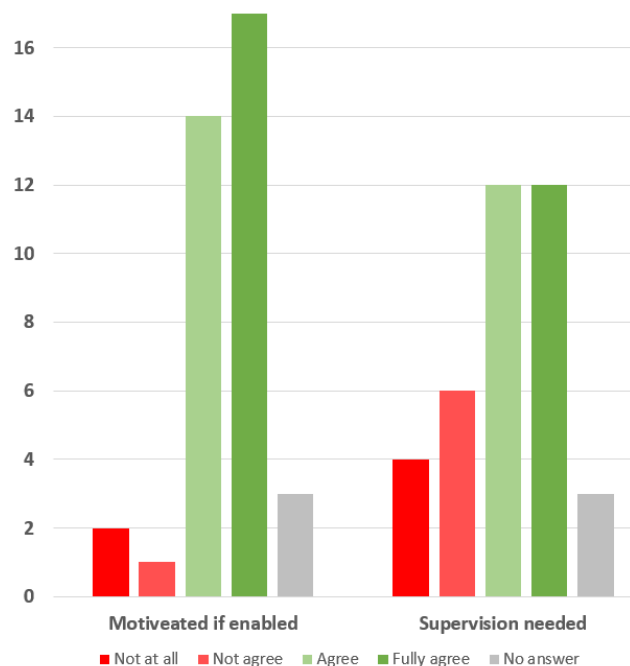


**Figure 5.4: Quantitative teacher survey (Question 5)  
“What is most important to empower children for their life?”**

Also, almost all of the teachers unambiguously agree that good learning should motivate critical and creative thinking (100%), help children to discover knowledge on their own (94%), and motivate children for self-studies (94%).

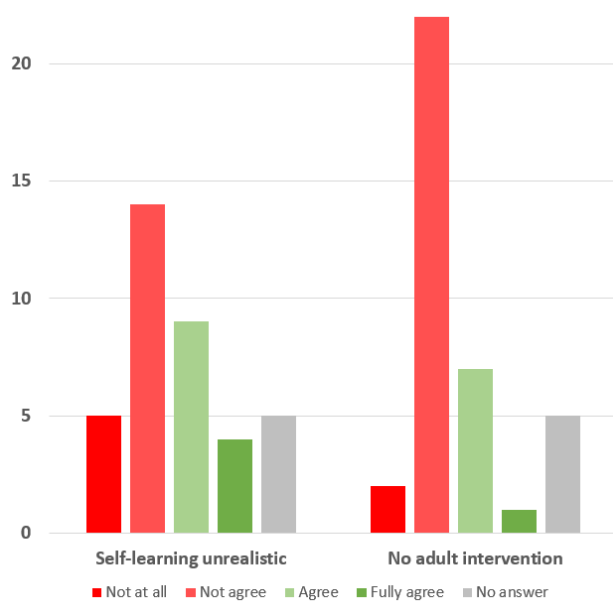
### 5.1.3 Self-determined learning versus teacher guidance

While most teachers show a big consensus on key educational goals, their views on the best way to get there vary widely. Particularly the question about their opinion on independent learning of children in school (Survey Question No. 8) reveals that teachers do not consent – or may not even know – how much supervision is needed or good for self-determined learning. Most teachers agree or fully agree that “children are motivated to learn on their own if they have the means to do so” (31 of 36 respondents). But at the same time 21 of these 31 teachers highlight that supervision is needed (Figure 5.5).



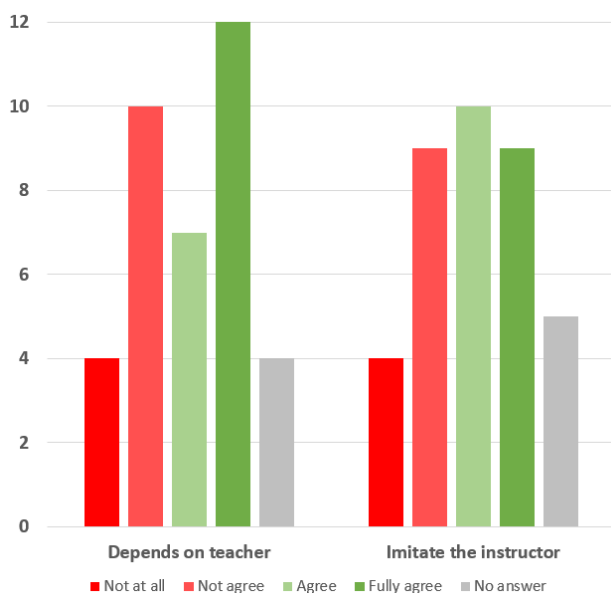
**Figure 5.5: Quantitative teacher survey (Question 8)  
About independent learning of children**

Teachers seem to be hesitant to believe that self-determined learning without a teacher is realistic. Although 29 of 35 teachers agree or fully agree that children can learn new things without a teacher (Survey Question No. 6), two-thirds of the teachers do not agree that learning happens best if no adults intervene (Figure 5.6):



**Figure 5.6: Quantitative teacher survey (Question 6)**

This mismatch between teachers' belief in pupils' ability to learn self-reliantly and their strong emphasis on the need for teacher guidance and supervision did not only come up in the teacher survey. As we will see later in this section it also plays an important role in the data analysis of the teacher interviews and the focus group discussions. This topic has a significant influence on the objective of this thesis to generate recommendations on how e-learning can positively impact learning environments and teaching styles in related schools in rural Tanzania. Due to this relevance, questions around this topic have been emphasized in the subsequent teacher interviews and focus group discussions. The mismatch is also visible when analyzing the way teachers reflect on their role in the education process. The results have been very mixed (see Figure 5.7). While 19 teachers agree or fully agree that good learning depends on the teacher, 14 do not (at all) agree. 19 teachers agree or fully agree that good learning should animate the children to imitate the instructor, and 13 do not (at all) agree (Survey Question No. 2).



**Figure 5.7: Quantitative teacher survey (Question 2)**

**“Which statements best describe your view of good learning?”**

Another interesting observation can be made in Survey Question No. 6: while 22 teachers (65%) agree or fully agree that facts are more important than understanding, only 12 of the teachers (35%) do not (at all) agree. This seems to contradict the widely accepted educational goal of critical thinking.

Two-thirds of the teachers agree or fully agree that self-determined learning works, but only in small groups (Survey Question No. 8), illustrating the importance of collaborative and interactive learning in the education process. This will be further explored later in this section. While almost 100% of the teachers agree or fully agree that collaborative learning in small groups should be practiced in school, three-quarters of them agree or fully agree that group learning needs strict rules to work effectively. This indicates again the mismatch between teachers’ belief in pupils’ ability to learn self-reliantly and their strong emphasis on the need for teacher guidance.

#### **5.1.4 Impacts and risks of digital media**

Teacher responses to the open Survey Question No. 9, how new digital media (e.g. tablets) can foster more self-determined learning, indicate a lot of positive expectations on digital learning (see Table 5.2). Many teachers highlight a positive effect of e-learning on learning practical skills and knowledge:

Teacher Statement	Source (Survey Doc.)
Digital media can help children to develop themselves even in the absence of a teacher.	Doc. 1001, Pos. 8
Digital learning provides an opportunity for the learners to interact and creates self-determination among the learners. Also, it creates a chance for the learners to discover new knowledge on their own.	Doc. 1002, Pos. 10
Pupils like to learn what attracts them and through using tablets it can encourage them to learn.	Doc. 1003, Pos. 6
Through digital learning, pupils can discover new knowledge and skills on their own.	Doc. 1005, Pos. 7
Digital learning motivates pupils because they are interacting with the world around them.	Doc. 1011, Pos. 6
Digital media help to improve learning through social networks, to understand things that are happening all over the world.	Doc. 1006, Pos. 14+15
Digital learning motivates critical and creative thinking.	Doc. 1037, Pos. 15

**Table 5.2: Teacher statements about the value of digital learning**

In addition to these appreciative statements about digital learning, teachers acknowledge that digital learning helps them as a teacher (Survey Question No. 10):

Teacher Statement	Source (Survey Doc.)
Digital learning simplifies the teaching process since most learning materials can be accessible through the digital media.	Doc. 1002, Pos. 11
Digital media help teachers to save time and energy during preparation and in the classroom.	Doc. 1004, Pos. 7
Digital learning simplifies the teaching process by displaying pictures, photos and videos practically.	Doc. 1037, Pos. 17

**Table 5.3: How can digital media help the teacher?**

When asked explicitly about risks and problems of digital learning (Survey Question No. 12), most teachers highlight hardware-related problems. There are not enough tablets, tablets can be damaged, or there may be a lack of electricity. Some teachers raised their concern that pupils may not use the e-learning system for what they are supposed to do, especially if there isn't strong supervision from teachers. Only a few statements touch on the availability and the suitability of the system's content. As we will see later, the importance of a curriculum match has been made more explicit in the teacher interviews after the ten-week trial.



### 5.1.5 Other findings of the teacher survey

The closing remarks (Survey Question No. 14: Would you like to add any further comment or observation?) revealed again the controversy between self-reliant learning and supervision through teachers. On the one hand, self-motivated studying among the learners should be promoted (Doc. 1002, Pos. 13), on the other hand, some teachers insist in their survey responses that grouping children without supervision is not good (Doc. 1006, Pos. 26). MAXQDA's Mixed Methods tool Crosstab has been used for a deeper analysis of this issue. Influences of teachers' sex and age have been explored. It is interesting to note that from all the claims and statements that support or promote self-determined learning only less than a third (9 of 34) were made by teachers of the age of 30 and below, although this group represented 18 of 32 teachers in the set (see Figure 5.8). Hence, the data of this study does not support the assumption that young teachers are more open than older teachers to promote pupils' independent learning.

	Document group	Teacher Survey	Age = <30	Age = <40	Age = <55	Total
Self-determined learning						
Challenge students		2		2		4
Freedom to learn		3	2	1		6
Independent learning		6	1	3	1	11
Self-reliance		3	2	1		6
Self-study		17	4	12	1	34
Student participation		3		3		6
<b>SUM</b>		<b>34</b>	<b>9</b>	<b>22</b>	<b>2</b>	<b>67</b>
<b># N = Documents/Speakers</b>		<b>37 (100,0%)</b>	<b>18 (48,6%)</b>	<b>11 (29,7%)</b>	<b>3 (8,1%)</b>	<b>37 (100,0%)</b>

**Figure 5.8: Crosstab “Self-determined learning” per Teacher Age**

Overall, digital learning is perceived very well by the teachers, for their school and beyond. Some teachers go as far as to claim that every school in Tanzania should adopt this program (Doc. 1034, Pos. 17), even starting from preschool (Doc. 1012, Pos. 15).

### 5.1.6 Re-validation of the teacher survey

After the ten-week trial and before conducting the teacher interviews, a second survey was done with the five teachers who participated in the trial at LEA Primary School in Dongobesh (Documents 1050 – 1054). The questions were a subset of the initial survey (eight questions) plus four new questions to summarize their observations. This short survey aimed to verify or disprove the findings of the initial teacher survey and to check, if any major changes can be observed in the teacher's responses. The following conclusions could be derived from this confirmatory survey:

1. All five teachers highlight the importance of independent and self-reliant learning.
2. All five teachers observed that pupils of the study groups were able to learn self-reliantly with the e-learning system.
3. All five teachers observed good interaction and cooperation among the pupils of the focus groups indicating that interactive and collaborative learning in groups works well even without the presence of a teacher.
4. Teachers now can better articulate more detailed requirements and specific areas of improvement (e.g. adding content matching the curriculum, better integration of digital learning into the school timetable).
5. Teachers confirm that e-learning saves time for them and that they can cover topics in less time.
6. All teachers acknowledge that the digital learning system is useful to teachers and pupils and that it fosters learning and teaching processes (Doc. 1051, Pos. 17)

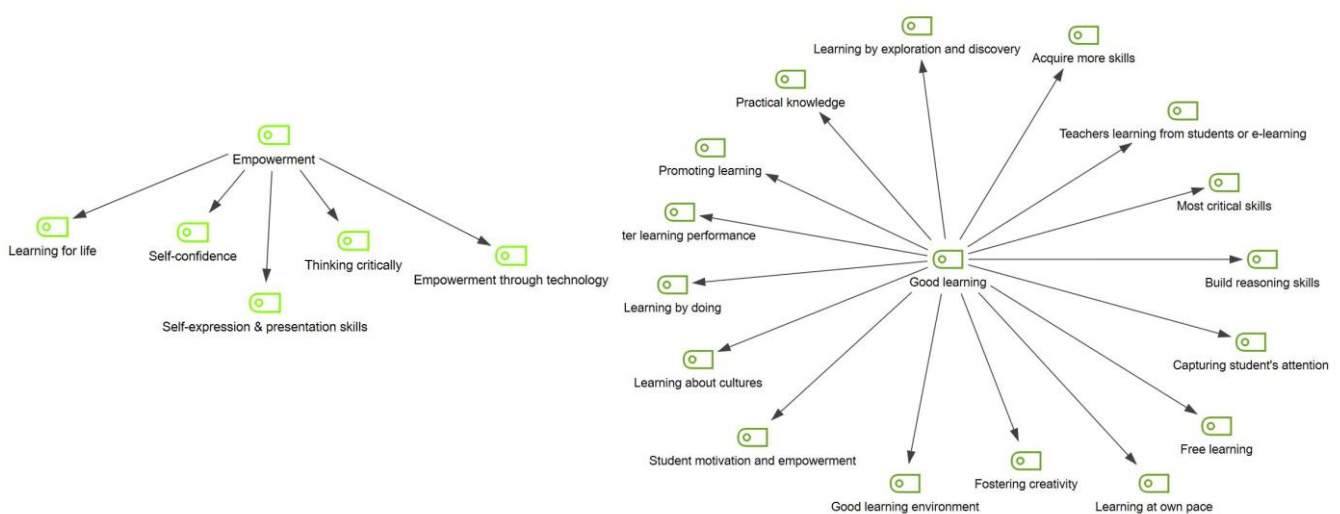
Further details on the re-validation of the teacher survey can be found in Appendix I. In the next section we will discuss the findings of the open coding process that leveraged the qualitative data from the teacher survey, the observation reports during the ten-week trial, the transcripts of the teacher interviews, and the transcripts of the focus group discussions with pupils.

## 5.2 KEY FINDINGS FROM THE OPEN CODING PROCESS

As one of the central parts of the Grounded Theory *open coding* identifies, reflects, and abstracts data and phenomena to better understand the qualitative data and its meaning. The data analysis of this study started with an open coding process in which codes were derived inductively from the data. The qualitative data consists of teacher survey responses (37 teachers participated), observation reports (20 reports), and transcripts (12 teacher interviews and 8 focus group discussions). The first round of coding was a *broad-brush coding* (Rädiker & Kuckartz 2018:73), coloring text paragraphs according to five categories (see excerpt in Appendix K):












- Yellow: Self-reliant learning (187 codes)
- Red: Empowerment (74 codes)
- Green: Benefits from e-learning (241 codes)
- Blue: Interaction (71 codes)
- Magenta: Requirements, Risks & Challenges (269 codes)

After that, individual codes were added in a line-by-line *micro-coding* process (Rädiker & Kuckartz 2018:74). The resulting unstructured code system was then further structured with MAXQDA's Creative Coding tool. This visual tool allows the researcher to easily group, aggregate, merge, or subordinate codes. Sample code structures are shown in Figure 5.9 and Appendix Q for different top-level categories.



**Figure 5.9: MAXQDA Creative Coding: structuring the code system**

Figure 5.10 shows the resulting structured code system with the ten top-level categories. Further details of the code system and the underlying document system are documented in Appendix Q.

 Code System	2638
>  Self-determined learning	146
>  Teacher guidance and supervision	87
>  Traditional learning	21
>  Children empowerment	95
>  Interactive, collaborative learning	95
>  Good learning	239
>  Good teaching	119
>  E-learning - Observations & Recommendations	221
>  Content	88
>  Risks & Challenges	198

**Figure 5.10: Code System after finishing the open coding process**

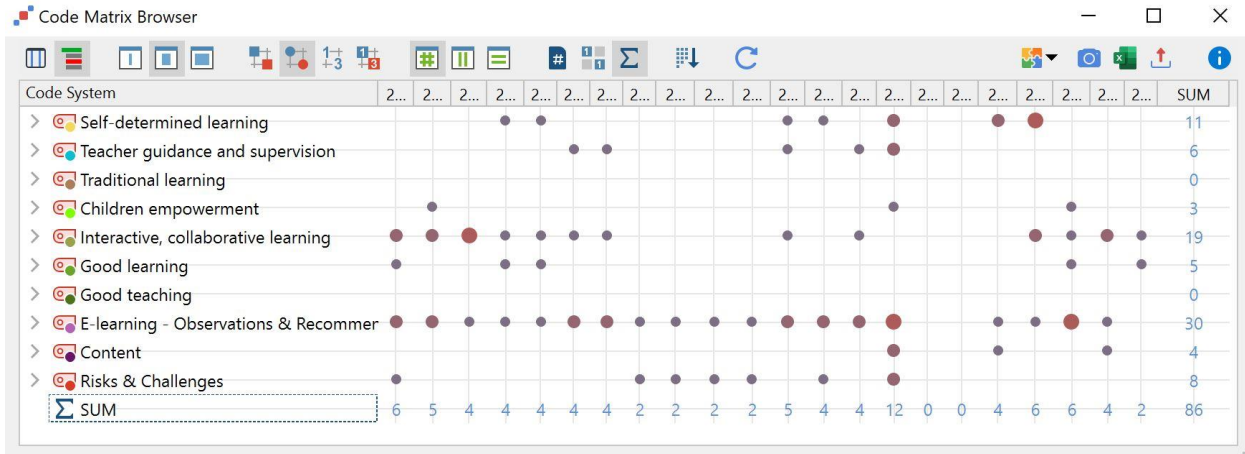
### 5.2.1 Observations during the ten-week trial

Participating teachers were asked to write weekly observation reports during the ten-week trial. Five of seven teachers did so, although not on a weekly basis (Documents 2001 – 2022). An open question in the beginning was if and for how long pupils of the focus groups were willing to participate. Working with the e-learning system was voluntary in their extra time in addition to all their normal school lessons. The start was promising as no child left the room during the initial trial sessions even though they were free to do so (Doc. 2001, Pos. 3; Doc. 2002, Pos. 3). This continuity of attendance was observed over the complete duration of the trial. Pupils even asked to have more time with the e-learning system:

“Pupils asked us about time, they begged us to add at least one hour but we told them it is difficult to add because of the timetable of the school” (Doc. 2012, Pos. 8).

The initial exploration with MAXQDA’s Code Matrix Browser indicates three dominant categories within the data of the observation reports (see Figure 5.11):

1. E-learning – Observations & Recommendations
2. Interactive, collaborative learning
3. Self-determined learning



**Figure 5.11: Code Matrix Browser – Number of coded segments in observation reports**

One of the most frequent observations is that children like to learn through videos (Doc. 2013, Pos. 7). Learning cartoons like Ubongo Kids were highly appreciated by the children, particularly in the early phase of the trial (Doc. 2003, Pos. 3; Doc. 2006, Pos. 3; Doc. 2007, Pos. 3). Pupils like to learn by themselves and they do enjoy much to look videos (Doc. 2018, Pos. 7). As we will see later when we discuss the feedback from the focus groups, the further the trial progressed, the more the children were focusing on learning videos that matched the topics of their classroom sessions.

The trial was structured in a way that pupils were given guidelines about proposed content that matches their curriculum and the topics covered in classroom sessions during the trial period. However, they were explicitly informed that they are free to choose other topics as well. Teachers observed that children’s interests sometimes did not match the proposed content. Some teachers raised concerns about this fact (Doc. 2014, Pos. 4). Others consider such curiosity as positive effect:

“In order for pupils to learn or to gain knowledge they need freedom. Thus this week I saw the way pupils they share their ideas in order to discover new knowledge” (Doc. 2019, Pos. 7).

Some teachers were surprised about the intensity of interaction between the pupils (Doc. 2001, Pos. 4; Doc. 2014, Pos. 6). As we will see later when we

discuss the findings from the teacher interviews, the interaction and collaboration among the pupils of the focus group has even intensified throughout the ten-week trial. Therefore, “interactive, collaborative learning” has been identified as a top-level category of this study. Group discussions took mainly place when Civics topics (e.g. What is love? What does it mean to love your neighbour?) were on the agenda (Doc. 2021, Pos. 3). This confirms the value of choosing Civics as a core topic for the trial sessions (along with Mathematics, which is testing if cognitive understanding is improving through e-learning). “Different from classroom sessions, boys and girls mix up in study groups, especially in Civics discussions” (Doc. 2020, Pos. 3). This observation was deemed significant by the teacher because such mixing of genders rarely happens during normal classroom sessions even if allowed or even promoted by the teacher.

Another highly relevant observation from one of the teachers supervising the e-learning program is that effective participation from children decreases as soon as teachers are around (Doc. 2022, Pos. 3). This statement means a strong argument for Minimally Invasive Education and questions the importance of strong supervision from teachers. He also highlights the positive effect of e-learning on the overall performance of the class:

“Performance is regularly measured through internal school performance assessments. In the past, it was hard to achieve 67%. Since the introduction of e-learning results have continuously improved, reaching 88% last year” (Doc. 2022, Pos. 4).

While this study does not objectively measure improvements in academic performance, the claim he is making indicates a tremendous potential for improving learning performance.

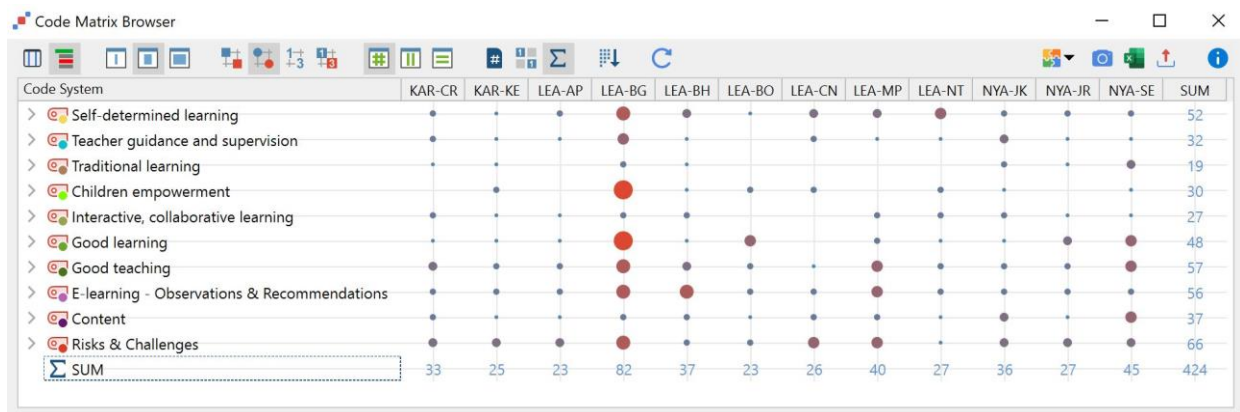
### **5.2.2 Key findings from the teacher interviews**

A total of twelve teacher interviews were conducted at the end of the ten-week trial. All of them had prior experience supervising the e-learning system within the ongoing pilot projects. And all of these teachers were eager to participate in the research, although this meant some extra working hours for them. The goal of these qualitative interviews was to discuss their experiences and observations using e-learning with their pupils and to think critically about the

impact on children’s empowerment. The interview guidelines started with a couple of opening questions about teachers’ perception of “good learning”. After that, three key topics were explored in more detail:

- How can children be empowered through education?
- Teachers’ view on self-determined and interactive learning
- Observations during the trial if and how effectively children can use digital media for education (and what obstacles remain)

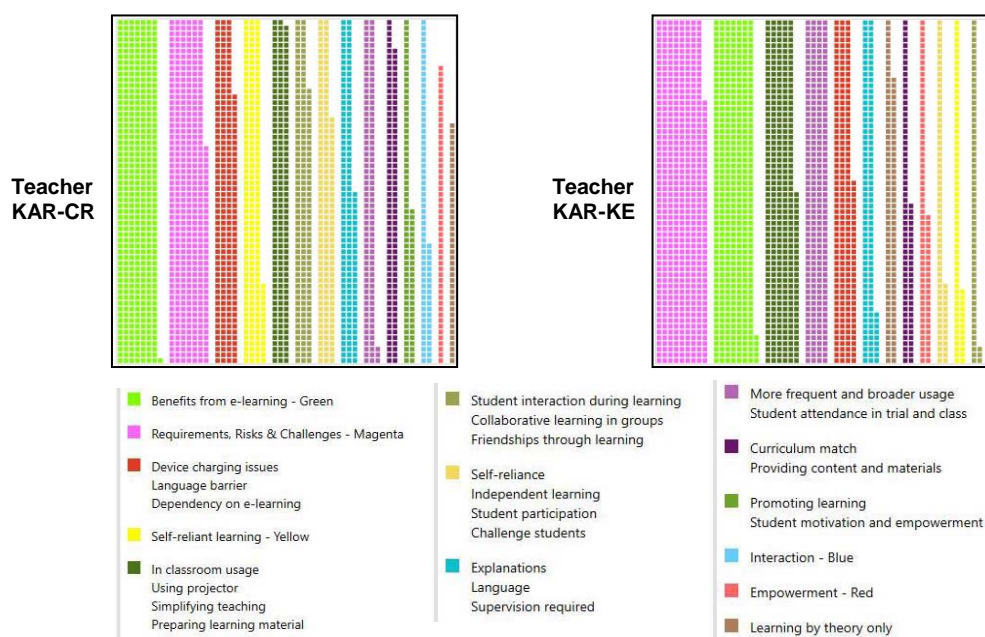
The interview guidelines proposed several questions for all these topics, but the moderator was free to ask further questions, change the order of questions, or leave out some of the questions. 424 coded segments within the top ten categories are associated with the interview transcripts. All topics of the top-level categories have been covered as illustrated in Figure 5.12. No specific topic stands out.



**Figure 5.12: Code Matrix Browser – Number of coded segments in interview transcripts**

Interview LEA-BG was exceptional because it represents feedback from a Secondary School (all other interviews were conducted with primary school teachers). Moreover, the corresponding LEA Secondary School has the longest experience with the *RACHEL* digital learning system which has been integrated into their school routine since January 2021. Other than that, the Heatmap of MAXQDA’s Code Matrix Browser (Figure 13.2 in Appendix G) shows a wide distribution of topics covered in all the teacher interviews without any noteworthy accumulation.

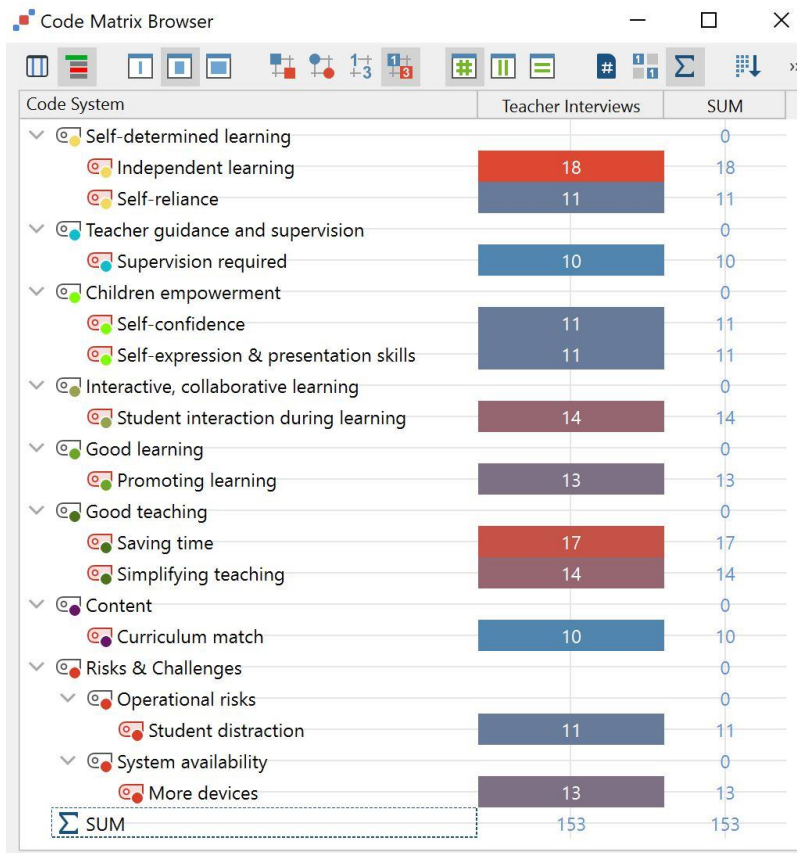
Appendix L illustrates the usage of MAXQDA's Document Portrait tool. MAXQDA allows to display the Document Portrait ordered by color frequency. While the Heatmap in the Code Matrix Browser did not reveal any accumulation of codes or categories in the teacher interviews it is interesting to note that almost all of the Document Portraits show a dominance of green and purple colors (see two examples in Figure 5.13). 10 of the 12 teachers have green and purple in their Top 3 colors in the Document Portrait. This represents the fact that "Benefits of the e-learning system" (green color code) and "Requirements, Risks & Challenges" (purple color code) were the topics that took most of the time during the teacher interviews. In line with the literature review, there are many hopes and expectations associated with digital learning in rural Tanzania (green color code). Teachers who are rather new to e-learning have a large, diffuse set of requirements and potential challenges that they are expressing (purple color code). The more experienced and sophisticated they become over time (e.g. teachers LEA-MP, LEA-NT, LEA-BG, LEA-BO), the more they can articulate very specific advantages and requirements for the e-learning system and its integration into everyday school life. Especially topics around "self-reliant learning" (yellow color code) with very specific recommendations on what to do to implement and foster such learning have become more central and elaborate in the interviews with these teachers.



**Figure 5.13: MAXQDA Document Portraits for teacher interviews at Karama School, ordered by color frequency**



The heatmap in Figure 5.14 lists 12 codes with 10 or more coded segments. These codes will be discussed further in the following analysis. MAXQDA’s Smart Coding tool has been used for a deep dive exploration.



**Figure 5.14: Code Matrix Browser – Heatmap of coded segments in interview transcripts (Top 12)**

### 5.2.2.1 “Independent learning” and “Self-reliance”

“Independent learning” is the most frequent code occurring in 11 of the 12 teacher interviews. It is closely related to the “Self-reliance” code because self-reliance requires that children can learn independently even without a teacher. Most teachers report that they have observed children to learn independently. “Instead of writing and teaching each and everything in the classroom, I come just to summarize it, because students themselves, they have already passed through this” (LEA-BG, Pos. 25, #0:15:58#). This statement indicates how far some of the experienced teachers already get by implementing the *Flipped Classroom* model that has been introduced in section 3.5. Independence is implemented through such a new learning model: “If they are free to learn themselves, they are more independent than

having a teacher“ (LEA-BG, Pos. 35, #0:25:02#). Several teachers confirm children’s preference to learn without a teacher. Support was only requested for technical or logistical issues:

“Most of them they liked themselves independent without the help of the teacher. The most part that they needed the help of the teacher is when there was a break of the Internet actually. So most of them they were learning independently for themselves” (LEA-MP, Pos. 21, #0:11:00#).

Some statements clarify that ‘independent learning’ does not necessarily mean ‘learning alone in isolation’, e.g.

“They like also to be independent, so that they are free to join with their other pupils, to ask some questions themselves and to interact with each other” (LEA-NT, Pos. 7, #0:03:24#).

As we will see later, interactive group learning is appreciated very much by most of the pupils and collaborative learning is not perceived as dependence from others. Teachers acknowledge the advantage of digital learning that can happen anywhere and anytime (LEA-NT, Pos. 29, #0:10:55#). In e-learning, children can use the devices as their teacher (LEA-BH, Pos. 23, #0:14:30#). Anyway, some teachers report that some pupils are now able to explore and use the tablets more than some of the teachers (NYA-JK, Pos. 17, #0:15:07#).

We already pointed out controversial statements between self-reliant learning and supervision through teachers in the analysis of the teacher survey. The same phenomenon can be observed in teacher interviews where teachers may highlight their observations and their belief that children can learn independently, but then continue to talk about teacher guidance in the exact same sentence. For example:

“Children they are able to learn themselves. But to be supervised also it is important. Because sometimes they cannot understand. Maybe the content to be explained by a supervisor. So, they are able to learn themselves, but supervision also it is very important” (LEA-NT, Pos. 15, #0:06:13#).

“VERY, VERY, VERY much they are able to use the system on their own without any kind of supervision, provided that you can guide them how to view a certain kind of topic, that they should go through a certain topic. And you can leave them some hours and they can learn on their own” (NYA-JR, Pos. 14, #0:10:59#).

### 5.2.2.2 “Supervision required”

The code “Supervision required” summarizes statements from teachers that raise concerns about children’s ability to learn effectively without a teacher.

“It is difficult for pupils to learn independently without any guidance or support from the teacher. Because sometimes you can [...] help them find materials in the system. But if you leave the class and get to the other class, pupils will take the chance to log out and go to explore other materials of their interest. So with no guidance, you find difficulties for pupils to learn properly” (KAR-KE, Pos. 15, #0:12:43#).

“Without supporting the students, they are not learning independently, because once you leave them themselves, they are going to look videos and the other things which is not necessary for the issue of studying. The students, they need support from teachers” (LEA-AP, Pos. 23, #0:06:18#).

These concerns were mostly expressed by teachers who have not played a leading role in the introduction of digital learning. While all of them acknowledge the great benefits of the e-learning system they still resist handing over more control to the pupils. The more experienced teachers become with digital learning, the more they are willing to do so. It is interesting to note that teacher KAR-KE points out that pupils go “to explore other materials of their interest”. A similar observation has been explained by LEA-BH who noticed that pupils of the focus group were very eager and spent significant time watching learning videos on cooking (LEA-BH, Pos. 19, #0:10:41#). Although all teachers understood and agreed to the rules and guidelines of the design research intervention (as outlined in section 4.5.2), especially the fact that the pupils are free to learn whatever they like, some of the less experienced teachers were still hooked to the judgment that “learning properly” means that pupils follow the proposed guidelines. Diverting to other topics like cooking or foreign cultures was sometimes considered a distraction from “real studying”. This contradicts the dominant theme in the teacher survey where almost all teachers highlight the importance of practical skills that apply to the children’s normal life and environment – like cooking. Most teachers agree that learning is for life and not for exams, but when children learn topics of their interest, many teachers raise concerns that this distracts them from what is needed in school. As we will see later, it is interesting to note that some of the pupils in the focus groups explicitly valued the

opportunity to learn things of their interest that are not related to the curriculum.

### **5.2.2.3 “Self-confidence” and “Self-expression & presentation skills”**

The impact of digital learning on children’s self-confidence has been an important research element in this study. The far-reaching impact of digital learning has been observed and highlighted by several teachers:

“One of the changes that I have discovered or observed is first pupils to having confidence, having self-confidence [...]. Because by the time they have been interacting with the material, because they have been learning alone. So, it has been giving pupils confidence while speaking with other pupils” (LEA-BO, Pos. 11, #0:04:16#).

“Before, when we start, and as the time goes, there is big changes. Before, the ability of pupils to stand in front of a mass of people to express themselves was difficult. But as the day goes on, you can see now, pupils are able to explain, even if to say anything. But before it was difficult. So what I can say, this system helped them to change. So they can stand in front of people and express themselves” (LEA-CN, Pos. 11, #0:03:30#).

The connection between self-confidence and the children’s ability to express themselves and present in front of other people is becoming clear in this context:

“Also, it has been raising self-explanation. Pupils can explain without any fear” (LEA-BO, Pos. 11, #0:04:46#).

“We have to instruct them to have an ability to explain, or to think critically about it. And to introduce or to explain in front of the people without any problem” (LEA-NT, Pos. 5, #0:02:40#).

An interesting application on the *RACHEL* server related to this topic is called “Touchable Earth”, a collection of videos from many different countries, where children explain their environment, their school, their traditions, and their culture to other children in the world. This application has inspired several pupils of the participating schools to also present themselves and their lives in short videos. The influence on children’s confidence has been astonishing. However, due to confidentiality restrictions, these videos were not included in this study.

#### **5.2.2.4 “Student interaction during learning”**

It has been concluded in section 3.3 that technology-based learning can help enable student interaction and collaborative learning. The data from the teacher interviews as well as the findings from the focus group discussions strongly support this hypothesis. Some teachers “became amazed by how pupils were able to interact with themselves and to use the devices” (LEA-BH, Pos. 7, #0:06:38#). This teacher observed big changes because “there was sharing of knowledge among pupils. If one group discovers something they were able to move from this group to that group” (LEA-BH, Pos. 9, #0:07:30#). These observations were confirmed by several teachers.

“During the studies when we were studying here, pupils were interacting with each other. They were able to move from one place to another place, asking questions for themselves, even without engaging teachers for when they studied. So they were able to move freely, interacting freely for themselves, stu– inquiring things for themselves” (LEA-MP, Pos. 9, #0:03:51#).

“Those who are able to use the tablets effectively, and those who are not able to use tablets effectively are bound together forming groups in learning, rather than before. So now the friendship and the interaction between pupils have raised a lot” (NYA-JK, Pos. 15, #0:13:05#).

“Friendship through learning” is an important subcode of “Interactive, collaborative learning”. With more interaction, the bond and friendship among pupils has been improved (NYA-SE, Pos. 11, #0:13:13#).

“For those who are inside the program, I realized that they have developed that friendship among themselves” (LEA-MP, Pos. 29, #0:14:40#).

An interesting exploration is what impact the teacher’s presence has on pupil’s interaction. On the one hand, it has been observed that the pupils don’t dare to interact and move freely if the teacher is around:

“Most of them they were interacting. Because there were some groups and from what I saw, if, for example, when they were in a group, and the teacher goes there, they keep quiet. When the teacher passes out or away from them, they continue talking, interacting with each other” (LEA-MP, Pos. 23, #0:11:26#).

On the other hand, positive impacts of e-learning have been reported even for the teacher-pupil relation:

“The bond between teacher and pupils is increased because the teachers and pupils are now closer, much more closer to each other. So the relation is raised” (NYA-JK, Pos. 21, #0:18:01#).

### 5.2.2.5 “Promoting learning”

Measuring academic performance has not been set as an objective for this study for several reasons. First, a trial phase of ten weeks is deemed too short to make enough impact on measurable performance. Second, it is hard to isolate the impact of digital learning from other performance influencers that happen at the same time, e.g. the availability of drinking water and solar energy on the school grounds. And third, children’s empowerment is not equal to academic performance that can be measured in standardized tests. However, the qualitative data analysis of this study does not ignore the impact on performance increases as perceived by teachers and pupils of the focus groups. The code “Promoting learning” captures all the statements related to what helps the children to learn more effectively. One concise statement from LEA-BO captures how e-learning has raised pupil’s participation:

Digital learning “has been promoting learning in the class. It has been really activating pupil’s participation in learning in the class. Because by the time we use as teachers, we use in the class to deliver the concept in the class and the pupils’ attention and participation have been very, very high compared to when we just teach in the class. We teach without – maybe using blackboards, it has not been interesting. But by the time we have been using this learning, for sure it has been a very interesting part” (LEA-BO, Pos. 3, #0:00:25#).

Another experienced teacher, LEA-BG, reports how digital learning has changed and simplified the learning process. As mentioned above, he has implemented the *Flipped Classroom* model that has been introduced in section 3.5. Ultimately, this has led to a tremendous performance increase according to his testimony:

“Then each group will go to the digital system. They learn for themselves. Then we come together and make a presentation. That will simplify our teaching and learning” (LEA-BG, Pos. 23, #0:14:12#).

“And it was a great success, because the content which I was supposed to teach for more than three weeks, they learn it within two days” (LEA-BG, Pos. 23, #0:01:53#).

There doesn’t seem to be any doubt in teachers’ minds that technology helps to promote learning effectively.

### **5.2.2.6 “Saving time” and “Simplifying teaching”**

The teacher interviews not only captured teachers’ perspectives on “good learning”, but also on “good teaching” and in which way digital learning can help teachers to improve their teaching practices. Many different advantages were highlighted by all of the 12 teachers. The two codes “Saving time” and “Simplifying teaching” processes have been mentioned most frequently. E-learning does not only help to make learning more effective but also teaching:

“The advantages, the importance of the e-learning for the teachers. First, it simplifies the time. It is a method, to me it is a method which is very effective and efficient” (LEA-BG, Pos. 25, #0:15:41#).

“Myself as a teacher, this digital learning really from what I observed, it really helps me to save time. For example, instead of using a lot of time creating materials, or when out of the school funding materials, I can see that these devices or this program contain some materials that are available there and I can use them. So it doesn’t consume a lot of time for me to go and find the materials because they are available there” (LEA-MP, Pos. 31, #0:15:38#).

“E-learning helps me as a teacher because I can summarize my topic and then I upload to the server, then we use in the classroom. And also, there is a lot of materials in the system. So it helps me as a teacher to simplify my work” (LEA-NT, Pos. 21, #0:08:37#).

An important area of research and exploration in this study was the question, if and how digital learning can improve learning in public schools in rural Tanzania, where the teacher-pupil ratio is around 1:80 or even worse. The feedback from teachers at Karama Primary School is very promising:

“Despite of the small number of staff available at the school the system can, and has been used to simplify work. Sending a portion of pupils in here and listen to the instructions and attend the other class. And the system has been functioning and trying to simplify work. Because sometimes teachers cannot be much enough to attend all classes. So the system has been simplifying the work” (KAR-CR, Pos. 29, #0:26:11#).

The significance of this statement is huge. Given the teacher scarcity in rural areas, if the existing teachers can do their work more efficiently and more effectively by using e-learning, this can constitute a tremendous opportunity for all schools in rural Tanzania. It has also been mentioned how technology can help teachers receive more support from pupils in their teaching, e.g. by searching specific content or finding answers to difficult questions:

“But sometimes I can use the students to find the answers for me. That's also sometimes simplified to help me in my teaching” (LEA-BG, Pos. 23, #0:15:18#).

### **5.2.2.7 “Content availability” and “Curriculum match”**

The importance of contextually appropriate content has been elaborated deeply in section 2.4. So it was a bit surprising that “Content availability” has not been raised as a bigger issue by all teachers. On the contrary, most teachers seem surprised and thrilled by the huge amount of content that is available in the *RACHEL* e-learning system. *RACHEL* is an open system, where Open Educational Resources (OER) and Digital Libraries can be uploaded from many different content providers and websites. The curation of content is not strictly organized. Even teachers can upload their own user-generated content if they want to. This feature is extensively used in the LEA schools in Dongobesh. On the flip side, the vast amount of content and applications in the system can be overwhelming for both pupils and teachers. As a result of that, one concern has been raised by half of the 12 teachers: the curriculum match of the available content.

“Some of the challenges that I saw from the system is actually, the contents that are available in the system are not matching with the current curriculum for our school or for the country. So, there are some that are not there. And there are some that are there. So these that are there, are good. And those that are not there I think we need to do something that we can at least upload more materials for that related with the current curriculum of our country” (LEA-MP, Pos. 33, #0:17:28#).

The requirement is to find and upload content that matches Tanzania’s official curriculum and can be identified and retrieved easily by teachers and pupils.

“According to our syllabus, I think we have to add more materials in order to help them according to the syllabus of our country. So when you check the programs you can see there are few materials, so it’s not enough at all. So in order to improve can say to add more materials according to the syllabus of our country. This would be good” (LEA-CN, Pos. 17, #0:05:30#).

In return, if content is easily available according to the topics currently covered in the classroom sessions, then the value is immediately recognized by the pupils. As an example, learning videos in Kiswahili have been uploaded to the Karama School server for all the Mathematics topics covered



in the classroom during the ten weeks of the research intervention. Teacher KAR-CR reports how this matching content has helped the children with their Math performance in the classroom:

“So when children came learning through the system, they were much more surprised finding that what they were learning in the class was also found in the system. So even the class attendance raised. And the pupils were able to follow the class instruction and enjoy the system as well because the topics and subjects covered in the class were also found in the system” (KAR-CR, Pos. 9, #0:06:06#).

The same effect has been acknowledged by the pupils themselves, as we will see in the analysis of the focus group discussions.

### **5.2.2.8 “Risks & Challenges”**

An important section of the teacher interviews was the questions about what didn't work well during the trial, observations of problems and challenges, or risks that teachers would envision for the future. Teachers were encouraged several times during the interview to articulate their concerns or highlight areas of improvement. All 12 teachers did comment on these topics. However, many of the teachers rated the risk associated with digital learning as very low (e.g. LEA-MP, Pos. 37, #0:19:33#; NYA-JK, Pos. 27, #0:23:29#; NYA-JR, Pos. 22, #0:16:50#; NYA-SE, Pos. 20, #0:23:43#). There were no or few concerns about the general setup and content of the e-learning system. Most problems that were observed and reported were related to technical issues (WiFi connectivity problems and charging problems due to power outages or weak solar charging during the rainy season), risk of breaking devices, and some usage challenges. The challenge that has been mentioned most frequently is the availability of devices. Both teachers and pupils request more devices to optimize and expand the usage of the e-learning system:

“The devices are not enough. Pupils are much enjoying, and we have been scrambling to get the service. So, really we shall help for more devices” (LEA-BO, Pos. 23, 0:13:01#).

“Also, to add the number of devices according to the number of pupils. You know classes in our country. For the case of government schools you can see small classes like this and have more than 60 pupils. But normally the number of pupils for a class should be at least 45 pupils. So if the number of tablets is not enough it will be difficult to use that system. So in order to improve also we have to add the number of tablets” (LEA-CN, Pos. 21, #0:07:58#).

“The number of tablets is not enough as pupils are eager. They want to learn through the system. And you see the class is sometimes being congested. One tablet can be used by a number of pupils” (NYA-JK, Pos. 31, #0:27:46#).

With regards to operational risks and usage challenges the word “distraction” has been mentioned most frequently. Related statements are captured in the code “Student distraction” which correlates closely to the above-mentioned code “Supervision required”. Several teachers raised their concern that pupils may waste a lot of time with games and entertainment if the digital learning program is not supervised closely by the teachers.

“But the problem, the challenge it comes when you give them the task and they are going to learn, to read other things. Then there, you can fail. And according to the students, the nature of the students of Tanzania, we know, [...] they go direct to the entertainment part. They want to watch the entertainment. That might be a challenge” (LEA-BG, Pos. 37, #0:28:20#).

“So they will waste much time maybe sometimes on watching or concentrating on the programs that won’t help them at the moment. But maybe they need to be worked on during free time. So during learning time, one of the risks is wasting time, especially when pupils are left free without teacher’s control” (LEA-BO, Pos. 21, #0:09:52#).

“Instead of studying, others they will play the game. Or others they will do their own activities. So, supervision also it is somehow important” (LEA-NT, Pos. 15, #0:06:37#).

After having analyzed the most critical codes from the teacher interviews we’ll now move on to see the findings from the focus group discussions with the pupils that participated in the research trial.

### **5.2.3 Key findings from the focus group discussions**

A total of eight focus group discussions with four to six pupils were conducted at the end of the ten-week trial. As outlined in section 4.5.1, each of the four focus groups was split into a girl’s and a boy’s group for the review of their experiences during the trial. The goal of these semi-structured focus group discussions was to get deep insights into pupils’ experiences using e-learning. What do they like and what do they dislike? What is helpful and what is disturbing? The discussion guidelines started with a couple of opening questions about pupils’ perception of “good learning”. After that, three key topics were explored in more detail:

- Pupils' experiences during the e-learning trial: What did they specifically like or dislike? What programs did they use most frequently and why?
- Pupils' perception of this new learning setup: Was the time of the e-learning sessions sufficient – or too much? What is their perception of unsupervised, independent learning?
- Suggestions for improving the current e-learning setup

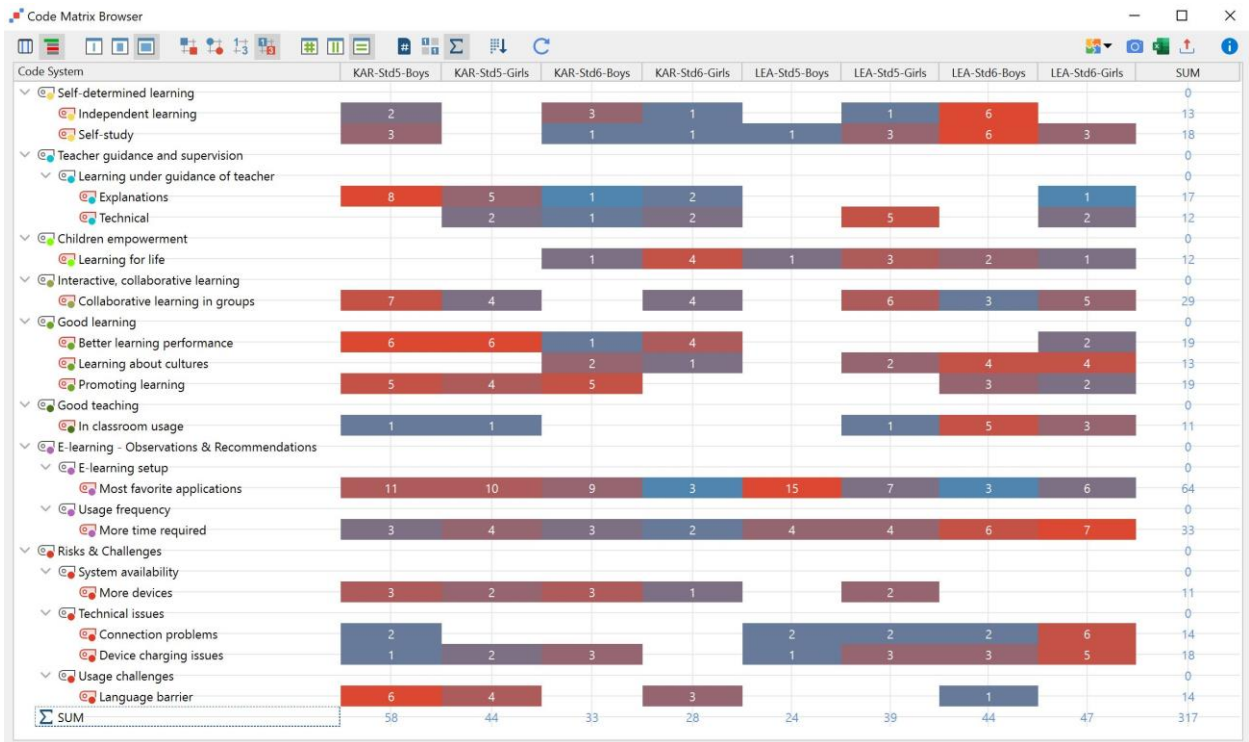
The discussion guidelines proposed several questions for all these topics, but the moderator was free to ask further questions to intensify the discussion on a specific topic, change the order of questions, or leave out some of the questions. Sample transcripts of the focus group discussions as well as sample Codelines that capture the flow of the discussions are provided in Appendix N and Appendix P.

422 coded segments within the top ten categories are associated with the focus group transcripts. Almost all topics of the top-level categories have been covered but the various focus group discussions had very different areas of focus as illustrated in Figure 5.15.



**Figure 5.15: Code Matrix Browser – Number of coded segments in focus group transcripts per code category**

Figure 5.16 shows a reduced heatmap with the Top 16 codes that occurred most frequently in the transcripts of the focus group discussions. In this visualization, the calculation of the heatmap color refers to the row. Meaning: red indicates in which focus group which topic has been covered most intensively. These Top 16 codes will be discussed further in the following analysis. Especially those, that were not yet covered in the discussions of the results of the teacher interviews. MAXQDA's Smart Coding tool has been used for a deep dive exploration.



**Figure 5.16: Code Matrix Browser – Heatmap of coded segments in focus group transcripts (Top 16)**

Another set of investigations has been done using MAXQDA's Similarity Analysis for Documents. This visual tool analyses if codes occur in a certain document (focus group transcript) or not. Then it compares this data for all activated codes in all activated documents. The resulting similarity matrix illustrates how similar codes have been used in the various focus group discussions. Figure 5.17 shows the similarity matrix for all eight focus groups using the Jaccard measure for the entire code system. This measure compares two documents by counting how many of all codes occur in both documents on a scale between 0 (completely different) and 1 (identical). Different from the simple matching approach, Jaccard ignores the non-existence of codes, meaning that it is not counted as a similarity if both documents do not cover a code. This measure is preferable if there are many codes and subcodes that do not occur in many documents (Rädiker & Kuckartz 2018:197). Each focus group discussion has been drilling into different areas. So the non-existence of codes should be ignored rather than counted as similarity.

Similarity matrix - Focus Groups - all codes - Jaccard								
Document name	KAR-Std5-Boys	KAR-Std5-Girls	KAR-Std6-Boys	KAR-Std6-Girls	LEA-Std5-Boys	LEA-Std5-Girls	LEA-Std6-Boys	LEA-Std6-Girls
Focus Group Discussions > KAR-Std5-Boys	1,00	0,44	0,46	0,35	0,25	0,37	0,39	0,33
Focus Group Discussions > KAR-Std5-Girls	0,44	1,00	0,37	0,46	0,11	0,23	0,30	0,33
Focus Group Discussions > KAR-Std6-Boys	0,46	0,37	1,00	0,38	0,25	0,35	0,42	0,32
Focus Group Discussions > KAR-Std6-Girls	0,35	0,46	0,38	1,00	0,16	0,33	0,31	0,34
Focus Group Discussions > LEA-Std5-Boys	0,25	0,11	0,25	0,16	1,00	0,48	0,43	0,31
Focus Group Discussions > LEA-Std5-Girls	0,37	0,23	0,35	0,33	0,48	1,00	0,48	0,46
Focus Group Discussions > LEA-Std6-Boys	0,39	0,30	0,42	0,31	0,43	0,48	1,00	0,43
Focus Group Discussions > LEA-Std6-Girls	0,33	0,33	0,32	0,34	0,31	0,46	0,43	1,00

**Figure 5.17: Similarity Matrix for all eight focus group discussions**

The focus groups differ by age (Standard 5 versus Standard 6), sex (girls versus boys), and school type (Karama / public versus LEA / private). Similarity is illustrated by the intensity of the green color and Figure 5.17 illustrates that the impact of the school type on the similarity is greater than the impact of age or sex. One of the main reasons for this is the language. Karama Primary School, like all other public primary schools in Tanzania, teaches in Kiswahili, whereas LEA Primary School is an English Media School teaching in English from preschool on. Language barriers and related challenges will be further explored below. They are also the reason why the focus group discussions at Karama School were conducted in Kiswahili. The statements below quote the English translation or summary of the social workers.

### **5.2.3.1 “Independent learning” and “Self-study”**

The possibility of “Independent learning” is highly valued by many pupils of the focus groups. They like to learn themselves independently without the teacher’s supervision as they have already captured the skills on how to use and explore materials from the system (KAR-Std6-Boys, Pos. 29). Some pupils prefer to learn independently, to explore programs, questions, and tasks of their interest and do them on their own (KAR-Std5-Boys, Pos. 122, #0:23.22#):

“It is better when we study independently because when we are studying independently we can get many things done being guided by teachers. Because if we are doing things and searching things ourselves is better than teachers guide us. But sometimes when we are independent, we can get many things from that” (LEA-Std6-Boys, Pos. 49, #0:09:14#).

Some pupils explain that they love to have time on their own because they bring questions from the classroom and then come to the e-learning session

to explore these topics and get extra knowledge from the system (LEA-Std6-Boys, Pos. 78, #0:18:04#). The boys of the LEA Standard 6 focus group have been especially articulate about their desire to learn independently. However, the topic was raised in almost every focus group, particularly in Standard 6.

### **5.2.3.2 “Learning under the guidance of a teacher”**

Although independent learning and self-studies have been valued by pupils, many of them appreciate the support and guidance from teachers:

“They are adding the comment that learning independently is good but teachers should be sometimes available” (KAR-Std5-Boys, Pos. 126, #0:26:22#).

Several pupils state “that they would like to learn with their teachers, as teachers were mostly guiding them how to go for those who the system was difficult for them to explore” (KAR-Std6-Boys, Pos. 55, #0:28:17#).

The support they need from the teachers could be technical (help with the tablet devices), language-related, or further explanations when solving difficult problems (KAR-Std5-Boys, Pos. 72). Sometimes, pupils expect directions (KAR-Std6-Girls, Pos. 63) or corrections (KAR-Std5-Girls, Pos. 37) from their teachers:

“They say that when they are learning on their own they use much time learning to use this system. And when the teacher is available that some questions they find being difficult for them. So when the teacher is available he can try to solve the question using this system. So they like learning on their own independently because they learn for a long time. And everyone can explore more. But also they like learning with their teacher because some question they find difficult, the teacher is able to explain more and try to solve these questions” (KAR-Std6-Boys, Pos. 59, #0:31:56#).

It is interesting to note that almost all of the coded segments related to “Explanations” come from the focus groups at Karama Primary School (see Heatmap in Figure 5.16). Their level of e-learning expertise and their self-confidence seem lower than in LEA Primary School, which explains their desire for more guidance from their teachers. Also, pupils of Standard 5 show a larger demand for teacher guidance than those in Standard 6.

### 5.2.3.3 “Risks & Challenges”

An important section in all the focus group discussions was the questions about what didn't work well during the trial and which problems and challenges they experienced when working with the e-learning system. Pupils were encouraged several times during the discussions to articulate their concerns or highlight areas of improvement. Most problems that were observed and reported were related to technical issues (WiFi connectivity problems and charging problems due to power outages or weak solar charging during the rainy season). Pupils (and teachers) request more devices to optimize and expand the usage of the e-learning system:

“I would like more tablets to be brought to facilitate effective learning with other fellows” (KAR-Std5-Girls, Pos. 56).

Above and beyond such technical issues the heatmap in Figure 5.16 indicates a critical challenge specifically at Karama School: the above-mentioned language barrier.

“They say most of them, for sure English language was the problem because they don't know that language. So that is the most challenging for them. Even if they want to search themselves they can't. So the teacher must be there to guide them. If you want to search for this and this you have to come here, here and here. So for them that is a challenge, English language” (KAR-Std6-Girls, Pos. 87, #0:18:34#).

The language barrier prevents pupils from being able to learn more self-reliantly, as many of the learning materials are available in English only. The lack of English speaking capabilities in public schools in rural Tanzania is a huge barrier for the children, especially when they move on to secondary school where the language of instruction flips to English for all subject matters except Kiswahili, resulting in very high failure rates. It is also acknowledged as a major barrier to self-determined e-learning:

“They say it was difficult to learn independently. And something difficult, they are not able to solve it in absence of teacher, because of language. So they can't learn independently themselves because language is a barrier for them” (KAR-Std6-Girls, Pos. 89, #0:19:44#).

This challenge is acknowledged by both pupils and teachers. Therefore, one request already picked up during the action research phase was to add Mathematics learning videos in Kiswahili, which was showing an immediate effect on pupils' motivation and performance:

“When these pupils found instructions which were Kiswahili based they were more cautious and attentive. So that they were able to follow the instruction and do much more better” (KAR-CR, Pos. 13, #0:10:31#).

#### **5.2.3.4 “Children empowerment” and “Learning for life”**

“Empowerment” has not been (and also has not been expected to be) a notion used by primary school pupils. However, the subcode “Learning for life” has been brought up several times, particularly by girls at Karama School:

“Pupils were able to declare that the system was and is still usable and will help them in their daily life for the long term. The knowledge they will gain through the e-learning system helps them in their life, in their future as they are able and they are planning to continue studying. So, the knowledge they gain will help them in their school life in the future and in their daily life as well” (KAR-Std6-Boys, Pos. 50, #0:24:12#).

Some of these statements are associated with the Civics sessions (discussions about topics like: What is love? What does it mean to love your neighbour?) that were proposed during the trial. Pupils reported that digital learning helps them to foster cooperation and love (KAR-Std6-Girls, Pos. 34), take care of fellow colleagues (KAR-Std6-Girls, Pos. 39), or learn how to help friends (LEA-Std5-Girls, Pos. 3).

“They say learning through e-learning has helped them to learn in terms of cooperation and teamwork. As well as the knowledge from Civics studies” (KAR-Std6-Girls, Pos. 81, #0:17:01#).

“I always look Ubongo Kids because I learn how to care about others, how to maintain good relationships with others” (LEA-Std6-Girls, Pos. 20, #0:03:23#).

This acknowledgment of impact above and beyond academic performance is remarkable. It is essential for children’s empowerment within their collectivist community.

#### **5.2.3.5 “Collaborative learning in groups”**

Related to the collectivist nature of Tanzanian communities, a large number of statements can be found highlighting the appreciation of collaborative learning in groups. Two-thirds of these statements were made by girls. Many of them like to study with their friends because they can correct each other “in a polite language” (KAR-Std5-Girls, Pos. 68, #0:33:49#; KAR-Std6-Girls, Pos. 61). These statements suggest that “being corrected in a polite language” is not



what they are used to from their teachers. Several pupils declared that they prefer learning in groups of two to three people (KAR-Std5-Boys, Pos. 123, #0:23:47#), or more (KAR-Std5-Boys, Pos. 56). Collaborative learning can help the pupils to improve their learning performance:

“And there is a question which is difficult and you didn’t understand in class, you can go to the tablet. We search together” (LEA-Std6-Boys, Pos. 65, #0:15:08#).

Moreover, the collaboration is not only restricted to fellow pupils. It may also include the teachers. Positive impacts of e-learning on the teacher-pupil relationship have already been reported by some teachers in section 5.2.2.

“They learned to cooperate between themselves. And also with the teacher” (KAR-Std6-Girls, Pos. 84, #0:18:18#).

### **5.2.3.6 “Better learning performance” and “Promoting learning”**

Measuring academic performance has not been set as an objective for this study for several reasons. Nevertheless, the qualitative data suggests a significant positive impact of digital learning on actual class performance as perceived by teachers and pupils of the focus groups (e.g. KAR-Std6-Girls, Pos. 79, #0:15:49#). The codes “Better learning performance” and “Promoting learning” capture all the statements related to such performance increases. It is clearly the perception of many pupils that e-learning technology helps to promote their learning effectively, sometimes even more effectively than the normal classroom sessions:

“This system is good to us because it helps us to learn more than in class hours” (LEA-Std6-Girls, Pos. 11, #0:01:52#).

“They say e-learning had given us extra time to learn, hence, improved our class performance. So, they observed that their performance in the class, it is a problem. So through e-learning, they improve their performance in the class. So before, performance is the problem, but now, for them, performance is not a problem again” (KAR-Std6-Girls, Pos. 91, #0:20:49#).

Performance increases are not only perceived for measurable subjects like Mathematics but also for reading skills:

“I did not know how to solve Mathematics questions but now I can solve the question even when I am alone” (KAR-Std5-Boys, Pos. 76).

“But through e-learning, they add other calculation skills that improve their learning. And another thing they say, improved reading skills” (KAR-Std5-Girls, Pos. 64, #0:30:55#).

Such performance increases are promoted by the fact, that pupils learn how to operate the e-learning system and how to search and find relevant content:

“We have gained greater knowledge than before for sure on how to use the e-learning system. Most of us were used to go to Ubongo Kids. We were not able to explore more in the system and try to find questions and books. But now we can explore a number of files and questions that are useful. And it has helped us increase class performance compared to before” (KAR-Std6-Boys, Pos. 35).

Several statements from pupils illustrate how the digital learning system has helped them to promote learning:

“They say the e-learning system is much help for them. They are now able to explore Mathematic questions and tasks and are able to try to answer them, as well as self-studies in Civics books and they are able to explore questions on different kind of subjects” (KAR-Std5-Boys, Pos. 119, #0:20:34#).

Teachers can play a significant role in promoting learning by using the power of the digital learning system:

“The teacher was able to direct them and teach them on different questions, different ideas and use the tablet and e-learning system to distribute questions and some tasks. And so that they would be able to answer and respond to the given task in time. Also, the teacher asks the pupils in their lessons to search for questions and try to respond to the given questions from the e-learning system” (KAR-Std6-Boys, Pos. 57, #0:31:04#).

“Better learning performance” and “Promoting learning” are subcodes of the category “Good learning”. At this point, it is important to remind ourselves that good learning refers to much more than pure academic performance. “Good learning” also includes practical knowledge, creativity, critical thinking, and more. As we have discussed in section 5.2.2, many teachers verbally acknowledge the importance of these aspects but raise concerns as soon as they see pupils’ attention and activities diverting from the curriculum. Other topics like cooking or foreign cultures were sometimes considered a distraction from the “real studying”. It is interesting to note that some of the pupils of the focus groups explicitly value the opportunity to learn things of their interest that are not related to the curriculum, for example, more knowledge about foreign cultures (LEA-Std6-Boys, Pos. 43, #0:07:39#) or learning how to cook food from other tribes (LEA-Std6-Girls, Pos. 25, #0:04:10#).

#### **5.2.4 System usage during the research intervention**

Both teachers and pupils confirm that attendance in the e-learning sessions, although being voluntary, has been very regular and stable. It did not drop throughout the ten-week trial. On the contrary, other pupils expressed their desire that they would like to be added to the program. Feedback from the focus groups shows that most of the pupils in the focus groups are trying to get more time with the e-learning system. This is true for both Karama and LEA Primary School. This is remarkable given that the e-learning lessons were extracurricular activities above and beyond normal classroom sessions. Some pupils commented that one hour per day is not enough and suggested more hours per day:

“And they say time is not sufficient for them. They need extra time. They use only one hour for that for three days per week. So they need more hours. And one suggests even three hours, she likes” (KAR-Std5-Girls, Pos. 66, #0:32:50#).

##### ***5.2.4.1 Most favourite applications***

Above and beyond the applications on cooking (Sikana) and cultures (Touchable Earth), a variety of different applications have been rated high by the pupils of the focus groups including Ubongo Kids, Khan Academy Kiswahili, Wikipedia offline, plus Bino and Fino (educational kid’s videos from Nigeria). Please refer to section 2.4.5 for more details about Ubongo Kids, Khan Academy, and Wikipedia offline. The preferences of the pupils in the focus groups confirm teachers’ observation that children like to learn through videos. However, curriculum-related content, especially the availability of all Tanzanian textbooks (especially Mathematics and Civics) on the digital learning server has also been highlighted. Moreover, other textbook collections like Openstax and CK12 have been used during the trial. This is confirmed by the statistical data extracted from the digital learning server (see Figure 5.18):

Top 10 URL		
No. of pages: 191	Access	Avg. Size
/modules/en-wikipedia/search.php	236	804 Bytes
/modules/sw-KhanAcademy/	214	1.05 KB
/modules/en-worldmap-10/search_maps.php	112	51 Bytes
/modules/en-ck12/math6.pdf	102	31.35 MB
/modules/sw-KhanAcademy/Videos/Addition and Subtraction/Basi...	96	351.34 KB
/modules/multi-wL ubongo kids/herufi.html	76	3.33 KB
/modules/en-openstax/OpenStax.html	58	1.57 KB
/modules/multi-wL ubongo kids/files/Herufi-A.mp4	50	395.82 KB
/modules/en-openstax/Content/fundamentals-of-mathematics-4.6.pdf	40	3.05 MB
/modules/en-worldmap-10/map.html	36	1.01 KB
Sonstige	1.064	7.20 MB

Figure 5.18: Excerpt from RACHEL Statistics – most frequently opened URLs at Karama School in February 2023

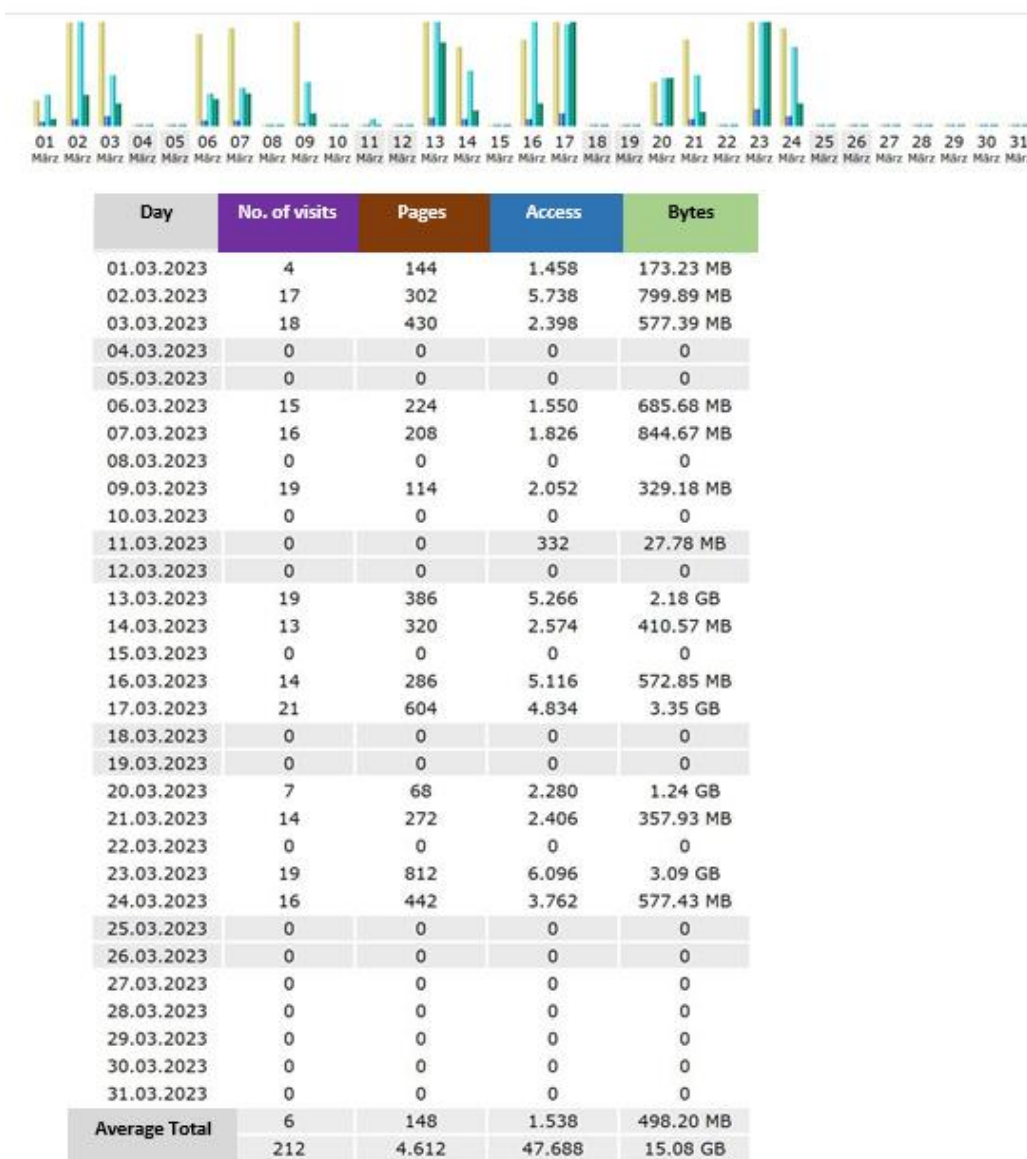


Figure 5.19: Excerpt from RACHEL Statistics – system usage data at LEA Primary School in March 2023

#### **5.2.4.2 Usage frequency**

As already mentioned in section 5.2.2, teachers observed and reported frequent usage of the e-learning system in the existing pilot projects. This was confirmed by social workers on site, but it has not been measured before. During the ten-week research intervention, system availability and usage frequency have been monitored. As an example, Figure 5.19 shows the usage pattern of the e-learning system in LEA Primary School in March. As we can see in the system data, children had access to the system on Monday, Tuesday, Thursday, and Friday every week except the last week of March when local exams took priority.

After having analyzed the code system and summarized the findings from the data analysis of teacher surveys, observation reports, teacher interviews, focus group discussions, and usage data, this completes the open coding process and we will move to the next step of the data analysis process, the axial coding.

### **5.3 KEY FINDINGS FROM THE AXIAL CODING PROCESS**

As described in section 4.6, *Axial Coding* is the process of relating codes to each other and constitutes another central part of the Grounded Theory. The goal of the axial coding is to explore code correlations and extract those codes and categories that are particularly relevant to the research question (Flick 2019:395). The simplification of the code system by merging, clustering, and categorizing codes has already been part of the open coding process. But it is also paving the way towards further abstraction through axial coding by further relating codes and categories to each other. In the process of axial coding, the Coding Paradigm from Corbin and Strauss (see section 4.6) is applied to some specific phenomena observed in the responses to the teacher survey, during the intervention, in the teacher interviews, or the focus group discussions. Axial coding is often applied to specific sources like an interview or a focus group discussion. In this study, the axial coding is focused on specific phenomena that are deemed either representative or highly

relevant for the understanding of the research question. These phenomena are then analyzed using different sources of the mixed methods study.

As a first step in relating codes to each other, MAXQDA's Code Relations Browser is used to explore connections and correlations between different codes and categories. To recognize correlations the Code Relation Browser compares the number of occurrences of one set of codes on the X-axis with the overlap of the occurrences of another set of codes on the Y-axis. The type of analysis can be set to "intersection" only or define the proximity of codes in the same document with a maximum distance of x paragraphs. The analysis below counted intersections and close proximity (codes in previous or next paragraph, Max. Distance = 1). Table 5.4 quantifies which codes overlap most frequently.

The availability of sufficient tablet devices and their proper functioning (solving problems with connectivity and charging) has been raised throughout the study by both teachers and pupils in response to the question about the risks and challenges of the e-learning system. It is not surprising that these three codes have often been mentioned together and therefore strongly interrelate with each other. This has been covered in section 5.2 in detail and will not be further discussed in this section (greyed out in Table 5.4).

Given that "Context" and "Intervening conditions" are largely overlapping, these two elements of the Coding Paradigm are often merged (Flick 2019:394). This is also how it's been handled in the analysis of this study.

Code on X-Axis	Code on Y-Axis	No. of overlaps
Risks & Challenges > Technical issues > Connection problems	Risks & Challenges > Technical issues > Device charging issues	26
Children empowerment > Learning for life	E-learning - Observations & Recommendations > E-learning setup > Most favorite applications	20
Good teaching > Saving time	Good teaching > Simplifying teaching	20
Good learning > Learning about cultures	E-learning - Observations & Recommendations > E-learning setup > Most favorite applications	19
Children empowerment > Learning for life	Good learning > Practical knowledge	16
Interactive, collaborative learning > Collaborative learning in groups	Interactive, collaborative learning > Student interaction during learning	16
Risks & Challenges > System availability > More devices	Risks & Challenges > Technical issues > Device charging issues	16
Good learning > Promoting learning	Good teaching > Simplifying teaching	15
Good teaching > Preparing learning material	Good teaching > Saving time	15
Teacher guidance and supervision > Supervision required	Risks & Challenges > Operational risks > Student distraction	14
Good learning > Promoting learning	Good teaching > Saving time	12
Good teaching > Simplifying teaching	Content > Providing content and materials	12
Self-determined learning > Independent learning	Interactive, collaborative learning > Student interaction during learning	11
Teacher guidance and supervision > Learning under guidance of teacher > Explanations	Interactive, collaborative learning > Student interaction during learning	11
Children empowerment > Self-confidence	Good learning > Student motivation and empowerment	11
Self-determined learning > Independent learning	Good learning > Promoting learning	10
Children empowerment > Self-confidence	Children empowerment > Self-expression & presentation skills	10
Good learning > Practical knowledge	Good learning > Student motivation and empowerment	10

**Table 5.4: Top 18 code correlations in MAXQDA Code Relations Browser**

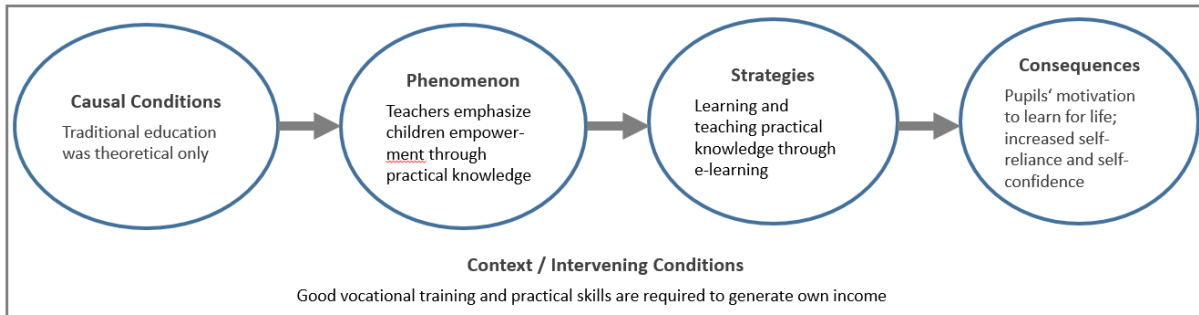
Starting again from the main research question “how a digital learning system can foster the empowerment of children and the perceived quality of education in schools in rural Tanzania”, the following code relations shall be further explored using the Coding Paradigm because these relationships address core themes of the open coding process as described in section 5.2.

- 1) Children's empowerment through practical knowledge
  - the relationship between "Practical knowledge", "Learning for life" and "Student motivation and empowerment" in the teacher survey
- 2) Children's empowerment through interactive, collaborative learning
  - the relationship between "Collaborative learning in groups", "Student interaction during learning", "Self-expression & presentation skills" and "Student motivation and empowerment" as observed during the ten-week trial
- 3) Children's empowerment through self-reliant learning
  - the relationship between "Self-reliance", "Independent learning" and "Promoting learning" based on teacher interview LEA-BG
- 4) Children's empowerment through teacher guidance
  - the relationship between teacher guidance and supervision in the codes "Supervision required" and "Learning under guidance of teacher > Explanations" and the codes "Student interaction during learning" and "Student distraction". This analysis helps to deepen the understanding of the teacher's role in digital learning.
- 5) Children's empowerment despite language barrier
  - the impact of the language barrier on children empowerment based on focus group discussions at Karama Primary School
- 6) Children's empowerment and good learning through better teaching
  - the relationship between "Good teaching" (as covered in codes "Simplifying teaching" and "Save time") and "Good learning" (as covered in codes "Promoting learning", "Preparing learning material" and "Providing content and materials") is explored based on teacher interviews at LEA Primary School

### **5.3.1 Children's empowerment through practical knowledge**

In Figure 5.20 the relationship between "Practical knowledge", "Learning for life" and child empowerment is illustrated based on the data from the teacher survey (Documents 1001 – 1037).





**Figure 5.20: Coding Paradigm for “Children empowerment through practical knowledge”**

### **5.3.1.1 The phenomenon:**

The majority of teachers view “good learning” as “practical knowledge” that enables children to apply and use what they learn in their daily lives and to solve real problems in life and society. “Quality learning is where learners practice what they are learning” (Doc. 1011, Pos. 2). Good learning is “through relating the lesson with their real-life situation. The children should relate the lesson with the real environment” (Doc. 1024, Pos. 8-9). So, “good learning” must be closely related to real-life concepts and must show practical learning activities (Doc. 1035, Pos. 13-14).

“Quality education is that learning which enables pupils to acquire skills which help him/her to use the environment for daily life” (Doc. 1027, Pos. 2).

“Pupils can be prepared for their life by teaching them about knowledge which is applicable in normal life” (Doc. 1003, Pos. 4).

“Students can be well prepared for their lives by teaching them things that are compatible with their environment and that will also help them” (Doc. 1026, Pos. 4).

Teachers view “good learning” as the knowledge that a student gets, aiming at understanding the environment around him (Doc. 1030, Pos. 4). And also, “to build knowledge that enables him to manage his life” (Doc. 1030, Pos. 5). Some statements indicate that empowerment is not only restricted to the personal life but should include solving real problems in the society:

“First of all, to me, good learning means that kind of learning which can enable pupils to get and discover new knowledge which he or she can use it in his or her own life later. So if she can use that knowledge to solve different problems in the society” (LEA-BH, Pos. 3, #0:00:30#).

### **5.3.1.2 Causal conditions:**

Teachers view practical knowledge as particularly important because they had the opposite experience when they were children. Their traditional school education was by theory only and teachers regard this as a major disempowerment. In Tanzania pupils are learning in theory only, so there is a lack of skills (Doc. 1011, Pos. 4).

“The mode of instruction and learning was more theoretical than practical. So they were not able to learn practically with the Internet-based systems. So they had to base on theoretical ways only. The best way during their learning was only based on theory rather than practical” (KAR-CR, Pos. 3, #0:01:04#).

Teachers are eager to change this “by motivating practical learning rather than theory based” (Doc. 1037, Pos. 11).

### **5.3.1.3 Context / Intervening conditions**

Teachers are aware that practical knowledge is essential for pupils’ future lives. The Tanzanian government will not be able to secure enough job opportunities for so many young people. Consequently, they need to be prepared through good vocational training and practical skills to build up their own small businesses to generate income. “Good learning” is “through doing practical and training in vocational training centers” (Doc. 1010, Pos. 10). “They must use knowledge got from the school to their home to their environment” (Doc. 1016, Pos. 5).

The government is trying to “make them be self-reliant so that they can depend on themselves sometimes like gardening, making bricks, cultivation. So that when they get back home they can cultivate and add some income, provided that currently, the government employs only a small number of graduates” (NYA-JR, Pos. 7, #0:05:35#).

### **5.3.1.4 Strategies**

Teachers are very open to new ways of learning and teaching practical knowledge. They have discovered the potential of e-learning videos as a great means to visualize and present practical facts and skills.

“The process of using digital media in various schools within our nation is so important because it makes students learn practical and get more concept of what is going on within our country or outside of our country” (Doc. 1009, Pos. 12).

“The tablets assist you, is the realistic best. They can see what they have been taught. [...] Now they can see the reality – in the tablet” (NYA-JR, Pos. 20, #0:16:03#).

Others have highlighted the importance of Information and Communication Technology (ICT), basic computer and programming skills, and good use of the Internet as important skills in parallel with agricultural knowledge and livestock keeping (Doc. 1034, Pos. 3-5; Doc. 1018, Pos. 6). The school should “foster more learning through teaching and learning real things found in their school environment and home” (Doc. 1016, Pos. 6).

“So we should equip pupils more practical. More emphasizing on skills which will help them do something in practical way” (NYA-SE, Pos. 7, #0:08:05#).

“By teaching them and instructing them to discover and put what learned into practice in their real-life situations” (Doc. 1014, Pos. 7-8).

“By instructing them through practical skills so as to be creative & innovative and be independent towards life” and “By creating good learning environment such as creating confidence to pupils, motivation and encouraging self-learning among them” (Doc. 1012, Pos. 8-9).

### **5.3.1.5 Consequences**

As a result of learning that is closely associated with pupils’ lives, they are more motivated to learn for life rather than exams. This has a significant empowering effect on pupils as they become more self-confident. Teachers see real benefits from practical knowledge as provided through digital learning. The following consequences are listed by teachers:

“To motivate the children and they will have more confidence during learning” (Doc. 1013, Pos. 5).

“The children in school be well prepared for their life, for their future life, like practical skills, self-confidence” (Doc. 1021, Pos. 6).

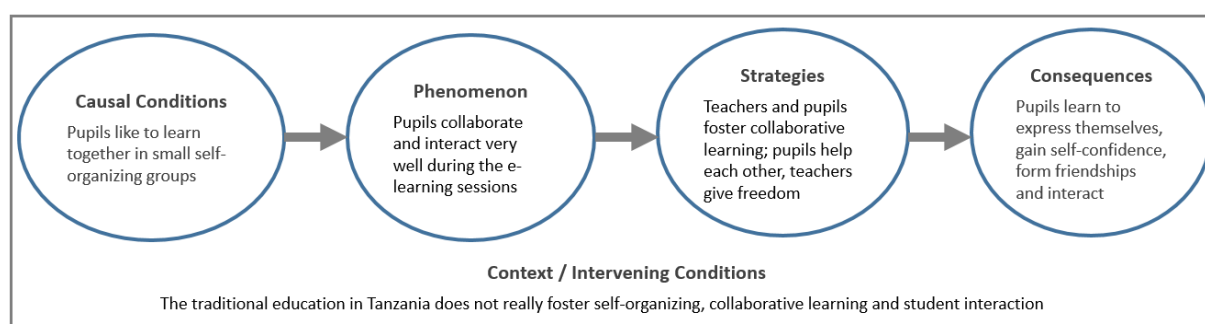
“Being involved in all stages of learning and being able to solve challenges that arise in everyday life” (Doc. 1028, Pos. 3).

“Children in school be well prepared for their life when teaching is practical based and self-reliance motivated to them” (Doc. 1037, Pos. 9).

Practical knowledge has been at the top of most teacher’s minds in their responses to the teacher survey. Once the research trial started, other topics came to the forefront, particularly the teacher’s observations on how pupils interacted with each other and how they collectively learned together in small groups.

### 5.3.2 Children’s empowerment through interactive, collaborative learning

In Figure 5.21 the relationship between “Collaborative learning in groups”, “Student interaction during learning”, “Self-expression & presentation skills” and “Student motivation and empowerment” is illustrated based on the observations recorded during the ten-week trial (Documents 2001 – 2022).



**Figure 5.21: Coding Paradigm for “Children empowerment through interactive, collaborative learning”**

#### 5.3.2.1 The phenomenon:

Section 5.2.1 highlights that some teachers were surprised about the intensity of interaction between the pupils (Doc. 2002, Pos. 4; Doc. 2014, Pos. 6). “Several children were moving to and interacting with other group members” (Doc. 2001, Pos. 4). Teacher interviews in section 5.2.2 have confirmed that the interaction and collaboration among the pupils of the focus group has even intensified throughout the ten-week trial. The emergence of this self-organizing, collaborative learning is a phenomenon that deserves further exploration. Some teachers explicitly point out pupils’ ability to collaborate and interact in the e-learning sessions:

“During the classes and sessions running through the e-learning system pupils were able to collaborate and learn together. So through that collaboration, team up in the groups, pupils themselves in teacher’s absence of no guidance were able to instruct and correct one another in their group. So some pupils gained more and are able to direct others learning in the groups. Changes were observed in the way that these students were able to interact with one another” (KAR-CR, Pos. 11, #0:08:09#).

Group discussions took mainly place when Civics topics were on the agenda (Doc. 2021, Pos. 3), confirming the value of choosing Civics as a core topic for the trial sessions. Pupils interacted with each other to gain new knowledge

(Doc. 2019, Pos. 6) or to solve problems together in a group (Doc. 2005, Pos. 5):

“They tried to discuss themselves in order to discover new knowledge” (Doc. 2019, Pos. 6).

“No any question asked by pupils in this week but I saw them the way they were interacting in order to solve problem” (Doc. 2005, Pos. 5).

#### **5.3.2.2 Causal conditions:**

Dialogic interaction could emerge during the trial in a self-organizing collaboration because pupils like to learn together in small groups. This discovery was made in both schools, especially among girls:

“They respond that to learn together is good. Because my fellow they help me. My fellow can correct me in right way” (KAR-Std5-Girls, Pos.68, #0:33:49#).

“Also, we like to learn together with our fellow colleagues because they correct us in a polite language” (KAR-Std6-Girls, Pos.61).

#### **5.3.2.3 Context / Intervening conditions**

The cultural background and context of traditional education in Tanzania do not foster self-organizing, collaborative learning, and student interaction. Details about cultural influences on education in Tanzania have been given in section 2.3.3. On the one hand, the collectivistic culture in rural areas of Tanzania values “togetherness” and cooperation in a group. On the other hand, the shame orientation of such collectivist cultures tries to avoid the loss of face by any means and promotes a learning style in the crowd rather than self-reliant, independent learning and self-expression. As we concluded in section 2.3.3 this leads to typical interactional patterns in Tanzania like frontal instructions with chanting-like responses in chorus. However, the research trial has shown that both teachers and pupils are very open to collaborative learning in small groups.

#### **5.3.2.4 Strategies**

Teachers are becoming increasingly open minded to using technologies and changing traditional interaction patterns. This open mindset was a precondition for a successful implementation of the study groups during the research trial. Both teachers and pupils were fostering collaborative learning in small groups. Teachers have observed how pupils were helping each other:

“Some were not able to access some contents from the browser so they were helped for few minutes by their fellows” (Doc. 2003, Pos. 4).

Some teachers observed and reflected on what could foster collaborative learning during the e-learning sessions:

“In order for pupils to learn or to gain knowledge they need freedom. Thus this week I saw the way pupils they share their ideas in order to discover new knowledge” (Doc. 2019, Pos. 7).

By using digital learning teachers were able to empower pupils in many different ways through interactive, collaborative learning. One observation from teachers was that pupils were largely independent from teachers because they were able to solve any issue in their groups.

“Firstly, I became amazed with how pupils were able to interact themselves and to use devices. That was the first thing. The second one, I realized that pupils, especially those strong ones in academic, they’re able totally to run the system, that they are able to find the materials themselves from devices and to read themselves” (LEA-BH, Pos. 7, #0:06:04#).

The open-mindedness of the teachers during the trial phase gives hope that teachers will continue to allow and encourage more dialogic interactivity in the classroom.

### **5.3.2.5 Consequences**

Learning independently from their teachers fosters interaction with fellow pupils:

“And they like also to be independent, so that they are free to join with their other pupils, to ask some questions themselves and to interact with each other” (LEA-NT, Pos. 7, #0:03:24#).

E-learning not only boosts pupils’ interaction, it even leads to stronger bonds and friendships:

“And also for those who are inside the program, I realized that they have developed that friendship among themselves” (LEA-MP, Pos. 29, #0:14:40#).

“Those who are able to use the tablets effectively, and those who are not able to use tablets effectively are bound together forming groups in learning, rather than before. So now the friendship and the interaction between pupils have raised a lot” (NYA-JK, Pos. 15, #0:13:05#).

As mentioned in section 5.2.1, teachers could even observe an increased interaction between boys and girls during the e-learning sessions which is a

remarkable consequence given that such mixing of genders rarely happens during normal classroom sessions.

“Different from classroom sessions, boys and girls mix up in study groups, especially in Civics discussions” (Doc. 2020, Pos. 3).

Another positive consequence resulting from the group work is that pupils learn to present results. While they were observed to be very shy at the beginning of the trial (Doc. 2002, Pos. 5), they more and more learned to summarize and present their findings (Doc. 2015, Pos. 8).

“Before, when we start, and as the time goes, there is big changes. Before, the ability of pupils to stand in front of a mass of people to express themselves was difficult. But as the day goes on, you can see now, pupils are able to explain, even if to say anything. But before it was difficult. So what I can say, this system helped them to change. So they can stand in front of people and express themselves” (LEA-CN, Pos. 11, #0:03:30#).

There is a positive correlation between the collaborative learning fostered through e-learning and pupils’ ability to express themselves and present results with more self-confidence.

### 5.3.3 Children’s empowerment through self-reliant learning

In Figure 5.22 the relationship between self-reliant, “Independent learning” and “Promoting learning” is illustrated based on teacher interview LEA-BG.

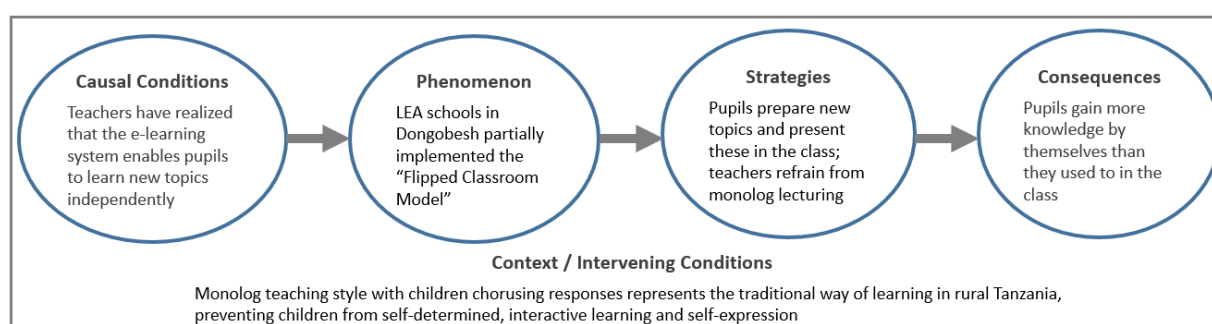


Figure 5.22: Coding Paradigm for “Children empowerment through self-reliant learning”

#### 5.3.3.1 The phenomenon:

Section 3.5 has introduced the concept of the “Flipped Classroom Model”, a pedagogical approach in which pupils engage with foundational materials outside of class as preparation for in-class activities. Short instructional videos and online exercises are used to enable independent, on-demand learning. Allowing the pupils to learn self-reliantly at their own pace increases their

motivation and promotes learning. This is why the codes “Independent learning” and “Promoting learning” strongly correlate.

### **5.3.3.2 Causal conditions:**

With classrooms in Tanzanian schools being overcrowded, teachers are looking for new ways to impart knowledge to children. Under current conditions, it is simply impossible to teach effectively and keep an eye on the individual child. Teachers have realized that the e-learning system enables pupils to learn new topics independently and therefore opens new opportunities for learning:

“What I know, children can learn for themselves. What is needed from the teacher is just to give them the subject matter and to direct them to the content which they are supposed to learn. And after giving them the instruction they can learn for themselves” (LEA-BG, Pos. 3, #0:00:24#).

### **5.3.3.3 Context / Intervening conditions**

As we have seen in section 2.3.2, the ongoing lack of teachers and overcrowded classrooms in rural Tanzania often leads to monologue teaching styles with children chorusing responses. This is disempowering children and preventing them from self-determined, interactive learning and self-expression. Section 2.4 highlights how technology-enhanced learning can improve educational quality. A lot of hopes are associated with this, from teachers as well as from the parents. Teacher LEA-BG has summarized this context as follows:

“My comment or observation, according to this study of empowering our students through digital systems in rural Tanzania, as a country of Tanzania we need to change from this older system of memorizing and cramming for the students. We need to give the students freedom to practice the things for their own. Learning by doing. Learning by observing. We must shift from teacher-centered, we must go the learner-centered” (LEA-BG, Pos. 39, #0:29:19#).

### **5.3.3.4 Strategies**

Long and passive lecturing is avoided in the classroom, and active and collaborative learning is promoted. Technology-enhanced learning has helped introduce this model by providing the materials to learn the basic concepts via e-learning in a self-directed way. Computer-based video lessons free up valuable class time replacing teacher monologues and reserving the



classroom time for collaborative dialogues rather than lecturing. Teacher LEA-BG has successfully established this model in his lessons:

“For our school and for my side in my subject, I have just tried to give the students the concept, especially the content which I cannot cover within a short period of time. I assign them the task, then they go to the computer lab, where there is server and tablets. They write the notes of that particular concept and summarize it. And then, when they be back in the next session in the class, I just pass through the exercises and mark them. [...] It was a great success, because the content which I was supposed to teach for more than three weeks, they learn it within two days. [...] That’s why I say the students, they can learn for themselves” (LEA-BG, Pos. 5, #0:01:05#).

Implementing the Flipped Classroom Model has proven to be very effective. It includes the promotion of collaborative group work. However, it is more than that. It replaces monologues and lectures with self-reliant preparation of new topics, leaving more time in the classroom for dialogic interaction and sharing of results. This leads to a lot of advantages including pupils’ ability to present and express themselves:

“My general observation for the teachers who are using the system in the classes. [...] The teachers took the system in the classrooms and assign the students in groups to go to a certain page or site to learn. [...] Then the student will share in the groups and one group after another will present. [...] And when you enter the session, we’ll share together. And also I’m using it when I see, as I said before, a topic which could take a long time and take much effort. I simplify by breaking down into small groups. [...] Then each group will go to the digital system. They learn for themselves. Then we come together and make a presentation. That will simplify our teaching and learning. And what I need also for my students, I need every one of them to speak. And now, also this simplifies, speaking for those students who are shy, who don’t like to speak, because you have been given the task, you must come and present. [...] Then we share together. From that, when they come, also I can learn new things from them” (LEA-BG, Pos. 23, #0:12:30#).

### **5.3.3.5 Consequences**

Pupils’ motivation and participation increases by establishing the Flipped Classroom Model. Pupils of the LEA-Std6-Boys focus group confirm that they gain more knowledge from the self-reliant learning than what they were used to from the class lessons:

“When we are studying independently I gain more knowledge than from normal classes. In normal classes they are following timetable” (LEA-Std6-Boys, Pos. 50, #0:09:46#).

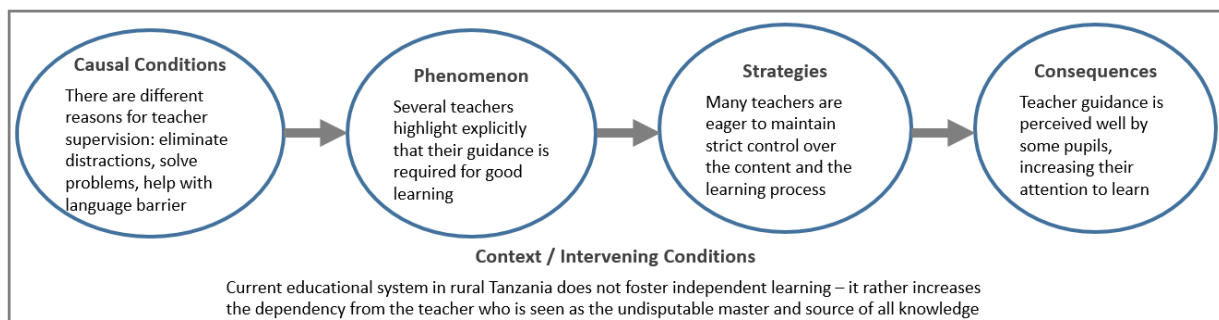
“It is better when we study independently because when we are studying independently we can get many things done being guided by teachers. Because if we are doing things and searching things ourselves is better than teachers guide us. But sometimes when we are independent, we can get many things from that” (LEA-Std6-Boys, Pos. 49, #0:09:14#).

It is interesting to note that this concept is not only working for academically stronger students. Teacher LEA-BG is convinced that the value is even greater for those pupils who struggle in normal classroom sessions:

“Because the weaker academic students, what I witnessed in the classrooms, sometimes they cannot understand you. [...] Whenever you assign them a task: “Go and learn for yourself. Or with your friend.” [...] If they are free to learn themselves, they are more independent than having a teacher. Therefore, to me, to the lower performing student, the weaker student, it is the greater of success” (LEA-BG, Pos. 35, #0:25:02#).

### 5.3.4 Children’s empowerment through teacher guidance

In Figure 5.23 the relationship between teacher guidance and supervision in the codes “Supervision required” and “Learning under guidance of teacher > Explanations” and the codes “Student interaction during learning” and “Student distraction” is illustrated. These code correlations can be found in all document groups. Related statements were made by teachers as well as pupils in all schools, especially in Karama Primary School. Analyzing them is an important element of the review and understanding of the teacher’s role in digital learning. Section 2.4.3 already concludes that technology-based learning will change the role of the teacher from an instructor (who portrays and delivers knowledge) to a facilitator of children’s self-determined and self-motivated learning. However, this does not define exactly how much guidance pupils still need or want. And if they want guidance, for what?



**Figure 5.23: Coding Paradigm for “Children empowerment through teacher guidance”**

#### **5.3.4.1 The phenomenon:**

Feedback about the value of teacher guidance during e-learning sessions is very mixed. This section will focus on those teachers who maintain their belief that grouping children without supervision is not good (Doc. 1006, Pos. 26). Several teachers highlight explicitly that their guidance and support are required, otherwise pupils will get distracted from learning:

“Without supporting the students, they are not learning independently, because once you leave them themselves, they are going to look videos and the other things which is not necessary for the issue of studying. The students, they need support from teachers” (LEA-AP, Pos. 23, #0:06:18#).

“I think this system for pupils is good, but they need guidance. Because when we leave themselves, no guidance, others they can go to do their business or unimportant things concerning to the subject. So in order to learn themselves, you have to give them at least guidance, maybe questions, then give devices in order to find answers” (LEA-CN, Pos. 9, #0:02:41#).

Although most teachers confirm that pupils can learn independently, a lot of them insist that this does not happen or is more complicated without the teacher’s supervision:

“With no supervision or guidance for our kind of pupils we have it is more complicated to assure all of them can learn perfect independent without guidance. So, with no guidance it is difficult” (KAR-KE, Pos. 17, #0:16:32#).

“He says that it is difficult for pupils to learn independently without any guidance or support from the teacher. Because sometimes you can elect the pupil that today we are going to learn this kind of topic. And try to help them find materials in the system. But if you leave the class and get to the other class, pupils will take the chance to log out and go to explore other materials of their interest. So with no guidance, you find difficulties for pupils to learn properly” (KAR-KE, Pos. 15, #0:12:43#).

#### **5.3.4.2 Causal conditions:**

There are different reasons why teachers believe that their supervision and guidance are essential for a good learning environment. One is to protect the learners from outside distractions. This aspect has been brought up several times by pupils of different focus groups.

“Some pupils outside the class come and interfere the session that they are not able to learn freely when the teacher is not around. So they prefer the guidance from the teacher. Or sometimes, when they are learning independently, teachers should be available to hear that the learning session is smooth and free from outside distraction” (KAR-Std5-Boys, Pos. 126, #0:26:22#).

“It was interesting. Though sometimes teacher’s absence led to some pupils outside of the session to interfere and make distractions in the class. Hence, we sometimes had to ask for teacher’s supervision for learning to be free from outside distraction” (KAR-Std6-Boys, Pos. 31).

Other reasons why pupils like the presence of a teacher are when the teacher helps them by explaining difficult issues and solving difficult questions (KAR-Std5-Boys, Pos. 72), for example in Mathematics (KAR-Std5-Boys, Pos. 94).

“They say that when they are learning on their own they use much time learning to use this system. And when the teacher is available that some questions they find being difficult for them. So when the teacher is available he can try to solve the question using this system. So they like learning on their own independently because they learn for a long time. And everyone can explore more. But also they like learning with their teacher because some question they find difficult, the teacher is able to explain more and try to solve these questions” (KAR-Std6-Boys, Pos. 59, #0:33:31#).

Pupils of Karama Primary School emphasize their need for teacher guidance when they are struggling with the English language:

“English language was a big problem for them. And that pupils were raising questions more frequently during learning. So teachers had to use more time directing them in finding programs. [...] During the English language instruction the teacher had to play a big part instructing the pupils” (KAR-CR, Pos. 13, #0:10:31#).

### **5.3.4.3 Context / Intervening conditions**

As we have seen in section 2.3.2, the current educational system in rural Tanzania with its overcrowded classrooms does not encourage children to self-determined and interactive learning. Rather than fostering independent learning such a setup often increases the dependency on the teacher who is seen as the undisputable master and source of all knowledge. Some statements from the pupils of the focus groups at Karama Primary School point in this direction. Although almost all teachers in this study confirm that independent learning is critically important for the pupils’ future, the application of this concept through e-learning is still new to them. This explains some of the skepticism that some of the teachers raise when they are supposed to hand over more control to the pupils.

#### **5.3.4.4 Strategies**

Those teachers who emphasize the need for guidance and supervision, are eager to maintain strict control over the e-learning system, the content, and the learning process. For example, teacher KAR-KE suggests to eliminate the free access and search of content by pupils:

“But also he is suggesting that we can try to make the system, that if someone or a teacher is opening a certain topic, a certain subtopic maybe. And all pupils are opening the same subtopic, no one can be able to log out or get back until a certain subtopic or topic is completed. That is the advice he is giving out” (KAR-KE, Pos. 17, #0:16:47#).

Pupils also seek help eliminating distractions. These aspects have been acknowledged by some pupils at Karama Primary School:

“They stated that they would like to learn with their teachers, as teachers were mostly guiding them how to go for those whom the system was difficult for them to explore. Also, sometimes learning independently was confusing some of them as some noises arose when they were learning. And that when the teacher was available was able to control them and the learning was calm and interesting for all of them. The teacher was providing good guidance” (KAR-Std6-Boys, Pos. 55, #0:29:13#).

#### **5.3.4.5 Consequences**

Teacher guidance, if applied well in the e-learning sessions has been perceived well by the pupils. Pupils point out that the teacher’s presence increases their attention and concentration to learn:

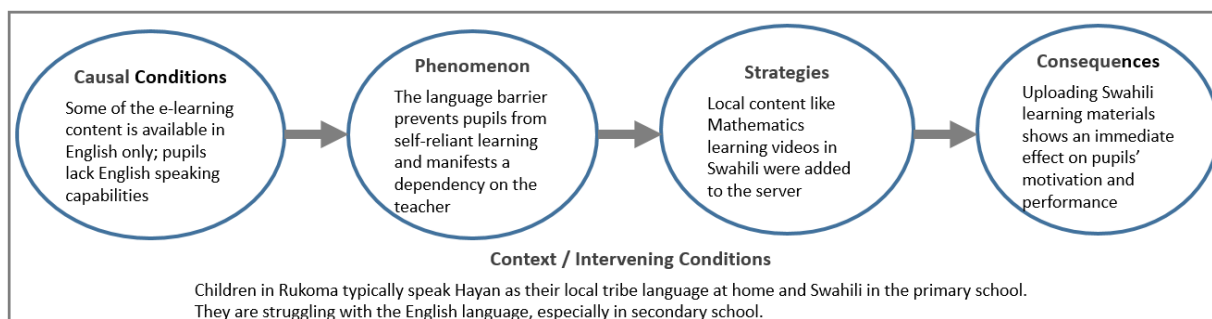
“Others they answer, teachers’ availability increases attention to learn and the concentration and their guidance. So, others they like teachers availability in the class because they correct them and they give them guidance” (KAR-Std5-Girls, Pos. 68, #0:34:51#).

In many cases, the available teachers helped them in the e-learning sessions with critical issues that they were struggling to solve by themselves.

“They say we learn together and independently. Teachers help us in difficult questions. So they like to learn independently, but most of the time teachers helped them” (KAR-Std6-Girls, Pos. 90, #0:20:20#).

### 5.3.5 Children’s empowerment despite language barrier

In Figure 5.24 the impact of language barrier on child empowerment is illustrated based on focus group discussions at Karama Primary School.



**Figure 5.24: Coding Paradigm for “Children’s empowerment despite language barrier”**

#### 5.3.5.1 The phenomenon:

The empirical data shows that in some situations, the children were simply not able to learn independently. While there are several reasons for this observation, a key challenge in digital learning and a particular source of disempowerment is the language barrier. Karama Primary School, like any other public primary school in Tanzania, teaches in Kiswahili, whereas LEA Primary School is an English Media School teaching in English. Consequently, the challenge of the language barrier was raised in the focus group discussions at Karama School multiple times, whereas it was not brought up as an issue at LEA Primary School.

“They say most of them, for sure English language was the problem because they don’t know that language. So that is the most challenging for them. Even if they want to search themselves they can’t. So teacher must be there to guide them. If you want to search for this and this you have to come here, here and here. So for them that is a challenge, English language” (KAR-Std6-Girls, Pos. 87, #0:18:34#).

The language barrier prevents pupils from more self-reliant, independent learning and manifests a dependency on the teacher to find, read, and understand content, especially when related to new topics.

“They say to learn independently is a challenge. We lack special and important guidance or correction. Because the language is a barrier. So they can’t learn themselves, independently they can’t” (KAR-Std5-Girls, Pos. 67, #0:33:17#).

### **5.3.5.2 Causal conditions:**

The lack of English-speaking capabilities in public schools in rural Tanzania is a huge barrier for the children. Children in rural Tanzania typically grow up speaking their tribe language at home (Hayan in Rukoma, Iraqw in Mbulu) and Kiswahili in primary school. Their ability to read or even express themselves in English is very limited. Because many of the learning materials on the e-learning server are available in English only, this is recognized as a major barrier to self-determined e-learning:

“They say it was difficult to learn independently. And something difficult, they are not able to solve it in absence of teacher, because of language. So they can’t learn independently themselves because language is a barrier for them” (KAR-Std6-Girls, Pos. 89, #0:19:44#).

“English language is a problem to do their learning. If she wants to search, she can’t, because she doesn’t understand the language” (KAR-Std5-Girls, Pos. 65, #0:32:11#).

“They responded that language was a barrier, and it was mostly challenging” (KAR-Std5-Boys, Pos. 120, #0:21:09#).

This challenge is acknowledged not only by pupils but also by teachers:

“Really, English language was a big problem for them. And that pupils were raising questions more frequently during learning” (KAR-CR, Pos. 13, #0:10:31#).

### **5.3.5.3 Context / Intervening conditions**

The influence of the language of instruction on children’s self-reliance in learning, their ability to express themselves, and ultimately, their empowerment for life constitutes a very complex subject. Children in Rukoma typically speak Hayan as their local tribe language at home and Kiswahili in primary school. They are struggling with the English language:

“We don’t know the English language” (KAR-Std6-Girls, Pos. 45).

“English language is difficult when you’re in the e-learning section” (KAR-Std5-Boys, Pos. 25).

The tragedy for many children in rural Tanzania is that when they move on to a secondary school the language of instruction flips to English for all subject matters except Kiswahili. This results in very high failure rates in secondary schools and children from rural areas are especially marginalized.

#### **5.3.5.4 Strategies**

It is mission-critical to note the importance of adding contextually appropriate e-learning content in Kiswahili to optimize the impact on children empowerment especially in public schools in rural Tanzania. This request has already been picked up during the action research phase. Mathematics learning videos in Kiswahili were added to the server at the beginning of the research trial. Adding local content is considered essential for successful learning in rural Tanzania, not only for this study. The requirement has been acknowledged and led to the foundation of local initiatives like *Ubongo* and *African Storybook* (see section 2.4.5). Pupils and teachers at Karama School would appreciate more learning content in Kiswahili:

“If possible they should add more Kiswahili and remove English because the language of English is very difficult to us” (KAR-Std5-Boys, Pos. 102).

They request Kiswahili as the language of instruction even though the language changes to English in secondary schools:

“Also, you can modify the language of instruction, provided that English language is a greater barrier for our children. As most of them, they know much local languages. And even they try a bit, they know Kiswahili. So if we improve the language of instruction from English to Kiswahili the student would enjoy more and pay more attention” (KAR-CR, Pos. 25, #0:21:46#).

Another action that local teachers have taken is to upload their own local content. This feature of the digital learning system allows teachers to add specific content (e.g. videos or text documents) in the actual context of the school.

#### **5.3.5.5 Consequences**

Uploading learning materials like Math videos in Kiswahili shows an immediate effect on pupils' motivation and performance:

“When these pupils found instructions which were Kiswahili based they were more cautious and attentive. So that they were able to follow the instruction and do much more better” (KAR-CR, Pos. 13, #0:10:31#).

As already pointed out in section 5.2.2 this local content has helped the children with their Math performance in the classroom:

“So when children came learning through the system, they were much more surprised finding that what they were learning in the class was also found in the system. So even the class attendance raised. And the pupils



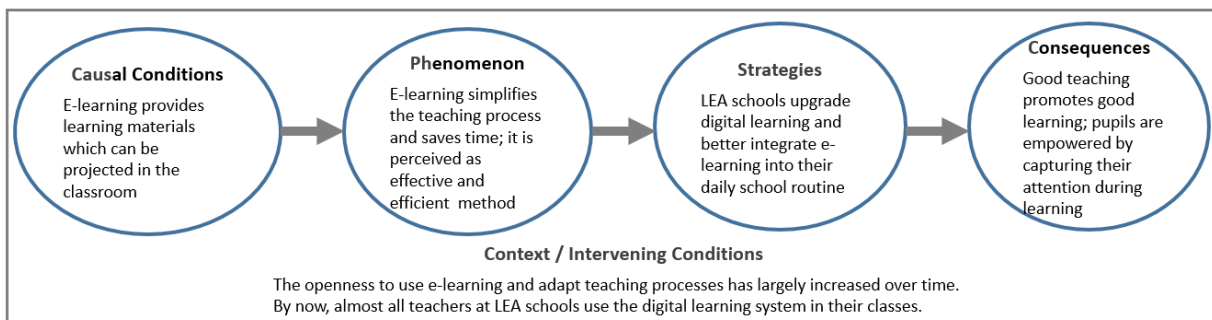
were able to follow the class instruction and enjoy the system as well because the topics and subjects covered in the class were also found in the system” (KAR-CR, Pos. 9, #0:06:06#).

Pupils confirm this statement as shown in section 5.2.3:

“We have gained greater knowledge than before for sure on how to use the e-learning system. [...] It has helped us increase class performance compared to before” (KAR-Std6-Boys, Pos. 35).

### 5.3.6 Children’s empowerment and good learning through better teaching

In Figure 5.25 the relationship between “Good teaching” (as covered in codes “Simplifying teaching” and “Save time”) and “Good learning” (as covered in codes “Promoting learning”, “Preparing learning material” and “Providing content and materials”) is illustrated based on teacher interviews at LEA Primary School.



**Figure 5.25: Coding Paradigm for “Children empowerment and good learning through better teaching”**

#### 5.3.6.1 The phenomenon:

Teachers in all participating schools, especially at LEA Primary School, report that the use of digital learning equipment helps them simplify their teaching process and save time. Digital learning is perceived as a method that is very effective and efficient:

“The advantages, the importance of the e-learning for the teachers. First, it simplifies the time. It is a method, to me it is a method which is very effective and efficient” (LEA-BG, Pos. 25, #0:15:41#).

By improving the teaching methods and processes, good learning is promoted in the class:

“It has been promoting learning in the class. It has been really activating pupil’s participation in learning in the class. Because by the time we use as teachers, we use in the class to deliver the concept in the class and the

pupils' attention and participation have been very, very high compared to when we just teach in the class. We teach without – maybe using blackboards, it has not been interesting. But by the time we have been using this learning, for sure it has been a very interesting part” (LEA-BO, Pos. 3, #0:00:25#).

Good learning and good teaching methods are strongly correlated.

### **5.3.6.2 Causal conditions:**

Teachers have given several reasons why digital learning helps them simplify their teaching and save time. One of the advantages of the e-learning system is the provisioning of learning materials:

“Myself as a teacher, this digital learning really from what I observed, it really helps me to save time. For example, instead of using a lot of time creating materials, or when out of the school funding materials, I can see that this devices or this program contain some materials that are available there and I can use them. So it doesn't consume a lot of time for me to go and find the materials because they are available there” (LEA-MP, Pos. 31, #0:15:38#).

The other advantage in the classroom is the use of a projector to display materials instead of wasting a lot of time by writing on and copying from the chalkboard:

“The use of the program, the system in the classroom, it is very nice. Myself, I observed, maybe sometimes I have a testing. Instead of writing on the blackboard then I use projector and then I display questions on the wall. [...] The system, it is very nice. Also, it saves time” (LEA-NT, Pos. 19, #0:07:59#).

These time savers free up teachers in the classroom for more individual support of pupils.

### **5.3.6.3 Context / Intervening conditions**

As more and more teachers have acknowledged the advantages of the e-learning system, their openness to use it and adapt their teaching processes has largely increased over time. By now, almost all teachers at LEA schools use the digital learning system in their classes.

“In our side, at the beginning, when you are introducing this system two years ago, I remember those who had been motivated. I think, six if not four or five teachers, they are very few. And some of them, they are not understanding at all at that time the advantage of this. But what I'm witnessing now at the moment, there are some of the teachers, at the previous times, they are not understanding what is digital, but now they are

operating, they are using it in their classes. There is a big change” (LEA-BG, Pos. 29, #0:21:31#).

This is a big change compared to the original hesitation to adopt the system. Over time, the e-learning system has been established in the school routine. This helps teachers to try it out, get used to it, and find new innovative ways of updating their teaching processes.

#### **5.3.6.4 Strategies**

Originally, only a few teachers used the e-learning system. And they used it predominantly during the extracurricular activities. Then they started to bring in the system into the classrooms and use it for group work. After some months, more teachers became curious and tried out the system for their subject matters, until almost all teachers started to use it. Due to this heavy usage, LEA schools have started to upgrade digital learning by adding additional servers and tablets. They are trying to establish clearer processes of integrating e-learning into their daily school routines to provide a better learning environment:

“Because the school has a daily routine which needs to be implemented. And also the daily routine is meant to facilitate pupils’ learning (LEA-BO, Pos. 19, #0:07:40#).

#### **5.3.6.5 Consequences**

Because good teaching promotes good learning, pupils are empowered. What they learn through e-learning sticks to their mind:

“It makes my teaching and learning process for the pupils to be easier because, for example, when I explain something and then I ask the pupils: „Please find this one from there“, they quickly find something. For them, it is also something that forces their minds. Or makes their mind master something because once something sticks [...], it sticks in your head for a long time without vanishing. So, for me as a teacher, I see that it saves time. And also, it’s easing my teaching processes” (LEA-MP, Pos. 31, #0:16:20#).

The system helps capture pupils’ attention during learning (LEA-BO, Pos. 13, #0:05:17#), and “students will be more in and also, it is building the confidence of the students” (LEA-BG, Pos. 39, #0:30:15#).

“The system has been helping a lot in improving, capturing pupils’ attention during learning. And also, so it facilitates learning, generally, which improves – which leads to pupils’ development academically, school

development academically, and also society development academically, especially to those remote areas” (LEA-BO, Pos. 23, #0:11:51#).

The axial coding above is centered around different aspects of children’s empowerment. It captures core aspects of the different components of the empirical study. The value of practical knowledge is reviewed in the context of the teacher survey. Children’s empowerment through interactive, collaborative learning has been a key observation during the ten-week trial. Some teachers have elaborated on the core value of self-reliant learning. Others have more focussed on the need for teacher guidance. The language barrier has been pointed out as a special inhibitor of independent e-learning in public schools. Moreover, it has been shown how children’s empowerment and good learning are fostered through better teaching processes using digital media. These core themes of the axial coding build a solid foundation to move to the next phase of the Grounded Theory, the selective coding.

## **5.4 KEY FINDINGS FROM THE SELECTIVE CODING PROCESS**

As described in section 4.6, *Selective Coding* unifies the data and the results from the previous coding steps on a higher level of abstraction. This step focuses on the central phenomenon of the study to construct a cohesive theoretical framework that explains the central phenomenon. It is a pivotal phase of the Grounded Theory in which a new theory is derived from the abstraction level of the axial coding. Selective coding helps to focus. The aim is to build a theory that provides answers to the research question. This theory is centered around the central phenomenon of this study, the empowerment of children in rural Tanzania. It covers inhibitors and promoters of children’s empowerment as well as the application and the impact of digital learning in this context. As pointed out in section 1.3, the objective of this study is to generate guidelines and recommendations for an empowering use of digital learning in rural Tanzania.

### **5.4.1 The central phenomenon: Children’s Empowerment**

The central phenomenon of this study is children’s empowerment. This phenomenon has been explored extensively from many different aspects

during the open coding and the axial coding process. The concept of empowerment and its supporting role in human development has been introduced in section 3.1. However, at this point, it is critical to review how the children and the teachers who participated in this study understand and perceive empowerment. The axial coding reveals different aspects of children's empowerment. Three core elements of empowerment are central in our context:

- Empowerment for life
- Empowerment for self-reliance
- Empowerment through interaction and collaboration

#### **5.4.1.1 Empowerment for life**

Teachers have highlighted the importance of children's ability to manage their lives (Doc. 1030, Pos. 5) and to solve problems in their lives (Doc. 1008, Pos. 3). Good learning prepares children for life and is applicable in normal life (Doc. 1003, Pos. 4). Learning for life means that it helps the children to fulfil their goals (Doc. 1013, Pos. 2). So empowerment and "good learning" always correlate with "good life":

Children are empowered "by teaching them life skills and prepare them to live a good and respective life and to teach them how to be cooperative to their societies" (Doc. 1020, Pos. 4-5).

This statement already indicates that child empowerment in Tanzania is not seen as purely individual, isolated from the community. "Life skills" are deemed important, but that goes along with the call to use these for the good of the community that children live in (Doc. 1009, Pos. 4-5). Caring about others and maintaining a good relationship with others is not only a request from teachers but it has also been expressed as explicit goals by pupils of the focus groups (e.g. LEA-Std6-Girls, Pos. 20, #0:03:23#). Maintaining good relationships in the society is important to the children (LEA-Std5-Girls, Pos. 6, #0:01:38#). Community empowerment is important for children's empowerment and development in Tanzania.

Empowerment for life is closely linked to knowledge and skill development. The importance of practical knowledge for children's empowerment has been

highlighted in section 5.3.1. Technological skills are considered critical for children's life and future:

“We should empower the children with the technological skills and knowledge. So that they can get the knowledge of technology at school and at home to try to reach a better life” (KAR-KE, Pos. 5, #0:05:01#).

And e-learning is a very useful and empowering way to transfer knowledge to the pupils:

The system “will help them in their daily life for the long term. The knowledge they will gain through the e-learning system helps them in their life, in their future as they are able and they are planning to continue studying. So, the knowledge they gain will help them in their school life in the future and in their daily life as well” (KAR-Std6-Boys, Pos. 50, #0:24:12#).

Empowerment for life also means “building self-discipline and self-development skills by using school expertise to develop developmental activities in various contexts by building self-confidence skills” (Doc. 1031, Pos. 5). This statement paves the way for another critical element of children's empowerment: self-reliance.

#### **5.4.1.2 Empowerment for self-reliance**

Teachers emphasize the goal of achieving the knowledge to build self-reliance in life (Doc. 1005, Pos. 5). Children shall be empowered in their talents (Doc. 1023, Pos. 16). Empowering learning enables learners to be creative and think critically:

“Good learning is the situation whereby a learner can achieve the education that can meet the daily needs and that also can help the learner to be more creative and a critical thinker after being educated” (Doc. 1001, Pos. 2).

Children should be motivated to critical thinking (Doc. 1008, Pos. 2). Good learning is empowering them to think critically and come up with ideas of how to answer questions (LEA-BG, Pos. 25, #0:19:01#). This can be fostered by e-learning as highlighted by several teachers in the survey and the interviews:

“Digital learning helps pupils or children to be more critical thinkers rather than when they are telling and repeating the chorus when the teacher is teaching” (Doc. 1001, Pos. 14).

“Now, in our country, there is what is called the competence-based examination. The question needs a student to think critically. And if, by using this digital system, if you give the student a concept which you need

him or her to think critically. They go to the system and think, where can I get this concept? Because they have – they know all the program. Therefore, it is their task to think: „Where can I get the answer to this?“ It's that, also it is making the development of critical thinking of the students" (LEA-BG, Pos. 25, #0:18:25#).

With that, children are more encouraged and learn well (NYA-SE, Pos. 9, #0:11:11#). Another important aspect of self-reliance is the children's ability to understand themselves as well as the ability to understand the environment that they live in (Doc. 1001, Pos. 3-4). Self-consciousness, understanding oneself and one's environment, is a critical condition for self-confidence. Many teachers highlight the importance of self-confidence for children's empowerment (e.g. Doc. 1002, Pos. 4; Doc. 1023, Pos. 7; LEA-BO, Pos. 11, #0:04:16#). Sometimes, self-confidence is mentioned in conjunction with self-expression:

“So, it has been giving pupils confidence while speaking with other pupils. Also, it has been raising self-explanation. Pupils can explain without any fear” (LEA-BO, Pos. 11, #0:04:41#).

“E-learning system enables pupils to have confidence. They learn. They interact with each other. Then they share the information. They have the ability to introduce or to express in front of others” (LEA-NT, Pos. 11, #0:05:09#).

“Before, when we start, and as the time goes, there is big change. Before, the ability of pupils to stand in front of a mass of people to express themselves was difficult. But as the day goes, you can see now, pupils are able to explain, even if to say anything. But before it was difficult. So what I can say, this system helped them to change. So they can stand in front of people and express themselves” (LEA-CN, Pos. 11, #0:03:30#).

Self-confidence and self-expression are viewed as major contribution to the future development of the children:

“But actually, when they understand this, and later on, when they go to the higher education, they are more free and independent. And they are confident when they are presenting, I think, in front of the others. Because they have been empowered since they are still young” (LEA-BG, Pos. 39, #0:30:34#).

#### **5.4.1.3 Empowerment through interaction and collaboration**

While all statements about the importance of critical thinking have been made by teachers only, both teachers and pupils acknowledge the empowering effect of interactive groups. Section 2.4.4 has already introduced dialogic interactivity as a powerful concept to foster learning and empowerment.

Moreover, section 5.3.2.5 describes how new friendships have emerged through collaborative learning and how pupils were able to solve issues jointly in small groups. Children consider cooperation and teamwork as important elements of empowerment in their lives. And e-learning has helped them in this process (KAR-Std6-Girls, Pos. 81, #0:17:01#). This collectivist understanding runs like a common thread through the data. Especially girls articulate their desire to take care of their fellow colleagues (KAR-Std6-Girls, Pos. 39). One girl even states that e-learning helps her to foster cooperation and love (KAR-Std6-Girls, Pos. 34). Allowing more interactivity and collaboration requires the teachers to adapt to their new role as facilitator. Empowerment requires freedom:

“In order for pupils to learn or to gain knowledge they need freedom. Thus this week I saw the way pupils they share their ideas in order to discover new knowledge” (Doc. 2019, Pos. 7).

For empowering, dialogic interaction children need more freedom than what they are used to in their normal classrooms:

“When they are with themselves, they are more free than when they are with teachers or with other pupils in the classes. They are more freely compared to other classes when they are studying” (LEA-MP, Pos. 13, #0:04:57#).

By giving pupils the freedom to learn by themselves they can discover new knowledge (Doc. 1003, Pos. 5). Through having more freedom children can do any learning activity for their future (Doc. 1025, Pos. 5). The request for freedom has been repeated several times by the pupils of the focus groups:

“In e-learning, free time is better because here in e-learning you see, you search, anything which we want” (LEA-Std5-Boys, Pos. 93, #0:13:02#).

“E-Learning is good because you can search any topic you want” (LEA-Std5-Boys, Pos. 99, #0:14:40#).

Establishing more freedom in learning has a significant impact on the setup of the learning environment:

“During the studies when we were studying here, pupils were interacting with each other. They were able to move from one place to another place, asking questions for themselves, even without engaging teachers for when they studied. So they were able to move freely, interacting freely for themselves, stu– inquiring things for themselves” (LEA-MP, Pos. 9, #0:03:52#).



“As the days go on then they (unintelligible) interacting. You can see that they are moving from one place to another to share some ideas. Sometimes maybe ((knocking door)), when is looking maybe Ubongo Kids and another one is reading in other chapter or other program. Then they interact, they share information (LEA-NT, Pos. 9, #0:04:31#).

“They recommend that we only leave them with instructions on what to do and then leave them freely to do themselves” (LEA-MP, Pos. 25, #0:12:11#).

More freedom for interaction and collaboration empowers children to create their self-organizing learning environment. The concept of Self-Organizing Learning Environments (SOLE) has been introduced in section 2.4.4 and is fundamentally different from any environment that is dominated by teacher’s control.

#### **5.4.2 Inhibitors and promoters of children’s empowerment**

After summarizing the participants’ understanding of children’s empowerment we will now review causal conditions that inhibit or promote children’s empowerment. Many different causal conditions have been identified during the open and the axial coding process. They can be differentiated as inhibiting and promoting factors of children’s empowerment. These factors will have to be taken into account when building or improving a digital learning system that fosters the empowerment of children and the perceived quality of education in schools in rural Tanzania.

##### **5.4.2.1 Inhibitors of children’s empowerment**

During the study it has been observed and concluded that the following conditions contribute to the disempowerment of children in rural Tanzania:

- Traditional school education is based on theory only.
- Passive learning through repeating and memorizing without understanding disempowers children.
- While e-learning has been widely accepted as promotor of children’s empowerment the study reveals several inhibitors to implementing an empowering digital learning environment:
  - Lack of sufficient hardware (e.g. tablets, learning servers) or issues with the e-learning setup (e.g. network connectivity problems, no

charging power) can prevent children from enjoying the e-learning benefits.

- Children can get distracted from outside the learning group.
- Even teachers can be perceived as a distraction by the pupils.
- E-learning can be confusing to children and teachers if the match with the curriculum and the normal classroom sessions is unclear.
- Some teachers fear that children will be distracted by content that is not relevant to their learning progress.
- Children are struggling with English content in e-learning because of a lack of English-speaking capabilities in public schools in rural Tanzania.

All of these inhibiting factors can be addressed through appropriate measures (e.g. provision of sufficient hardware and content that is matching the curriculum). There has been no fundamental disagreement with the e-learning concept as such, neither from pupils nor from teachers. Only a few items on this list may spark a larger, more general debate. For example, what should be the ideal language(s) of instruction in the e-learning system considering children's limitation to understanding concepts in English now, while it is mandatory for them to express themselves in English two years later at secondary school? Moreover, the fact that teachers can be perceived as a distraction by some pupils during the e-learning sessions contradicts the desire of other pupils that view teacher guidance as a strong promoter of their learning and empowerment.

#### **5.4.2.2 Promoters of children's empowerment**

Promoters of child empowerment can only have their impact if they are accepted and embraced by key stakeholders. In the case of e-learning, we need to assess the willingness and openness of teachers, parents and children to use e-learning as a core element of their education. A comprehensive overview of the educational context in Tanzania is given in section 2.3. Officially, *Education for Self-Reliance* has been the most prominent educational goal since the early days of the country's independence. Education empowers people to develop and liberate from ignorance and dependency by increasing freedom and control over

themselves, their own lives, and the environment they live in (Nyerere 1978:27). Quality education is seen as an important prerequisite for the future of children. This is not only manifested in publications from political leaders, it also represents the people's perception that can be observed in rural Tanzania. Many parents opt to suffer from restrictions so that their children can enjoy the best possible education. This attitude can be observed in all the schools of this study. It is remarkable because it is by no means self-evident in rural Africa. Education is often viewed as a ticket to a better life. On the other hand, as explained in section 2.3.2, the reality in rural schools often looks very different with overcrowded classrooms and a huge lack of teachers. Details of these educational challenges shall not be repeated at this point. However, it is important to highlight the open attitude towards digital learning in the rural communities of this study. People did not seem to have prejudices or fixed ideas about e-learning before the pilot projects. They were curious and open-minded. Most teachers recognized the advantages and benefits of digital learning early on. Even though some teachers are hesitant to make further changes to their teaching styles (e.g. handing over more control to pupils to become more self-reliant), the majority has largely adopted new learning and teaching methods that the digital learning system enables. The open and explorative attitude of the pupils, even young children, has strengthened their trust in the power of digital learning.

During the study it has been observed and concluded that the following conditions contribute to the empowerment of children in rural Tanzania:

- E-learning provides practical knowledge that helps children to learn for life rather than exams.
- Teachers have realized that the e-learning system enables pupils to self-study new topics independently.
- E-learning increases children's self-confidence and self-reliance.
- E-learning enables teamwork in a group, followed by a presentation in front of the whole class which fosters pupils' ability to express themselves.
- Dialogic interaction can emerge during e-learning because pupils like to collaborate in small groups.

- E-learning fosters friendships among the learners and between pupils and teachers.
- In several cases, e-learning has increased the academic performance of pupils even after a short period.
- Some teachers believe that their supervision and guidance are essential for a good learning environment. Teachers help pupils by explaining difficult issues and solving difficult questions.
- E-learning allows children to actively search for content and learn things of their interest.
- E-learning provides many suitable collections of content and exercises to enable self-reliant learning.
- E-learning enables teachers to improve their teaching style and do their work more efficiently. This has a direct impact on children's empowerment.
  - E-learning provides learning materials and visual content that can be projected in the classroom.
  - E-learning helps to save time and simplify teaching, freeing up teachers' time for more individual support of pupils.

These are promoters of empowerment as perceived by teachers and pupils during the study. All these promoters can be optimized in the e-learning setup. However, some require different setups of the instantiation of the e-learning. E.g. optimizing the digital learning system for the most empowering use within the classroom sessions will lead to a totally different set of requirements compared to an optimization for individual self-study or teamwork in small groups. This illustrates that the system architecture must be very flexible to be able to empower children in many different learning scenarios and different contexts. This will be further explored later in this chapter.

### **5.4.3 The application of e-learning**

During axial coding, it is analyzed for some specific cases of what the research participants do to increase children's empowerment. We will now focus on core themes and directions that these actions and interactions are pointing toward. Different dimensions of the strategy have to be distinguished.

#### **5.4.3.1 Place of use: self-study versus classroom setting**

Different teachers have used the digital learning system in very different ways. For example, Karama School and Nyakaju School almost exclusively use e-learning in special sessions. One classroom is open for one or two hours and children are allowed to explore the system, sometimes on their own, but mostly in small groups. Only a few individual teachers take the system into the classroom, and this rarely happens. However, this doesn't mean that teachers do not value the use of digital media in the classroom. Teachers highly appreciate digital learning materials for visualization, e.g. about animals of Tanzania. And children are encouraged to learn more.

A teacher stated "that from his observation point of view, pupils enjoy and are more attracted to use the tablets. [...] So when they come to school and are able to use tablets, they are more encouraged to learn more. And the good thing about the tablets, there are a lot of materials, Mathematics, Kiswahili, Civics. [...] A good thing is, in our environment sometimes they are teaching in the class, for example, elephants, another day zebras, rhinos. So when they go in the tablet they are able now to check some pictures, some videos of elephants. And they are more encouraged and they learn very well" (NYA-SE, Pos. 9, #0:10:11#).

Teachers can articulate the advantages of using digital media with a projector in the classroom and they expect high outcomes from this method:

"It is help for teachers to ensure that all pupils in the class are concentrating on the topic of interest. For example, when the teacher is teaching a certain kind of topic, he can ensure and supervise that all pupils with tablets are opening the same topic and are following the topic. [...] Compared to before or the normal way of teaching, where the teacher is writing on the blackboard, [...] if we are using tablets with every pupil in the class and we open the same topic, pupils can follow the instructions and learn from that perfectly" (KAR-KE, Pos. 19, #0:18:21#).

In LEA Primary and Siday School, teachers use the system very regularly and successfully in the classroom. In addition, triggered by the research intervention, they have now started to open one classroom regularly for digital learning to give children the chance for self-study. Teachers realize how motivated and eager their pupils are to use the e-learning system if they are allowed to learn at their own pace (LEA-Std6-Boys, Pos. 55-57, #0:11:46#).

The empirical data of this study does not warrant a judgment on whether self-study, group learning, or in-classroom usage is most effective and empowering. There is no one-size-fits-all setup or strategy. Therefore, the

digital learning system shall flexibly support all such learning scenarios. Depending on the context, pupils and teachers can then choose to integrate respective options into the daily school routine:

“The first thing is to encourage them to use the devices that we have, though they are few. We can use them in classes or lessons. And also during free time, pupils can access those devices that we have” (LEA-MP, Pos. 27, #0:12:39#).

#### **5.4.3.2 Time of use**

As commented in section 5.2.3, feedback from teachers and pupils in all participating schools confirms that the time for e-learning has been too short. The system usage and attendance in e-learning sessions are very stable. And more pupils would like to spend more time with the system. Sufficient and regular access to e-learning is a big challenge if guaranteed for all pupils in the school.

“The devices should be accessible all the time. At any time once they wish to use them, they should access. Even without presence of teacher. [...] If possible, that timetable must be fixed. So then, they can have enough time to play with the system and to become familiar with it” (LEA-BH, Pos. 33, #0:19:07#).

Consequently, scalability becomes another requirement of the digital learning system. However, the availability of technical resources is just one piece. To secure regular access, e-learning has to be deeply integrated into the timetable of the school. During the research intervention, e-learning has mostly been an extracurricular activity. Teachers have realized that there is more unleashed potential that can help to empower children:

“First of all, we have to create timetable in order to avoid challenges. I think there was interruption normal school timetable and our program. So in order to use now tablet to help pupils it’s better to create schedules so that it cannot interrupt with normal school timetable” (LEA-CN, Pos. 21, #0:07:22#).

“The school maybe can prepare a timetable. The permanent timetable for e-learning so that it can be in the master timetable and every teacher knows that there is timetable of e-learning. So that it will help even us to – (.) the system to run effectively” (LEA-NT, Pos. 17, #0:07:14#).

#### **5.4.3.3 Implementation of the Flipped Classroom Model**

Section 5.3.3 has extensively elaborated on the *Flipped Classroom Model*. The results are very promising and confirm many of the expectations raised in the literature (please refer to section 3.5). But while teacher LEA-BG seems very advanced in his implementation of this innovative learning model, other teachers are not – at least not yet. Even if they may suspect that there is great potential, they haven't found the right way to implement this model. One reason is the complexity of the task. Changing established teaching styles while facing big pressure to cover curriculum topics and being held responsible for the class performance may sound like a too risky path for many teachers. The school leadership can help here to encourage teachers to move ahead and implement the required changes. The digital learning system can help them in a big way by providing the learning materials via e-learning in a self-directed way and freeing up valuable class time for collaborative dialogues rather than lecturing. At this point, we conclude that the Flipped Classroom Model has proven its potential in individual cases, but a broad roll-out has not happened yet.

#### **5.4.3.4 Promoting interactive and collaborative learning**

Section 5.3.2 has highlighted the outstanding value of student interaction and collaborative learning in groups for children's empowerment, self-confidence, motivation, and academic performance. The Flipped Classroom Model can go hand in hand with increased teamwork activities (as we have seen in section 5.3.3). E-learning gives pupils access to a digital library that in most cases is much larger than any library they have ever been to. With that, they gain more independence from the teachers as the sole source of knowledge, whether it is through self-study or group work. Learning independently from their teachers fosters interaction with fellow pupils (LEA-NT, Pos. 7, #0:03:24#). It can even lead to stronger bonds and friendships (LEA-MP, Pos. 29, #0:14:40#; NYA-JK, Pos. 15, #0:13:05#). Many teachers have intensified the teamwork activities for their classes in conjunction with expanding e-learning sessions:

“Despite of the small number of staff available at the school the system can, and has been used to simplify work. Sending a portion of pupils in here and listen to the instructions and attend the other class” (KAR-CR, Pos. 29, #0:26:11#).

Collaborative learning emerged through digital learning:

“During the classes and sessions running through the e-learning system pupils were able to collaborate and learn together. [...] Changes were observed in the way that these students were able to interact with one another” (KAR-CR, Pos. 11, #0:08:09#).

New and different forms of collaborative group learning should be experimented with in order to maximize children’s empowerment.

#### **5.4.3.5 The role of the teacher and the necessity of teacher guidance**

We have seen in section 5.3.4 that teachers’ perspectives on the necessity of guidance and supervision are very mixed. On the one hand, supervision is required to eliminate distractions and give pupils support and directions when they are struggling. On the other hand, a teacher’s presence can prevent pupils from free, independent learning. This conflict emerged at several points during the empirical study – sometimes even within a single statement:

“Children, they are able to learn themselves. But to be supervised also it is important. Because sometimes they cannot understand. Maybe the content to be explained by a supervisor. So, they are able to learn themselves, but supervision also, it is very important” (LEA-NT, Pos. 15, #0:06:13#).

If teacher guidance and supervision can be empowerment and disempowerment at the same time, then it is strongly advised to review carefully which role teachers are playing in the operation of the digital learning system. We have concluded in section 5.2.3 that the need and the perception of teacher guidance largely differ between children. Although independent learning and self-studies have been valued by pupils, many of them appreciate the support and guidance from teachers (KAR-Std5-Boys, Pos. 126, #0:26:22#; KAR-Std6-Boys, Pos. 55, #0:28:17#). Others strongly prefer to learn on their own (KAR-Std5-Boys, Pos. 122, #0:23:22#; LEA-Std6-Boys, Pos. 49, #0:09:14#). This largely depends on their level of e-learning expertise and their self-confidence. For example, pupils of Standard 5 show a larger demand for teacher guidance than those in Standard 6. Or pupils struggling with English demand more help and directions from the teacher.



Any good implementation of digital learning has to acknowledge that different children in different contexts require different levels of teacher support and guidance. There is no ideal one-size-fits-all solution. The right level of teacher support has to be determined on a case-by-case basis, depending on the school and depending on the individual pupils. This requires a lot of wisdom and sensitivity from the teachers and their school leadership. A clear vision is mandatory here. And this vision is to promote children's empowerment and self-reliance. Teacher guidance and supervision are merely means to this end and not an end in itself. Some teachers have realized that their support and directions shall lead to more independence and self-reliance for pupils in the future:

“Because when you give them instructions about how to go through the system, search for certain kinds of sessions, when you give an introduction for a certain topic today. So tomorrow pupils can go on their own search for the next topic and learn on their own without any kind of guidance or supervision” (KAR-CR, Pos. 19, #0:15:31#).

This is how the teacher's role will change from an instructor (who portrays and delivers knowledge) to a facilitator of children's self-determined and self-motivated learning (as we have seen in section 2.4.3).

#### **5.4.4 The expected impact of e-learning**

A variety of consequences have already been derived during the axial coding in section 5.3. It can be noted that the expected impact of high-quality education is a better life, at least in the long term. The concept of empowerment is holistic in nature, many factors and dimensions come into play. Therefore, the impact on children's lives can be material, mental, or spiritual. And the consequences may not only affect individual lives but also the life of the whole community.

##### **5.4.4.1 Better material life**

As stated earlier, education is often viewed as a ticket to a better life. Good learning leads to good performance and that leads to new and better opportunities in life. This is the main reason why practical knowledge and skills have been rated so high in the teacher survey. If pupils gain more knowledge by themselves than what they are used to in class, this opens

better options for their careers. The empirical data indicates that e-learning can have an immediate effect on pupils' motivation and performance, for example through learning materials in Kiswahili (see section 5.3.5). Also, good teaching promotes good learning and captures pupils' attention during learning.

#### **5.4.4.2 Better mental and spiritual life**

Good education through e-learning has not only influenced pupils' academic performance and future opportunities, it also empowers their mental and spiritual lives. If pupils learn practical skills that they can apply in their daily life they are motivated to learn for life rather than exams. As we have concluded in section 5.3.1 this leads to increased self-reliance and self-confidence. This is true no matter whether the learning setup is via self-study, collaboration in small groups, or under the guidance of a teacher. A good teacher can act as a facilitator increasing pupils' attention and concentration to learn. Also, as we have seen in section 5.3.2, through e-learning pupils learn to express themselves, gain self-confidence, form friendships, and interact with each other. All of these are indispensable qualities of an empowered person who is taking responsibility and control over her or his life.

#### **5.4.4.3 Better life for the community**

The focus group discussions reveal that many children are concerned about their community (see section 5.2.3). A "better life" for them is not selfishly focused on themselves as an individual, it does include their families, their friends, their community, and their environment. Pupils, especially girls, reported that digital learning helps them to foster cooperation and love (KAR-Std6-Girls, Pos. 34), take care of fellow colleagues (KAR-Std6-Girls, Pos. 39), or learn how to help friends (LEA-Std5-Girls, Pos. 3). Cooperation and teamwork are of high importance to them (KAR-Std6-Girls, Pos. 81). It is essential for children empowerment within their collectivist community.

## 5.5 SUMMARY OF FINDINGS

Chapter 5 describes the key findings of the empirical study. MAXQDA and a variety of its visualization tools have been used for data analysis and the presentation of results. A diverse set of empirical data has been collected from teachers and pupils in two regions in rural Tanzania before and after a ten-week research intervention. The teacher survey has revealed some of the elements that are deemed important by the teachers, especially the importance of practical life skills for the future of the children. The open coding process of all the qualitative data including observations, teacher interviews, and focus group discussions resulted in ten top-level categories. These categories were centered around good, self-determined, collaborative and interactive learning, good teaching, and related requirements for content and the e-learning system as well as risks and challenges associated with digital learning. Key aspects of these top-level categories were then explored further in the axial coding phase. Six specific phenomena of children's empowerment were analyzed using the Coding Paradigm. Finally, the data and the results from the previous coding steps were unified on a higher level of abstraction through selective coding to build a theory that provides answers to the research question. Resulting guidelines and recommendations for the empowering use of digital learning in rural Tanzania are summarized in Chapter 6.

## CHAPTER 6: DISCUSSION AND RECOMMENDATIONS

The results of Chapter 5 will now be placed into the current research and literature context in order to summarize the conclusions and derive recommendations from this study. Afterward, the research will be reflected in terms of the role of the researcher and the underlying methodology. Also, recommendations for further research will be given.

### 6.1 DISCUSSION OF THE STUDY RESULTS

Human development is about expanding people's freedom, enlarging their choices, enhancing their capabilities, and improving their opportunities (UNDP 2016:25). As illustrated throughout this thesis, quality education plays a critical role in children's development and empowerment. And the catalytic role of technology-based learning for educational quality is highlighted in the literature review in section 2.4.1 (e.g. NAEYC 2012:2-5; Ng'ambi 2006:4; BECTA 2007:13; Selinger 2009:242; MoEVT 2007:2). The empirical data confirms the empowering effect of e-learning on children's life, self-reliance and collaboration (as summarized in section 5.4.1). The main research question of this thesis is: *How* can a digital learning system foster the empowerment of children and the perceived quality of education in schools in rural Tanzania? Sub-questions of this research question ask about further details:

- How do teachers perceive technology-enabled learning during the intervention and what changes and challenges are they facing?
- What changes can be observed in the way children learn through digital learning and what is their perception of how this empowers them within their life context?

One challenge raised during the literature review was how to translate the holistic and contextually oriented nature of child empowerment into measurable indicators (see section 3.5). Eight indicators that are deemed critical for children's empowerment were proposed:

- Factual knowledge and practical skills
- Digital literacy

- Self-reliance and ability to learn self-determined
- Children's motivation to attend school
- Readiness for teamwork and ability to learn interactively
- Level of critical thinking and engagement in discussions
- Communication skills and self-expression
- Social competence and participation in the community

Based on the empirical data about observed and perceived changes in children's learning behavior and self-confidence, the catalytic effect of digital learning on all these indicators, therefore on children's empowerment can be concluded. Some specific results of Chapter 5 are reviewed in the following.

### **6.1.1 Empowerment through practical skills**

Many teachers acknowledge that education, if related to practical skills that are important for pupils' lives and environment, empowers children to solve problems, fulfill goals, gain self-confidence, and manage their lives (see section 5.3.1). This strongly correlates to the notions defining the framework of empowerment in section 3.1 (Narayan 2002:11; Oladipo 2009:121; Alsop 2007:120-123). Practical knowledge increases children's freedom of choice and their mastery over decisions concerning their lives. The teacher survey (as presented in section 5.1.1) confirms these assumptions from the literature, showing how "practical life skills", "preparing and learning for life" and "empowerment" are intertwined. Section 5.3.1.5 indicates that pupils are more motivated to learn for life rather than exams if they acquire practical life skills through digital learning.

### **6.1.2 Empowerment through self-confidence**

Section 3.1 emphasizes the extraordinary importance of self-confidence in the framework of empowerment. Beyond control over resources and decision-making processes, psychological empowerment includes the aim to discover one's identity and "the ability to trust in one's personal abilities in order to act with confidence" (Oladipo 2009:121). It has also been highlighted that strengthening self-confidence through education is particularly important in the context of children's empowerment (Alsop 2007:123). Increased levels of

education and self-confidence are both important assets and indicators for empowerment (2007:133). Several statements in the teacher interviews highlight their observations that children's self-confidence has largely increased during the research trial (as presented in section 5.2.2.3). Such increased self-confidence is observed, for example, as children's improved ability to express themselves and present in front of other people. These results are very encouraging and indicate a significant impact of digital learning on children's empowerment already after a short period of ten weeks.

### **6.1.3 Empowerment through self-reliance**

Section 3.5 has introduced the concept of the "Flipped Classroom Model", a pedagogical approach in which pupils engage with foundational materials outside of class as preparation for in-class activities. Technology-enabled learning through short instructional videos and online exercises can be used to deliver the pre-class materials to pupils, fostering self-paced, self-directed learning (Persky & McLaughlin 2017:3). This independent, on-demand learning is a much more active process than in-class lectures, because students can decide what they need to watch and when, or if they have to repeat something they didn't catch the first time. With that, students take responsibility for their own learning (Khan 2012:113). Self-reliance promotes learning. These conclusions from the literature review have also been observed in some specific real-life implementations of the Flipped Classroom Model as highlighted in section 5.3.3. Without calling it explicitly, teacher LEA-BG and his team have implemented the core principles of the Flipped Classroom Model. In some cases, teacher monologues were replaced by video lessons that pupils could watch at any time on the digital learning system. Classroom time is reserved for dialogic interaction and collaborative dialogues rather than lecturing, promoting collaborative group work. In section 5.4.3.3 we concluded that the Flipped Classroom Model has proven its potential in several individual cases, but a broad roll-out has not happened yet. There is more potential that schools in rural Tanzania could and should exploit.

#### **6.1.4 Empowerment through interactive and collaborative learning**

Bruner's model that has been introduced in section 3.3 highlights the importance of interactive and collaborative learning especially in countries like Tanzania where traditional education has often suppressed such learning environments. It has been concluded that technology-based learning can help enable student interaction and collaborative learning. The data from the teacher interviews as well as the findings from the focus group discussions support this hypothesis (e.g. sections 5.2.2.4, 5.2.3.5, and 5.4.3.4).

Section 2.4.4 discusses the implementation of relatively new educational concepts like Self-Organizing Learning Environments (SOLE) and Minimally Invasive Education (MIE) in projects like *Whole in the Wall* in India or *Digital Doorway* in South Africa. The emergence of self-organizing, collaborative learning is a phenomenon that was also observed and explored in this study. Section 5.2.1 highlights that some teachers were surprised about the intensity of interaction between the pupils. Teacher interviews in section 5.2.2 have confirmed that the interaction and collaboration among the pupils of the focus group has even intensified throughout the ten-week trial (see section 5.3.2). Dialogic interaction could emerge in a self-organizing collaboration because pupils like to learn together in small groups. This discovery was made in both schools, especially among girls. During the e-learning sessions, pupils were empowered in many different ways through interactive, collaborative learning. Learning independently from their teachers fosters interaction with fellow pupils. E-learning not only boosts pupils' interaction, it even leads to stronger bonds and friendships (see section 5.2.2.4).

#### **6.1.5 Scaffolding Theory as a model for the right level of teacher support**

While some of the assumptions for Self-Organizing Learning Environments (SOLE) and Minimally Invasive Education (MIE) (see sections 2.4.1.3 and 2.4.4.1) were confirmed in the study, it is important to note that many of the teachers and some of the pupils insist that teacher guidance is critical for their learning progress (see section 5.3.4). As concluded in section 5.4.3.5, the lower the pupils' self-confidence and their level of e-learning expertise, the more they depend on their teacher. This contradiction between independent,

self-reliant, minimally invasive learning and the request for good support and guidance from teachers has been revealed several times throughout the study. What looks like a contradiction can be resolved through the ‘*scaffolding theory*’ that was introduced in the domain of education by Vygotsky and Bruner. As explained in section 3.3, Bruner acknowledged that children need active support from teachers. But while they are more dependent on teacher support and guidance in the beginning, Bruner argued that children can and should become more and more independent in their thinking and knowledge acquisition over time. The goal is that the intervention from the teacher or any other adult gradually fades. “To begin with, children are dependent on their adult support, but as they become more independent in their thinking and acquire new skills and knowledge, the support can be gradually faded” (Steve Wheeler quoted in: TeachThought 2014:1). Vygotsky and Bruner compared this to a scaffolding that is needed for the construction of a building, but will gradually be removed as the work gets completed (Gönülal 2018:1). Consequently, the right level of teacher support and guidance has to be determined on a case-by-case basis. This explains the difference in the empirical data from LEA and Karama Primary School. However, it is important to reiterate the ultimate goal and vision: scaffolding is there to promote children’s empowerment and self-reliance. Teacher guidance and supervision are merely means to this end and not an end in itself (see section 5.4.3.5). Teachers need to realize that their role needs to change from an instructor who delivers knowledge to a facilitator of children’s self-determined and self-motivated learning to maximize their empowerment through digital learning. Enabling interactive, collaborative learning through e-learning technologies represents a crucial milestone towards this goal.

### **6.1.6 Meaningful use of technology**

In section 2.4.5 we have summarized several lessons learned from existing digital learning platforms. One of the most prominent e-learning platforms ever was the *One Laptop per Child (OLPC)* initiative. OLPC implemented a top-down approach and stated five core principles (Cristia et al. 2012:6). Looking at the empirical data from this study, I would strongly argue against individual



ownership of laptops for every child. Also, permanent Internet connectivity is not a necessity. It is not mere access to content and technology that empowers children. Emphasis has to be given to the “meaningful use of technology” (Rubagiza, Were and Sutherland 2011:40) and how it promotes self-determined and collaborative learning. Providing equipment is insufficient to promote educational change as acknowledged by some of the thought leaders of digital learning (e.g. Hennessy & Onguko 2010:96; Khan 2012:122). This is corroborated by several statements from teachers in the revalidation survey which explicitly highlight the need for better alignment with the current curriculum and a better integration of digital learning into the school routines (see section 5.1.6). However, if implemented well, self-organizing learning environments (SOLE) can and will emerge.

### **6.1.7 The need for localized content**

The influence of the language of instruction on children’s self-reliance in learning, their ability to express themselves, and ultimately, their empowerment for life constitutes a very complex subject. It has been investigated in a variety of studies (e.g. Wedin 2005). Local language requirements have been acknowledged and led to the foundation of local initiatives like *Ubongo* and *African Storybook* (see section 2.4.5) which are trying to fill the language gap

“by developing and refining the tools that make it possible for local schools, projects and community libraries to write, adapt, translate and print the local language stories they need for their literacy development activities and programmes” (Welch & Glennie 2016:209).

We could only scratch the surface regarding language requirements in this thesis. However, it is mission-critical to note the importance of adding contextually appropriate e-learning content in Kiswahili to optimize the impact on children empowerment especially in public schools in rural Tanzania. Related results are described in sections 5.2.3.3 and 5.3.5.

## **6.2 GUIDELINES AND RECOMMENDATIONS FOR DIGITAL LEARNING IN RURAL TANZANIA**

After discussing some of the key findings of the study in the context of the broader literature review I will now summarize the recommendations for an empowering digital learning system in rural Tanzania. It has been the primary objective of this research to investigate the impact of technology-enabled education on children empowerment and human development in rural Tanzania and to generate recommendations on how e-learning can positively impact learning environments and teaching styles in related schools. With the results of the study, we can now respond to two sub-questions of the research question:

- How can the digital learning system be adapted within and after the intervention to take advantage of the experiences and feedback of teachers and students in the schools participating in the study?
- How is the digital learning system integrated into the school routine and what changes in learning styles and teaching practices can be observed in the case studies?

The following recommendations are derived from the empirical data and the results presented in Chapter 5.

### **6.2.1 Recommendations for the e-learning system**

Regarding the e-learning system itself, the following recommendations are summarized based on the results of the study.

#### **6.2.1.1 System flexibility**

There is no one-size-fits-all solution for digital learning. The system must be flexible to adapt to different contexts and learning scenarios:

- Teachers must be able to take the system into the classroom and visualize content during normal sessions. Technically, this can be achieved by providing a video projector that either connects directly to the server via WiFi or is attached to a laptop that accesses the content (e.g. learning videos).

- The system must support teamwork in small groups. For that, content is accessed via tablets that are distributed to the learning groups. Pupils shall be able to present results in the classroom, either by using tablets or a video projector.
- The system must support free, independent, and self-determined learning at their own pace. For that, enough time and room must be provided. This requires access to the learning server during extracurricular activities and throughout the whole day.

### **6.2.1.2 System scalability:**

The system must be scalable to adapt to the usage patterns of each school:

- Enough servers and tablets must be available. The existing equipment must be utilized efficiently, e.g. access to the system is balanced over the day.
- The system architecture must be open so that teachers and local administrators can add user-generated content (e.g. teaching notes) and additional programs and learning content.

### **6.2.1.3 System content**

The content on the server must be relevant and contextually appropriate for the children:

- Pupils and teachers must be able to find relevant content. This requires a good user experience with a clearly structured user interface that is logical and easy to understand.
- There must be sufficient content that matches the curriculum.
- Sufficient content must be available in the language of instruction.
- Additional content beyond the school curriculum shall be available to open additional opportunities for leisure or practical knowledge, e.g. reading materials, educational entertainment programs (Edutainment), technical instructions, and learning videos for vocational training.
- Internet connectivity is optional and shall not be mandatory. Data bandwidth is still rather expensive in Tanzania. Many rural schools would not be able to afford e-learning if it relies on (high bandwidth) Internet connectivity.

## **6.2.2 Recommendations to integrate teachers in the process**

As discussed in section 2.4.3, the role of the teachers will largely change if Information and Communication Technologies for Education (ICT4E) are implemented in the school routine.

### **6.2.2.1 Teacher training**

As we learned from the literature “teachers will often be reluctant or fearful of new technologies, especially if the children show a greater aptitude for it” (Camfield, Kobulsky & Paris 2007:28). Therefore, there is a great need for teacher training:

- There are diverse training requirements: teachers in Tanzania need to learn how to use technology *and* how to teach with technology (Olson et al. 2011:38).
- Teachers need to be properly trained on ICT4E equipment. Training should include a solid upfront introduction as well as on-the-job coaching and mentoring (Komba & Nkumbi 2008:70).
- Teachers need to be trained on pedagogical changes that e-learning will bring along if it is used at its full power.
- Discussion groups shall be established to review what the transformation from an instructor to a facilitator of children’s learning means for them.
- Self-organizing learning environments (SOLE) will only emerge if they are not suppressed by teachers. That requires preparation and training for teachers.
- Subject teachers should be encouraged and trained to integrate ICT into their teaching concept (Hennessy & Onguko 2010:99).

### **6.2.2.2 Leverage advantages for teachers**

Section 5.3.6 explains how digital learning has helped teachers to simplify their teaching and to save time. Good teaching promotes good learning. The following captures some of the additional advantages that came up during the study:

- More quizzes shall be added to the digital learning system. This will help pupils to get immediate feedback on their proposed solution.

- A specific pain point for teachers is exam preparation. Previous examination tests are available, but the current process is very tedious. Exams are printed on hardcopy, filled out by pupils, corrected by teachers, and redistributed to the pupils. This means a big waste of time and money (thousands of pages per school in every preparation step). The request for an exam preparation tool should be picked up to develop a digital version of a multiple-choice test that eliminates paperwork and gives immediate feedback to the pupils.
- It shall also not be neglected that many teachers in the study appreciate access to more content not only for the students but also for themselves. Even for them, access to good learning materials is sometimes difficult. Teachers must have easy access to the system when they prepare lessons, e.g. in the afternoon or evening.

### **6.2.2.3 Local teacher community of practice**

In section 2.4.5 the value of connecting teachers in a local community of practice has been brought up.

- Teachers shall be enabled and encouraged to share and discuss best practices in implementing e-learning into their classrooms.
- Such networks shall be established within the school, but also beyond on a community level. In the literature review, Olson already advocated for a grassroots approach fostering teacher networking and local communities of practice among teachers (Olson et al. 2011:3). This has been only partially established in the existing pilot projects. The social media network exists connecting teachers from all the different schools, but it is only used sporadically by the teachers.
- Such a teacher community of practice shall be used as a forum to share and receive additional ideas and content. With that, the system can grow over time, addressing specific local requirements of the children. And the community of practice can expand to a community of excellence, where teachers search and find answers to questions that are contextually relevant to them.

### **6.2.3 Recommendations for schools**

Regarding the school environment, several recommendations are given regarding the infrastructure and the integration into the daily school routine.

#### **6.2.3.1 Vision from the school leadership**

The introduction of digital learning will question and change existing ways of learning and established teaching styles. It will not come without resistance.

- The school leadership has to articulate a clear vision of why e-learning is introduced and which objectives should be achieved by when.
- Desired changes in pedagogy and teaching styles need to be openly discussed and reviewed. This includes an open dialogue about the expected or desired role of the teacher.
- The school leadership should clearly articulate how much self-reliance should be supported by teachers and expected from pupils, and if the emergence of self-organizing learning environments (SOLE) is desired.
- No teacher shall be forced to use e-learning. The empirical data suggests that almost all teachers will use the system, but many of them will watch the early adopters first before they dare to go their own way with it.

#### **6.2.3.2 Basic school infrastructure**

The school must provide some basic infrastructure to systematically support digital learning:

- It is recommended that the school establishes a “digital library” room (potentially associated with an existing library or computer room) where children can collect tablets and learn self-reliantly whenever they want whatever they want.
- The school shall appoint one or a few responsible teachers that take care of the digital learning equipment. A good process needs to be established to ensure that devices are fully charged before taken to the classroom. This is especially important for schools that are not connected to the electricity grid and only solar charging boxes are available for the e-learning equipment (like in Karama School).

- Even though the digital learning system operates very smoothly in the vast majority of cases, a maintenance process needs to be established to handle damages (e.g. broken tablet glasses) and repairs (e.g. system resets). This includes software and hardware-related issues.
- The school should establish a solid process to fund the maintenance and expansion of the digital learning system. External funds may be used for the introduction, but a good fundraising system is essential for a long-term, sustainable operation of the system. Additional funds should be opened up from the community as well as the local ministry of education.

### ***6.2.3.3 Integration into the daily school routine***

The empowering effect of e-learning will largely depend on the way it is integrated into the daily routine of the school.

- E-learning needs to be established as an integral part of the school's timetable. This should include in-classroom usage as well as group work and individual learning throughout the whole day. E-learning should not only be restricted to a pure extracurricular activity in the afternoon.
- Access to equipment needs to be organized by the school leadership. The more teachers actively participate in e-learning, the more organization is required to ensure teachers have access to the system resources whenever they need it.

## **6.3 REFLECTION OF THE STUDY**

### **6.3.1 Financing of e-learning equipment**

Overall, the study has confirmed the assumption that children in rural Tanzania are willing and able to use e-learning to improve their education quality. However, financing the e-learning equipment can be a huge obstacle. In the existing pilot projects, the Bridge of Hope Foundation has sponsored one server and 20 tablets per school as an initial starter package. It is very encouraging that in seven of the nine schools, heavy usage of the system can be observed. The other two schools use e-learning more sporadically. As we have seen during the research trial and in the focus group discussions (refer

to section 5.2.4), pupils are trying to get more time with the e-learning system. Two of the schools have used digital learning so extensively, that a second server has already been added to allow system usage in two classrooms in parallel. Further tablets shall be added as rightfully requested by teachers and by the students in this study. However, the aim is to avoid dependencies on external funding. The schools are encouraged to find new ways of funding the procurement of new tablets. One school has already set up a program asking richer parents to buy a tablet for their child. The device would be added to the pool rather than being used exclusively by this child. Also, connections to the local school authorities are established to generate government support for relevant content and funds for new devices. Neighbour country Kenya recently announced a major investment campaign in digital equipment for schools. Tanzania also started to roll out tablet PCs to teachers and it remains to be seen, if and when more investment in digital learning will be available from the Ministry of Education.

### **6.3.2 Reflection on the role of the researcher**

The design and implementation of the research strategy included a critical reflection on the chosen methods and procedures to make the research results as valid as possible. Both the methodology and the personal role of the researcher were questioned and adjusted wherever appropriate or necessary.

As a researcher, I had to critically reflect and question my motivation, my background, and my influence on the study in several ways:

#### *1. My origin from Germany*

Quality education has a long-standing tradition and is valued very highly in Germany. The correlation between quality education and child empowerment feels very intuitive to me. However, it would not be wise to take this for granted in rural Tanzania. Therefore, I added explicit questions in the teacher interviews about what is important and empowering for children in rural Tanzania.

Germany is an individualistic society. German education aims at preparing the individual for an independent, self-determined role in society. Children in Germany are requested to be critical thinkers,



learning to cope with new, unknown, unforeseen situations, that the individual is expected to manage. The collectivist culture of Tanzania has more emphasis on collaboration and “togetherness”. I realized in the focus group discussions how deeply this thinking is anchored in children, especially girls. This observation underscores the importance of cultural influences on education as reflected in section 2.3.3.

Related to this, I realized I have to remain open to concerns from teachers in rural Tanzania even if I feel that some of their statements originate in a traditional view of education which they verbally reject. For example, some teachers insist that children cannot learn anything without their guidance, although they verbally admit that children can learn independently. Therefore, I explicitly added an unbiased review of children’s empowerment through teacher guidance in section 5.3.4.

## 2. *My technological background*

As outlined in section 1.2 I have a long-term background in the high tech industry. Therefore, I have generally a positive attitude toward technology and it is my deep belief that many of the current global crises and problems cannot be solved without technological innovation. The educational challenge in rural Tanzania due to the massive scarcity of teachers is one of such problems. However, as a researcher in development studies, I had to take a neutral, unbiased role throughout the study. Wherever possible (e.g. in the consent letter, during the development of the questionnaire and interview guidelines), I tried to encourage all research participants to articulate critical items. I believe this was successfully achieved. The same holds for the data analysis process. Data about the risks and challenges of e-learning has not been ignored or suppressed (e.g. sections 5.2.2.8 and 5.2.3.3).

Nevertheless, the general acceptance of digital learning and new, technology-enabled learning concepts has been very high among all research participants. The children appear to be technology-savvy even in regions where ICT technology is still rather rare. Very few children were shy to use the technology. And if so, they always got help from other children around them.

Acknowledging the hesitation or resistance from some teachers to use digital technologies, it is important to reiterate that no teacher shall be forced to use digital technologies. This statement has been articulated through this study.

### 3. *My personal engagement through the Bridge of Hope Foundation*

As a founder and board member of the Bridge of Hope Foundation, I had to take special precautions to avoid creating any role conflict. For example, there was full attention on the academic goals of the study and how the research will be conducted between the different parties involved. There was no need to discuss any financial issues as all participating schools already owned and used the *RACHEL* e-learning system. It was reiterated multiple times that the goal of the study is to improve the system and maximize children's empowerment. The results have no impact on any future financing decisions.

### **6.3.3 Reflection of the methodology**

Finalizing the definition of the research methodology was a bit tricky. A Mixed Methods approach applied to a holistic Multiple-Case Study design is complex per se. Dealing with minors that are not used to focus group discussions with adults added to the complexity, especially in Rukoma, where the language barrier came on top. Several partner organizations including World Vision Tanzania and LEA Ministry were involved. Therefore, managing the complexity of the methodology was the biggest challenge. A thorough review with the supervisor was helpful and necessary.

Choosing Design Science Research (DSR) as the research paradigm, where knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact (Hevner et al. 2004:75), has turned out to be a good choice. DSR "enhances technology and science knowledge bases via the creation of innovative artifacts that solve problems and improve the environment in which they are instantiated" (vom Brocke, Hevner & Maedche 2020:1). Through the action research during the ten-week research trial, new knowledge has been created and revealed that would not have been available otherwise.

Using Peffers' process model as methodology provided an easy-to-understand, well-defined representation of the research process. It has helped to manage the complexity of the process.

The extensive mixed methods approach provided a significantly large amount of data, adding to the complexity of the data analysis process. The powerful toolset of MAXQDA was extremely helpful in extracting meaningful codes and code relations to build new theories.

The language barrier in Rukoma turned out to be larger than expected. Many children pointed out that they are not able to read English. Additional content in Kiswahili was uploaded and rated as very helpful. The data collection process was simplified. While the whole teacher interviews and focus group discussions have been recorded, only the English summary translations of the social workers have been transcribed. It has been concluded that this is sufficient given the large amount of suitable data extracted from this process.

## **6.4 RECOMMENDATIONS FOR FURTHER RESEARCH**

During the data analysis, several topics emerged that were not critical for responding to the research question but deserve further exploration.

- *The language of instruction in digital learning*

The influence of the language of instruction on children's self-reliance and empowerment has been mentioned several times (e.g. section 3.5.3). It has been concluded in section 6.1.7 that contextually appropriate e-learning content in Kiswahili is required to optimize the impact on children's empowerment particularly in public schools in rural Tanzania. On the other hand, children need to become fluent in English as soon as they enter secondary school where the language of instruction flips to English. Optimizing digital learning concerning language requirements needs further research.

- *The impact of digital learning on gender equality*

Teachers observed that boys and girls mix up in the study groups, more than usual during normal classroom sessions. Also, a few data points

suggest some gender-specific differences in the experiences with digital learning. Further research would be needed to conclude gender-specific requirements and recommendations for the digital learning system.

- *Long-term impact on children empowerment and academic performance*

One limitation of this study is the restriction on a ten-week trial. A study to capture the long-term impacts of digital learning would need significantly more time and data. And it would require a solid process to separate the effects of digital learning from other causes that influence children's empowerment and academic performance. A much broader research approach would be required to measure such long-term impacts. This may include a research design with Randomized Controlled Trials (RCT) as mentioned in section 4.5.1.

- *Research on Flipped Classroom Models in rural Tanzania*

The power of the Flipped Classroom Model has been highlighted several times during this study. In section 5.4.3.3 we concluded that this model has proven its potential in several individual cases. However, a broad roll-out has not happened yet anywhere in Tanzania. There is more potential that schools in rural Tanzania could and should exploit, potentially in parallel to introducing digital learning. More research is needed in the African context.

- *Better learning and empowerment through gamification*

A playful approach to learning did not pop up in the empirical data of this study, although it is expected to have a significant impact on children's learning behavior and empowerment. Only quizzes and multiple-choice testing have been requested by a few teachers. However, improved learning through gamification is a big topic in the research literature. Digital learning opens up a large number of new opportunities. There is very little research on gamification in the context of education in rural Africa.

- *AI-powered teacher assistant*

One of the perceived weaknesses of the current *RACHEL* digital learning system is the lack of good search functionalities. On the

Internet, people are very much used to powerful search engines like Google, Bing, Yahoo, and many others. Smart personal assistants based on artificial intelligence (AI) have emerged for a large number of devices and use cases. Innovations in smart learning software are expected to leverage the AI megatrend. A smart AI-powered teacher assistant could help children easily find relevant and appropriate content based on their personal experience and current learning status. It could also help teachers to keep the overview on individual performance and learning progress of all pupils. The research field on AI-powered teacher assistants is largely untapped, particularly in Africa. Few research initiatives exist like the AI-based “Super Teaching Assistant” at Stanford University. Also, Khan Academy has teamed up with OpenAI in March 2023 to explore the potential for GPT-4 in a pilot program (see <https://openai.com/customer-stories/khan-academy>).

I suggest not setting the focus on the discussion of whether, how, and when AI may replace human teachers (e.g. Parab 2020) but rather investigating how an AI-powered teacher assistant can help the existing human teachers to effectively deal with a large amount of pupils. More research is expected and needed on this topic.

## **6.5 CLOSING REMARKS**

This thesis investigated the impact of digital learning on children’s empowerment in rural Tanzania. The topic has been explored extensively through a mixed methods study that included a ten-week research trial. It has been an inter-disciplinary research connecting subjects like development, IT, and pedagogy. On one side, this complexity has been a continuous challenge. On the other hand, it’s been exciting to research in a field where there is a real-world problem (teacher scarcity in rural schools) that deserves immediate attention. It is my hope and my belief that this study can contribute to the understanding of the issues and provide recommendations on how to address them through a technology-enhanced digital learning system that empowers children in rural Tanzania and potentially beyond.

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## APPENDIX

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## APPENDIX A: RESEARCH APPROVALS

**THE UNITED REPUBLIC OF TANZANIA**  
**PRESIDENT'S OFFICE**  
**REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT**  
**BUKOPA DISTRICT COUNCIL**  
(ALL MAILS REFER TO DISTRICT EXECUTIVE DIRECTOR)



Correspondences should refer  
**REF. No. KGR/BDC/D.3/191/V/100** 02/08/2022

✓ The Kagera Cluster Manager,  
World Vision Tanzania,  
P. O. Box 133,  
**BUKOPA - KAGERA.**


**RE: PERMISSION TO CONDUCT A STUDY/RESEARCH**

The above captioned heading refers.

2. In response to your letter dated 1<sup>st</sup> August, 2022 the permission is granted to Mr. Arnd Aweil to conduct a study/research titled "children Empowerment Through Digital learning in Rural Tanzania at Karama Primary School in Rukoma Ward for the period of twelve (12) months ranging from September, 2022 to October, 2023.

3. The office understands that research ethics and principles will be adhered to.


4. Yours sincerely

  
E. R. Ruginamula  
**For: DISTRICT EXECUTIVE DIRECTOR**

**C.C:** District Pre-Primary and Primary Education Officer,  
Bukoba District Council,  
P. O. Box 491,  
**BUKOPA.**

The Head teacher,  
Karama Primary School,  
**BUKOPA.**

✓ Mr. Arnd Aweil,  
P. O. Box 133,  
**BUKOPA.**

  
*Jiandae kuhesabiwa siku ya Jumatane tarehe 23/08/2022*

P. O. Box, 491 Bukoba, Kagera  
**Telephone:** 028 2220287, **Fax:** 028 2221836 **Email:** [ded@bukobadc.go.tz](mailto:ded@bukobadc.go.tz), **website:** [bukobadc.go.tz](http://bukobadc.go.tz)

*KWAZI MURUGENZI MITINDA  
HALMASHAURI YA WILAYA BUKOPA  
S.L.P 491  
BUKOPA*

Figure 7.1: Research Approval Bukoba District Council



THE UNITED REPUBLIC OF TANZANIA  
PRESIDENT'S OFFICE  
REGIONAL ADMINISTRATION AND LOCAL  
GOVERNMENT



MBULU DISTRICT COUNCIL

In reply, please quote:

MDC/DED/M7/6/VOL.IX/94

28<sup>TH</sup> OCTOBER, 2022

Director of Lea Pre and Primary School,  
P.O.BOX 208,  
MBULU.

**RE: PERMISSION TO CONDUCT AN ACADEMIC RESEARCH ENTITLED  
"CHILDREN EMPOWERMENT THROUGH DIGITAL LEARNING IN RURAL TANZANIA" AT  
LEA PRE AND PRIMARY SCHOOL IN MBULU, DONGOBESH WARD IN PARTICULAR**

Please refer to the heading above together with your letter with no Reference number dated 19<sup>th</sup> September, 2022 with the caption above.


You are informed that, the Office of District Executive Director, Mbulu District Council has accepted your request for permission for Mr. Arnd Awail, a Germany citizen pursuing a Master Degree of Arts in Development Studies at the University of South Africa to **Conduct an Academic Research Entitled "CHILDREN EMPOWERMENT THROUGH DIGITAL LEARNING IN RURAL TANZANIA"**. The permission is granted from January, 2022 and ends May, 2023.

You are required to adhere to the Laws, Codes of Conduct and Ethics, Acts, Regulations and Directives of the United Republic of Tanzania. The results that will be found in this research shall be for internal use only, if you wish to be published and distributed, the permission to do so shall be sought from the authority responsible.

Together with this reply, please be informed that no costs will be incurred by Mbulu District Council for this Research.

We hope that you will utilize the results of the Research for the benefit of the School, Council and the Nation at large.

Wishing you all the best.

  
Moses J. Nduligu  
Acting District Executive Director  
Mbulu District Council  
MBULU

Copy: Mr. Arnd Awail,

**DISTRICT EXECUTIVE DIRECTOR  
MBULU DISTRICT COUNCIL  
MBULU**

District Executive Director's Office, Mbulu District Council, P.O.BOX 74 Mbulu – Manyara, Phone: +255027 2533015 or +255027 2533016 Fax: +255027 2975124, E-mail: [md@mbuludc.go.tz](mailto:md@mbuludc.go.tz). Website: [mbuludc.go.tz](http://mbuludc.go.tz)

Figure 7.2: Research Approval Mbulu District Council

## APPENDIX B: PERMISSION LETTERS




	
<b>PERMISSION LETTER</b>	
<b>Research title: Children empowerment through digital learning</b>	
<b>Researcher: Arnd H. Weil</b>	
<b>Request for permission to conduct research at</b>	
"Children empowerment through digital learning in rural Tanzania"	
	21.09.2022
Name:	
Department:	
Contact Details:	
Dear _____,	
<p>I, Arnd Weil am doing research with Dr. Thomas Kröck, Director of Development Studies, towards a Master of Arts (MA) at the University of South Africa (UNISA). We are inviting you to participate in a study entitled "Children empowerment through digital learning in rural Tanzania".</p> <p>The aim of the study is to investigate the impact of technology-enabled education on children empowerment and human development in rural Tanzania.</p> <p>Your school has been selected because you are already engaged with the Bridge of Hope Foundation in educational programs as part of a broader area development program.</p> <p>The study will entail an eight week trial associated with an empirical study that includes an initial survey plus teacher interviews and student group discussions after the intervention.</p> <p>The benefit of this study for the participating school is an enhanced learning environment leveraging technological innovation to address the huge issue of teacher scarcity. An immediate benefit is the daily access to e-learning in school.</p> <p>Potential risks are low from my point of view. There is some incremental investment of time required by the participating teachers and students.</p> <p>Feedback procedures will entail regular sharing of observations and a final workshop to present the findings from the empirical study.</p>	
Yours sincerely	
	
Arnd Weil (Researcher)	Dr. Thomas Kröck (Director of Development Studies)

Figure 8.1: School Permission Letter

**CONSENT TO PARTICIPATE IN THIS STUDY**

**Research title: Children empowerment through digital learning**

**Researcher: Arnd H. Weil**

I, \_\_\_\_\_ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

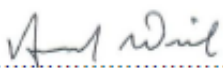
I agree to the recording of the interviews.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname: ..... (please print)

Participant Signature: ..... Date: .....

Researcher's Name & Surname: Arnd H. Weil

Researcher's signature:  ..... Date: .....

**Figure 8.2: Participant Consent Form – Teachers – English**

RIDHAA YA KUSHIRIKI KWENYE TAFITI

Mada ya Utafiti: Uwezeshwaji wa watoto kupitia kujifunza kwa njia ya mtandao.

Mtafiti: Arnd H. Weil

Mimi, \_\_\_\_\_ (Jina la Mshiriki), nathibitisha kuwa mhusika wa tafiti hii anayeniomba kushiriki kwenye tafiti hii amenieleza kuhusu tafiti, hatua za tafiti faida na changamoto ambazo zinaweza kupatikana kupitia ushiriki wa tafiti hii.

Nimesoma (au amenielezea) na nimeelewa tafiti hii kama inavyoelezwa kwenye karatasi ya taarifa.

Nilipata muda wa kutosha kuuliza maswali na nimejiandaa kushiriki kwenye tafiti hii.

Ninaelewa kwamba ushiriki wangu ni wa hiari, na niko huru kujiondoa ndani ya muda wowote bila kutozwa faini yoyote (kama inahusika).

Ninafahamu kwamba, matokeo ya utafiti huu yatachakatwa kuwa taarifa kamili ya tafiti, machapisho au mkusanyiko wa machapisho ya hadhara, pia ushiriki wangu utabaki kuwa siri na ikiwa imeainishwa.

Ninakubali kurekodiwa wakati wa mahojiano/usaili.

Nimepokea nakala iliyosainiwa kama ridhaa ya makubaliano ya ushiriki.

Jina la mhusika.....

Sahihi ya mshiriki..... Tarehe: 04/2/2023

Jina la anaye fanya utafiti: Arnd H. Weil

Sahihi ya Mtafiti: ..... Tarehe: 04/02/2023

Figure 8.3: Participant Consent Form – Teachers – Kiswahili



**LETTER REQUESTING ASSENT FROM LEARNERS IN A PRIMARY SCHOOL AND THEIR PARENTS / GUARDIANS TO PARTICIPATE IN A RESEARCH PROJECT**

Date: \_\_\_\_\_

Dear learner,

my name is Arnd Weil and I would like to ask you if you can participate in an eight week trial, that will allow you to learn on a tablet for up to one hour per day in your school. You will be granted this extra time in addition to your normal school lessons. I am trying to learn more about how children use digital media to learn and share knowledge with friends.

If you say YES to do this, your teacher and I will come and watch you when you are using the digital learning system. We will do a fun game where you have to answer some questions for me. I will also ask you to do some activities with your teacher. I will not ask you to do anything that may hurt you or that you don't want to do. After eight weeks we will do a group discussion together with the other participants about what you liked and what you didn't like when learning with the tablets.



I will also ask your parents or guardian if you can take part. If you do not want to take part, it will also be fine with me. Remember, you can say YES or you can say NO and no one will be upset if you don't want to take part or even if you change your mind later and want to stop. You can ask any questions that you have now. If you have a question later that you didn't think of now, ask me next time I visit your school. You can also ask your teacher or social worker.

Please speak to mommy or daddy or your guardian about taking part before you sign this letter. Signing your name at the bottom means that you agree to be in this study. A copy of this letter will be given to your parent/s or guardian.

Regards



Name of the researcher: Arnd Weil

Your Name	Yes I will take part	No I don't want to take part
		

Date: \_\_\_\_\_

Learner's signature:

Signature of parent(s) or guardian(s):

Witness:

**Figure 8.4: Participant Consent Form – Pupils – English**

**BARUA YA KUOMBA KIBALI CHA USHIRIKI WA WANAFUNZI WA SHULE YA MSNGI NA WAWAZI/WALEZI WAO ILI KUSHIRIKI KATIKA MRADI WA UTAFITI**

Tarehe: 31/01/2023

Mpendwa Mwanafunzi,

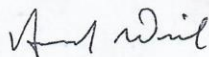
Naitwa Arnd Weil, ningependa kukuuliza kama unaweza kushiriki katika tafiti ya majaribio ya wiki nane (8), ambayo itakupa nafasi ya kujifunza kwa kutumia kishikwambi kwa takribani saa moja kwa siku pindi uwapo shuleni. Utapewa nafasi hii ya muda wa ziada Pamoja na masomo yako ya kawaida ya shule. Ninajaribu kujifunza Zaidi jinsi Watoto wanavyotumia vyombo vya Habari vya kidijitali, kujifunza na kubadilishana ujuzi na marafiki.

Kama unasema **NDIO** kufanya hivyo, mimi na mwalimu wako tutakuja kukuangalia pindi unatumia kishikwambi kujifunzia. Tutacheza mchezo ambapo utakuwa unajibu baadhi ya maswali yangu. Nitakuomba pia kufanya baadhi ya kazi zangu ukiwa na mwalimu wako. Sitakuruhusu wala kukuomba kufanya kazi ambazo zitakuumiza au ambazo hutaki kufanya. Baada ya wiki nane (8), tutafanya majadiliano ya Pamoja kwa vikundi na washiriki wengine juu ya kile ulichopenda na ambacho hukupenda wakati unajifunza kwa kutumia kishikwambi.



Pia, nitamwomba mzazi/mlezi wako ashiriki. Kama hutaki kushiriki, nitajisikia vizuri pia, Kumbuka, unaweza kusema **NDIO** au **HAPANA**, na hakuna atakayejisikia vibaya kama hutaki kushiriki au hata ukiamua kubadilisha maamuzi baadaye na kuamua kuacha kushiriki. Unaweza kuuliza swali lolote ambalo unalo kwa sasa. Kama ukipata swali baadaye ambalo hujalifikiria kwa sasa hivi, basi utaniuliza baadaye pindi nikitembelea shule yako. Unaweza pia kumuuliza mwalimu wako au mfanyakazi mwingine wa jamii.

Tafadhari mpe taarifa Baba au Mama au mlezi wako juu ya ushiriki wako kabla ya kusaini barua hii. Ukisaini kwa jina lako hapo chini unamaanisha kuwa mzazi/mlezi wako amekubali ushiriki kwenye tafiti hii. Nakala ya barua hii atapewa mzazi/ mlezi wako.

Asante



Jina la Mtafiti: Arnd Weil

Jina lako	NDIYO, nitashiriki	HAPANA, sitashiriki
		

Tarehe: 31/01/2023

Saini ya Mwanafunzi:

Saini ya mzazi/ mlezi:

Shahidi:

**Figure 8.5: Participant Consent Form – Pupils – Kiswahili**

## APPENDIX C: PARTICIPANT INFORMATION SHEET



**Research title:**  
**Children empowerment through digital learning in rural Tanzania**

**Researcher: Arnd H. Weil**

Ethics clearance reference number:

Research permission reference number (if applicable):

<Date>

Title: "Children empowerment through digital learning in rural Tanzania"

### **Dear Prospective Participant**

My name is Arnd Weil and I am doing research with Dr. Thomas Kröck, Director of Development Studies, towards a Master of Arts (MA) at the University of South Africa. We have funding from the Bridge of Hope Foundation for a tablet based digital learning system. We are inviting you to participate in a study entitled "Children empowerment through digital learning in rural Tanzania".

### **WHAT IS THE PURPOSE OF THE STUDY?**

I am conducting this research to investigate the impact of technology-enabled education on children empowerment and human development in rural Tanzania. This study is expected to collect important information that could generate recommendations how technology can positively impact learning environments in your schools.

### **WHY AM I BEING INVITED TO PARTICIPATE?**

Your organization has been selected because you are already engaged with the Bridge of Hope Foundation in educational programs as part of a broader area development program. Based on our existing co-operation I invite you to join this research study to further enhance the learning environment of your children.

In each school participating we would like to involve two teachers and two focus groups with 8-10 students per group.

### **WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?**

The study will entail an eight week trial associated with an empirical study that includes an initial survey plus semi-structured teacher interviews and focus group discussions after the intervention.

During the trial phase, student of the focus groups will get daily unsupervised access to the e-learning system for up to one hour in addition to the normal lessons. This study will analyze the observations and the feedback from the experiences of the focus groups.

In the survey, interviews and group discussions, we will ask the participants questions about how the digital learning system can foster the empowerment of children and the perceived quality of education in their schools. We would plan a full day for collecting the participant's feedback in these interviews and group discussions at the end of the trial.

### **CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?**

Participating in this trial and research study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

### **WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?**

The benefit of this study for the participating school is an enhanced learning environment. Innovative technologies and digital media like tablets are used to help teachers with their task of teaching large classes. An immediate benefit is the daily access to e-learning in school.

The academic benefit of this study is the generation of guidelines and best practices for interactive, self-determined learning specifically for schools in rural Tanzania.

## **ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?**

The negative consequence for the participants of the study is the additional investment of time during the trial phase and for the interviews and group discussions at the end of the trial.

## **WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?**

You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research and school management team, will know about your involvement in this research

Your answers will be given a code number or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings.

People involved in the data processing (social worker, translator, transcriber) will have access to the research data. Related individuals will maintain confidentiality by signing a confidentiality agreement. Your answers may be reviewed by people responsible for making sure that research is done properly, including the transcribers or members of the Research Ethics Review Committee. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

Anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings. Privacy will be protected in any publication of the information. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report. Please keep in mind that it is sometimes impossible to make an absolute guarantee of confidentiality or anonymity, e.g. when focus groups are used as a data collection method.

While every effort will be made by the researcher to ensure that you will not be connected to the information that you share during the focus group, I cannot guarantee that other participants in the focus group will treat information confidentially. I shall, however, encourage all participants to do so.

For this reason I advise you not to disclose personally sensitive information in the focus group.

### **HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?**

No hard copies of your answers will be stored by the researcher beyond the duration of this study and will be shredded afterwards. Electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

### **WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?**

No personal incentives, payment or reward is offered to the participants of the focus groups, financial or otherwise. Any costs incurred by the participant should be explained and justified in adherence with the principle of fair procedures (justice).

A financial incentive may be considered during the intervention period for the teachers leading the focus groups in order to recognize their incremental work load with the focus group.

### **HAS THE STUDY RECEIVED ETHICS APPROVAL**

This study has received written approval from the Research Ethics Review Committee of the *[identify the relevant ERC]*, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

### **HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?**

If you would like to be informed of the final research findings, please contact the researcher, Arnd Weil on +49-172-6765525 or via email (arnd@aweil.de). A summary of initial findings will be presented to and reviewed with all participants including teachers, school leadership and local social workers from the partner organizations before finalizing the study.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Arnd Weil using the contact details above.

Should you have concerns about the way in which the research has been conducted, you may contact Dr. Thomas Kröck (Mobile: +49-163-8020924, Email: Thomas.Kroeck@gmail.com). Contact the research ethics chairperson of UNISA (<insert name of the committee, the name of the research ethics chairperson and contact details here, including email, internal phone number and fax number>) if you have any ethical concerns.

Thank you for taking time to read this information sheet and for participating in this study.



Arnd Weil  
(Researcher)

## APPENDIX D: WEEKLY OBSERVATION REPORT

Name: \_\_\_\_\_

Week from \_\_\_\_\_ to \_\_\_\_\_

What was most remarkable or special this week?

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Any technical issues observed?

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Any questions raised by one or more of the children?

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Any specific observation / situation worth noting?

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## APPENDIX E: WEEKLY OBSERVATION REPORTS - RESULTS

DOC ID	Week	Most remarkable	Technical issues	Questions raised	Specific observations
2001	30/01 Intro Math	No child left the room although they were free to do so Several children were moving to and interacting with other group members Several children explored extensively the available digital media with or without following the suggestions for related content Some clicked through many different apps, others explored and exercised deeply within one or two apps	Background noise when many children play learning videos while others read >> was not considered critical by teachers, nor students (decided together with teachers that no headsets will be provided as this may reduce the interactivity with other group members)	--	Two children were tired after a full day in school and slept for 20 minutes before continuing with some self-studies Most children love Ubongo Kids videos Bench neighbours typically did the same activities
2002	30/01 Intro Civics	No child left the room although they were free to do so Children were interacting with other group members (3 groups) Children were shy to present results	--	--	Game activity ("black stories") started slow but was getting increasingly interactive over time, finding right answer to difficult question Concentration to watch videos is limited to few minutes
2003	06/02 to 12/02	Most pupils were interested in watching different video clips	Some were not able to access some contents from the browser so they were helped for few minutes by their fellows	There was no question raised by pupils	Most pupils were interesting each other
2004	06/02 to 12/02	Nothing special happened but most of pupils were interested in watching video instead of learning	In this week every pupils tried to open different program in tablet in order to discover new things and knowledge	No any question asked by pupils but they were discussing themselves in groups	This week I saw the way pupils they need freedom in order to acquire knowledge

2005	06/02 to 12/02	Nothing special happened but most of pupils were watching video	In this week every pupils tried to open different programmes in their tablet in order to discover new knowledge	No any question asked by pupils in this week but I saw them the way they were interacting in order to solve problem	This week I saw the way pupils they need freedom in order to acquire knowledge
2006	13/02 to 19/02	Pupils use or spent more time in watching videos amd Ubongo Kids instead of discussing their subjects	Every pupils use tablet to acquire new knowledge	No any question asked by pupils but they were discussing themselves in groups	This week I noted that pupils are able to learn things under supervision of teachers
2007	13/02 to 19/02	Nothing special happened in this week but it seems that pupils like to learn through short videos because they used much time to watch videos	In this week every pupil tried to use tablet to acquire new knowledge	No any question asked by pupils but they were discussing themselves in groups	This week I noted that pupils are able to learn things under supervision of teachers
2008	13/02 to 17/02	Pupils participated enough	weak signal Wifi	--	--
2009	17/02 to 23/02	Pupils participated well in the following topics - Multiplication of Numbers - Division of Numbers	weak signal Wifi	--	--
2010	23/02 to 28/02	Pupils participated enough in Roman Numbers	Slow charging of tablets	Relations between Roman Numbers and Ordinal Numbers	--
2011	01/03 to 06/03	Children participated well in Roman Numbers	weak sunlight energy	--	--
2012	06/03 to 12/03	This week the attendance was not good. Others they told me they were not OK. I think this attendance will be because of tiredness.	In order for pupils to learn they need guidance. The pupils are able to learn / discover knowledge by using tablet but under supervision of teachers.	Pupils asked us about time, they begged us to add at least one hour but we told them it is difficult to add because of the time table of the school.	This week pupils were able and busy for watching videos in groups about different subjects without considering the time table

2013	13/03 to 17/03	This week attendance of pupils was not good. That means two pupils were absent although it was in different days.	This week there was problem of Internet	No any question raised by pupils. That means pupils are able to solve problems themselves.	Pupils like to learn through videos
2014	20/03 to 24/03	Pupils spent more time in watching video and Ubongo Kids instead of discussing their subjects	Every pupils use tablets to acquire new knowledge	No any question asked by pupils but they were discussing themselves in groups	This week I noted that pupils are able to learn things under supervision of teachers
2015	21/02 to 29/03	Study groups take place regularly as planned Pupils from Std. 5 and Std. 6 are present and prepare tablets and server well for the session Two of the teachers are always present to observe the pupils Problems with server or tablets are solved rapidly and professionally by the teachers Each session begins with announcing the topic of the day, but children are free to choose their own videos or topics At the end pupils report what they have learned during this session Afterwards teachers evaluate their observations and take notes	--	--	Pupils are highly interested and excited about the e-learning system Content of e-learning system expands children's horizon and is usable in many ways It was difficult to get a first overview because of the amount and missing structure of programs and content - it takes time to get into it Pupils like to watch other videos than those that were suggested by the teachers - this has potential to disrupt the lessons Charging of tablets is sometimes difficult because of frequent power outages Server functions very well, only few time there were connection problems (Wifi)
2016	27/03 to 30/03				Math Examinations
2017	01/04 to 11/04				Easter Holidays

2018	17/04 to 21/04	Pupils were busy on discovering new content from Wikipedia	No any technical issues raised	There was no any question asked	Pupils like to learn themselves and they do enjoy much to look videos
2019	24/04 to 28/04	This week pupils were busy on watching Ubongo Kids although most of them they tried to watch videos which was out of the subject of the given day	This week pupils tried to use tablet themselves without any assistance except if there is any problem of network	No any question raised from the pupils. But they tried to discuss themselves in order to discover new knowledge.	In order for pupils to learn or to gain knowledge they need freedom. Thus this week I saw the way pupils they share their idea in order to discover new knowledge.
2020	02/05 Sum- mary				Different from classroom sessions, boys and girls mix up in study groups, especially in Civics discussions Girls like Sikana program (e.g. practical cooking skills), boys like more sharing of information Girls were more shy to show some of the content they were interested in (e.g. video on topic of delivery of babies)
2021	02/05 Sum- mary				Group discussions took mainly place when Civics topics were on the agenda The digital learning system supports Math / Science and Civics / Social equally well Academically strong students benefit more from e-learning because they are more independent in searching for content
2022	03/05 Sum- mary				Effective participation from children decreases as soon as teachers are around. Performance is regularly measured through internal school performance assessments. In the past, it was hard to achieve 67%. Since the introduction of e-learning results have continuously improved, reaching 88% last year.

## APPENDIX F: TEACHER SURVEY

1. If you look back at your experiences as a pupil: What did you like about school? What is “good learning” or “quality education”?

(Please share your view based on your own life experience)

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2. Which statements best describe your view of good learning?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
Good learning should motivate critical and creative thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning should animate the children to imitate the instructor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning helps children to discover knowledge on their own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning depends on the teacher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning allows children to question what the teacher is telling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning motivates children for self-studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good learning helps the children to absorb all the content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What skills and abilities are important to learn for children in Tanzania?

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4. How can children in school be well prepared for their life?

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5. What is most important to empower children for their life?

	Not Important	Little important	Rather important	Very important	Don't know / no answer
Factual knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-consciousness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Practical skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to learn on their own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Which statements do you agree with?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
Facts are more important than understanding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good teaching poses questions rather than giving answers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Children should be motivated to ask critical questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Collaborative learning in small groups should be practiced in schools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Telling and repeating in chorus is a good teaching style	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Children can learn new things without a teacher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. How could your school foster more self-determined learning?

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8. What is your opinion about independent learning of children in school?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
Learning always needs supervision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-determined learning without teacher is unrealistic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-determined learning works, but only in small groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Children are motivated to learn on their own if they have the means to do so	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Learning happens best if no adults intervene	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Group learning needs strict rules in order to work effectively	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. How can new digital media (e.g. tablets) help fostering more self-determined learning?

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10. How can new digital media help you as a teacher in your daily routines and in the classroom?

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11. Which statements best describe the main value of digital learning?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
The main purpose of e-learning is to provide reading materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-learning will help the academically weaker children to repeat subject matters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-learning will help the academically stronger children to develop themselves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digital learning provides an opportunity for individual, interactive learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The main purpose of e-learning is to provide teachers materials for visualization in the in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
An e-learning system must be aligned with the curriculum to be effective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. What risks and problems do you see with using new digital media in school?

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13. What would be your preferred setup for an e-learning system?

(Please rate different setups based on the scale below)

	Not Important	Little important	Rather important	Very important	Don't know / no answer
Individual use of tablets in school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In classroom use with large screen or projector for visualization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In classroom use of tablets for exercises	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of classroom group exercises with one large screen per group	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Individual access to learning tablets at home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of school access in the villages for the whole community	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Would you like to add any further comment or observation?

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## Background data:

a) Sex:

Male

Female

b) Age:

<30

<40

<55

≥55

c) Years of experience as teacher:

0-2 years

2-5 years

5-10 years

>10 years

d) Are you participating in the study trial?

yes

no

## APPENDIX G: TEACHER SURVEY – RESULTS

DOC ID	M/F	Age	Experience as teacher	Question 1: Good learning	Question 3: Important skills and abilities
1001	F	<40	2-5 years	Good learning is the situation whereby a learner can achieve the education that can meet the daily needs and that also can help the learner to be more creative and a critical thinker after being educated	ability to understand his/her self ability to understand the environment that they live ability to solve different Problems that associated in their daily life
1002	M	<40	5-10 years	Good learning is the one that creates a chance for the learner to discover new knowledge on their own through critical thinking	Empowering children to study on their own Develop creating self confidence among the learners Enabling the learners to learn through practical skills under the guidance of the teacher
1003	M	<30	0-2 years	Good learning is the receiving of knowledge from some one without any challenge	Things which are important to learn for children include to learn so that they can apply in normal life
1004	M	<30	0-2 years	Yes I like about school. Quality Education is the kind of education which the learners learn through experience or practice without teachers	Skills of using their own time in studies and abilities of using material for searching, example laptop
1005	M	<30	2-5 years	Good learning is that learning can help a pupil to discover and develop new thought, and build competence to pupil	Reading, Writing, Arithmetics to discover new skills, experience and competence
1006	M	<30	0-2 years	I like to improve my knowledge through imitating, listening from teachers, learning from others, through group discussion and motivation from other pupils	They should learn to take responsibility of developing their knowledge according to the area (??), at the moment They should learn on how they can (*master*) different challenges They should learn and stand to improve their talent
1007	F		2-5 years	Good learning due to most material I was get through learning	Teaching them
1008	M	<30	5-10 years	The good learning or quality education is the education which people use in their life that be practical in order to get money and should motivate critical thinking	To know how to solve the problem in their life
1009				Good learning because I make him/her to learn a reality of the life experience	The things which are (*important*) to the children, he or she must get to know the life skills experiences and to teaching him or her most important things
1010	M	<30	2-5 years	Good learning is the ways of teaching the pupils through practical and also it involve good environment, enough teachers, learning resources such as books, journals to be enough for learning	Doctors Nurses Teachers Engineers
1011	F	<40	2-5 years	Is the place where pupils and teachers sharing in learning. Quality learning is where learners Practise what they are learning	It is better to put into practice what they are learning rather than theory
1012	M	<30	5-10 years	Good learning. Due to the fact that by that time we learned practical things that were the catalyst in liking education, regardless am getting it at school or at the surrounding environment	Farming skills Fishing skills Crafts skills Arts skills Digital skills due to the changing world
1013	M	<30	>10 years	Good learning for a child is when the education he or she will help to fulfill his or her goals	Agreeing by receiving and thinking

1014	M	<40	5-10 years	Good learning is the learning that involves pupils studies to discover new experiences after getting guidance from instructor or teacher	The skills and ability to learn the environment The skills of doing experiements The life skills Skills of having good relationship with others
1015	M	<30	0-2 years		Computer skills Investigation (Practical) skills Self-reliance (Education)
1016				Good learning is the learning that include sharing of ideas between teacher and pupils. Quality education is the education based in life experience	Curriculum must be based in their environment Children must use skills practically and theoretically
1017	M	<30	0-2 years	I was like school because of sports and game that was performed Good learning is learning that concerning with practicals	Social life study Sports and game skills Cultural believe skills
1018	M	<30	5-10 years	Good learning is the learning which (*is*) conducted in safe environment	Actual performance Computer skills
1019	F	<30	2-5 years	Good learning was the best to me because it has made me to have self confidence, critical thinking and more understanding	They are very confident in anything they did Also they need much follow up for what they are doing
1020	F	<30	2-5 years	Good learning is a process of giving pupils better education such as providing education of life skills	Life skills
1021	F	<40	5-10 years	Good learning is the process of pupils to get the important knowledge which helps for the society / life to get knowledge, skills etc.	Skills and activities are import to learn for children in Tanzania They (??) skill in daily life
1022	F	<30	5-10 years	To have more teaching materials To get more time of learning in practical Have good environment for (*studying*)	It is better because they put what they learn in practice
1023	M	<30	2-5 years	Good facilities for learning Good methodology for pupils Time Presence of enough professional teachers	Creative thinking Self confidence Self study Practical studies
1024	M	<30	2-5 years	I like most the school with all human and material resources Good learning should based on real environment and specific season and environment which might break learning monotonous	Sport and game skills Attention and listening skills Communication skills and others
1025	F	<30	2-5 years	Good learning is the process of having all materials in teaching process	Skills and abilities are important to learn for children in Tanzania because they apply this skill in daily activities
1026	F	<40	5-10 years	I loved to read books. The best way to teach it is to challenge students to find answers to their questions.	Knowledge and ability to be independent in their lives
1027	M	<55	>10 years	quality education is that learning which enable pupils to (*acquire*) skills which help him/her to use the environment for daily life	To (*acquire*) the goals of improving the ability in using environment
1028	M	<40	5-10 years	The best way to learn is to participate well in learning and discovering different things that enable you to solve the challenges that arise in everyday life	Being involved in all stages of learning and being able to solve challenges that arise in everyday life
1029	M	<40	5-10 years	We were pushing each other as students all the times with different games	Te able to use the knowledge they have to make various instruments such as horn, singing, drawing and carving things
1030	M	<40	5-10 years	The best way to learn is to involve the student I liked to participate in sports besides football	The knowledge a student gets should be aimed at understanding the environment around him

1031	M			Sports especially football Good education is the education that a person gets by following teaching and learning and acquiring knowledge and using knowledge in various contexts in everyday life	An important skill is to be able to use knowledge and various life skills to raise the level of professionalism in the environment by communicating, using games and solving challenges in various contexts
1032	M	<55	>10 years	The best way to learn is to involve the student / learner more in action than in thought	The knowledge a student gets should help him deal with the environment around him
1033	M	<55	>10 years	Teaching at school The best education is the education that the student gets that meets his future goals	Be creative Determine the important things related to the subject being taught / learned
1034	M	<40	5-10 years	To me there was nothing like "Liking the school", "Good learning" or "quality education" because were no proper infrastructure, was a long distance to walk to and from (5km), so much of punishments than class learning, working for teachers than getting their help academically. So I had no idea about quality education during my primary school learning till when I joined secondary school. May be playing football, thats all to tell!	Information and Communication Technology (ICT) especially: Basic computer skills, Programming and Good use of the Internet. Agricultural skills of both Agribusiness and Livestock keeping. Sports
1035	M	<40	2-5 years	Practical learning and innovative skills. Quality education is the way of transferring knowledge which rely on the life experiences.	The skills and abilities to be learnt by the Tanzanian children are Transformation and accountability skills Innovative skills, reading, writing and counting Scientific implementational knowledge
1036				Practical learning and innovative skills. Quality education is the way of transferring knowledge which is based on the life experiences	The skills are: Innovative skills Computer skills Life skills Writing ,Reading, and counting skills The skills are: Ability to apply education skills in real life situations Ability to use globalization as an opportunity to get in-come
1037	M	<30	2-5 years	At school I did like sports and games and debate session Good learning is learning by practical based Quality education is education that motivates self-reliant	Computer skills Self reliance skills Practical based knowledge skills Discovery knowledge skills

ID	M/F	Age	Experience as teacher	Question 4: Prepare for life	Question 7: Self-determined learning
1001	F	<40	2-5 years	children are well prepared in the school because they (*are*) taught many things in their real life and sometimes they have been taught in how to live in their societies	In our school pupils are allowed to study themselves with out even to be taught by the teacher and then they can narrate what they have learned from their studies, by doing so pupils will be able to think critically and analyse different ideas
1002	M	<40	5-10 years	Enable (*Anable*) them to learn on their own and let the teachers be facilitators of their children	Encourage learners to study on their own, by creating group studies among children Creating motivation among the learners Encourage critical (*creational*) thinking among the learners and practical learning among them
1003	M	<30	0-2 years	Pupils can be prepared for their life by teaching them about knowledge which is applicable in normal life	By giving pupils freedom to learn themselves so that they can discover new knowledge
1004	M	<30	0-2 years	The children prepared by giving them task or work to do and observing them	by providing teaching and learning materials
1005	M	<30	2-5 years	To achieve the knowledge which build the self-reliance in life	to motivate pupils to have self studies and building confidence and competence to them
1006	M	<30	0-2 years	They must get better education They must stand with their talents and develop it They must prepare to live with others They must learn in better environment	The school should be close to the learners The school must prepare better environment for learning The school must have better teachers The school must manage the pupils in better environment
1007	F		2-5 years	Through learning Through getting knowledge from their fellow and their teacher	By creating new environment for learning
1008	M	<30	5-10 years	To teach them about bad thing and good thing which can help them in their life	Through good supervision and using their time (*effectively*)
1009				To teach the life skills To teach good and bad in their community they live	(??) to our school; learning is too much applicable because the students learn using practically and school bodies also, they take care to follow the academic development of (*the*) each student of all level
1010	M	<30	2-5 years	Through teaching the current issues Through teaching by using teaching aide Through carrying self reliance Through doing practical and Training in vocational training centres	Through providing good and quality education about the self-reliance and teaching the current issues and practical (??)
1011	F	<40	2-5 years	In Tanzania pupils are learning in theory so during implementation of the skills they have there is lack of job vacancies	School has good plan to foster self-determined through private Study during special programme
1012	M	<30	5-10 years	By instructing them through practical skills so as to be creative & innovative and be independent towards life	By creating good learning environment such as creating confidence to pupils, motivation and encouraging self learning among them
1013	M	<30	>10 years	By dealing with them in academic issue and moral behaviour	To motivate the children and they will have more confidence during learning
1014	M	<40	5-10 years	By teaching them and instructing them to discover and put what learned into practical in their real life situations To instruct pupils to discover and investigate the things in their environment	By using partizipatory learning in the class Through using assessment tools and teaching aid when teaching By guiding pupils to be innovative about what they learn
1015	M	<30	0-2 years	By getting Computer Education (skills) By promoting Practical Skills in science By promoting Self-reliance Education such as Poultry, Carpentry, Livestock in learning areas	By promoting E-learning in the learning contexts By using teaching Aids and Practicals By observing and assessing pupils capacity using Test, Exams By promoting tourism activities

1016				(*They*) must use knowledge got from the school to their home to their environment	School foster more learning through teaching and learning real things found in their school environment and home
1017	M	<30	0-2 years	Can prepared by educating them the social life skills. Like sports and game and agriculture	Improving practical learning with the quality assessment on their things implemented
1018	M	<30	5-10 years	By studying different areas By practicing things during learning such as computer and (*livestockkeeping*), farmer	By teaching them in groups By improving studying through computer By teaching them by using teaching aid
1019	F	<30	2-5 years	As a teacher who is the one who preparing those kids suppose to build friendship with them to build their internal skills what they have also to build them to have self confidence	For those kids who have already understand themself we can create groups of discussions and also introducing of this digital media to be used with those kids under the supervision of their teachers
1020	F	<30	2-5 years	By teaching them life skills and prepare them to live good and respectively life To teach them how to be cooperative to their societies	By asking pupils different questions
1021	F	<40	5-10 years	The children in school be well prepared for their life, for their future life, like practical skills, self-confidence	Thought having more skills and motivated the pupils
1022	F	<30	5-10 years	Children in schools be well prepared for their life through practicing what they learn in practical	By improving practical learning among the learners Independent learning
1023	M	<30	2-5 years	be given good education empowered best knowledge (*from best*) teacher self confidence	By encouraging the pupils Giving pupils knowledge about self confidence Empowering children talents Telling them about their goods and bads
1024	M	<30	2-5 years	Through relating the lesson with their real life situation The children should relate the lesson with the real environment	The school has prepared the school motto, this could motivate both pupils and teachers to work hard
1025	F	<30	2-5 years	Through learning activities children are well prepared for their life	Through having more freedom to do anything in learning activities for future
1026	F	<40	5-10 years	Students can be well prepared for their lives by teaching them things that are compatible with their environment and that will also help them	The school can promote independent education by placing many digital devices so that students can be independent in their studies
1027	M	<55	>10 years	To be trained well to (*know*) four skills: speaking, reading, writing and Mathematics (calculation)	by giving children motivation, using of teaching aids, and using of small groups in classroom
1028	M	<40	5-10 years	Students should be actively involved in self-learning so that they can acquire skills and knowledge sufficient to face challenges in life	Giving students the freedom to learn on their own - to be able to discover and acquire knowledge and skills
1029	M	<40	5-10 years	By identifying the talents they have in various aspects	By providing various strengths to students and following their performance while being corrected
1030	M	<40	5-10 years	To build knowledge that enables him to manage his life	Develop ICT resources / tools to facilitate learning
1031	M			Building self-discipline and self-development skills by using school expertise to develop developmental activities in various contexts by building self-confidence skills	Independent education is a state or form of extra work that takes place after class periods. It is to do the activities of growing crops and irrigation
1032	M	<55	>10 years	By building skills, knowledge and knowledge that will enable him to lead his life	By establishing reading groups for learning among students in the community
1033	M	<55	>10 years	For all life skills	By starting various projects at school Providing education on independent education



1034	M	<40	5-10 years	Grooming them based on their interests, abilities and talents. This is possible when there are supportive school Infrastructure, Qualified and multi talented teachers	By making learning resources available. Such resources are: * Enough text and reference books in a library * Well equiped computer lab * Qualified teachers
1035	M	<40	2-5 years	To be taught their real life experiences. Practical oriented courses. Participatory centered teaching in research and observation and evaluation.	To use digital learning program as the only way of portray and enhance skills and knowledge to the students/pupils. The teacher should be considered as learners to expand more understanding.
1036				To be taught their real life experiences. Practical oriented courses. Participatory centered teaching in research and observation and evaluation.	To use digital learning program as the only way of portray and enhance skills and knowledge to the students/pupils. The teacher should be considered as learners to expand more understanding.
1037	M	<30	2-5 years	Children in school be well prepared for their life when teaching is practical based and self-reliance motivated to them	By motivating self lerning style By motivating practical learning (*rather*) than theory based By group discussion and raising critical questions to teachers

DOC ID	M/F	Age	Experience as teacher	Question 9: Self-determined learning & digital media	Question 10: Digital media as help for teachers
1001	F	<40	2-5 years	digital media can help because sometimes its help the children to develop them selves even in the absence of a teacher	as a teacher digital media helps me many things for example if there is a shortage of books I can upload my documents to the device (*the*) it will be easier for the children to use even when I'm not in the class digital learning provide learning material for visualize in the classrooms
1002	M	<40	5-10 years	It provide opportunity for the learners to interact and creates self determination among the learners. Also it creates chance for the learners to discover new knowledge on their own	It easen + makes teaching process easier for me as a teacher since most learning materials can be accessible through the digital media
1003	M	<30	0-2 years	pupils they like to learn some thing which attract them so through using tablets it can encourage them to learn	digital media can help me as a source of materials like notes, also it can help me to make presentation easily and to cover large area
1004	M	<30	0-2 years	By creating critical (*creatical*) thinking to the learners and save time when learning without consuming time	Help me to save time and save energy which used during the class hours
1005	M	<30	2-5 years	Pupils can discover new knowledge and skills on their own	to memorise pupils the previous class sessions in forms of video
1006	M	<30	0-2 years	It helps to improve learning through social network It helps to understand things that (*are*) happening all over the world It helps to improve social learning to other or (??) Instead of going to school, you may learn through social networks (??)	It helps me to give real examples while teaching It helps me to get new knowledge cut from books It helps to simplify work It helps to get new ideas
1007	F		2-5 years	Through getting enough experience for learning (*Through*) getting new knowledge	Through digital media pupils they learn and they like much Pupils they get a knowledge faster than theories
1008	M	<30	5-10 years	To learn a new thing through digital media	To find some materials and other teaching materials
1009				It fostered due to the following reason: The student are learn all content practically, they see it really what in their tablet	It help me due to (*the*) this fact: when I use that tablets I show (*it*) the realistic things which happen to that content which I teach it, and it makes them to get a real concept to that content
1010	M	<30	2-5 years	Digital media foster the pupils because it help them to learn through online which help the pupils search the information that they need It (??)	It saves me time It helps us to keep the teaching records and learning records It helps us to keep the school's records, (*save*) the academic results, and other journals which is used in teaching and learning and keeping the records of pupils
1011	F	<40	2-5 years	It motivated pupils because they are interacting with world around them	Because it is visual aid they excited rather then writing in their exercise books
1012	M	<30	5-10 years	By raising curiosity among pupils to know / learn many things especially those based on contemporary issues around them	It help to facilitate my teaching process as well as it make the lesson to be reality rather than theories
1013	M	<30	>10 years	This helps because you can use books from the tablets and let the children to follow (*step*) by (*step*)	The digital media helps me to simplify my teaching because I can devide the tablets to children and share the knowledge without writing on the chalk board
1014	M	<40	5-10 years	It helps the learners to learn practically and to innovate various things. Also it improve cognitive ability of thinking and makes them to remember fast.	It helps to teach pupils by making demonstrations It (*makes*) learning and teaching process easy It helps teacher to access materials online

1015	M	<30	0-2 years	By promoting knowledge as source of material By serving time to acquire materials By motivating learners to like lessons By enhancing participation by innovation	By getting teaching materials from Internet By serving time to deliver contents to pupils By getting sample teaching Aids needed Increase of (*efficiency*) in work
1016				This helped through serving time and relating the effects of digital media to their real life experience	Helping to simplify the process of teaching and learning through serving time
1017	M	<30	0-2 years	Helps faster mastering of knowledge Saving of time Simplify teachers in transfer of knowledge to their pupils	By saving time since a notice and document to be (??) is simply downloaded to the internet
1018	M	<30	5-10 years	It simplifying learning study process It motivating pupils during lessons	It helps during lesson
1019	F	<30	2-5 years	It is somehow helping because we can get different concept from digital media about a certain thing and that can make us to have a big knowledge about that thing	As a teacher it can help me in having different ways of delivering my content or concept to the pupils
1020	F	<30	2-5 years	To give pupils more knowledge and skills about different things	It simplify work because I can teach one thing in a short time and students gets enough time to learn through using digital media
1021	F	<40	5-10 years	New digital media help fostering more self-determined learning	It help teacher to get time for get vocabularies in order to use dictionaries
1022	F	<30	5-10 years	Digital media ist so helpful for the learners because its help to know the things by showing steps to follow	Digital media helps to simplify the work in the classroom because pupils are learning in visual
1023	M	<30	2-5 years	By making learning easy Requiring more knowledge & skills	By simplifying work Getting more knowledge Making (??) of pupil's convenience
1024	M	<30	2-5 years	The new digital could maintain the time It also ensure availability of teaching and learning materials Comfort	The teacher has full accessible with teaching materials It reducing the teacher with a lot of talking of the content but learners (??)
1025	F	<30	2-5 years	New digital media help pupils to motivate in learning process	New digital media help teacher during teaching process because sometime it help to simplify teaching activities
1026	F	<40	5-10 years	Quizzes contribute to the growth of independent education as students use them to find answers to their questions	Modern equipment helps me in the classroom because it makes teaching and learning easier
1027	M	<55	>10 years	Pupils can use tablets to get more materials without teachers and so they can learn more and get more ideas of many different things surrounding them	New digital media it can help teachers to get more materials which enable him/her to teach their children / pupils and it makes pupils to understand well about the subjects
1028	M	<40	5-10 years	Students use them as their resource - for themselves to be able to learn and to gain knowledge and skills	Modern devices help me to get knowledge and skills easily
1029	M	<40	5-10 years	Searching for different people who do interesting activities through the Internet	Finding ways and means to teach things that are difficult for students to understand quickly
1030	M	<40	5-10 years	Enabling students to change their knowledge and learning methods	Streamlining teaching methods Have solid references
1031	M				
1032	M	<55	>10 years	A student can study at his own time, it is also easy to find what he needs to learn quickly and on time	It is easy to find / make a reference with urgency, time and certainty. You also get a chance to find different materials so you can choose the best one for your work.
1033	M	<55	>10 years	It is to get information and answers from social networks	It is to get a good resolution of decisions based on relevant issues

1034	M	<40	5-10 years	A child can study in absence of a teacher through tutorials, reference books and text books in the customized local content and the fact that it is an offline study no worry about ethical and moral issues, so this fosters self determined learning!	I can upload Audio Visual (AV) content so pupils can see and hear, this easens the lessons. Pupils can learn in my absence, provided the lesson is uploaded. Pupils can have suppliment knowledge about the same lesson in other apps in the server. Pupils can do exercise on their own and get their responses corrected in the server in my absence
1035	M	<40	2-5 years	Must be closely and related to the real life concepts. Must shows practical learning activities.	It is the faster way of teaching and learning It allows the interactive learning between pupils and children It is the quick way of attaining goals and objectives in learning processes
1036				Must be closely and related to the real life concepts. Must shows practical learning activities.	Is the faster way of teaching and learning Enables slow learners to understand easily Allows interactive learning between learners and teachers
1037	M	<30	2-5 years	It facilitates teaching and learning situation It attracts learning by practicals It motivates critical and creative thinking It motivates the discover of new knowledge	It simplify(ies) my teaching process (doing digital teaching) displaying pictures, photos and videos practically To provide materials in digital way

ID	M/F	Age	Experience as teacher	Question 12: Risks and problems with digital media	Question 14: Further comments
1001	F	<40	2-5 years	digital media e.g. tablets if are not kept well they are very easy to be broken but for the issue of study no problem that I recognize at all	digital learning helps pupils or children to be more critical thinker rather than when they are telling and repeating the chorus when the teacher is teaching so the use of digital learning is much important for the self-determination of any children
1002	M	<40	5-10 years	The devices are delicate for the pupils to use (*own*) on their own without the presence of teachers and this makes most teachers feel risky of let pupils to use on their own	We should encourage self motivated studying among the learners
1003	M	<30	0-2 years	The problem of using new digital media is it can not (*be*) used for large classes but it can be used in groups with few people	Yes!
1004	M	<30	0-2 years	Lack or absence of material, example tablets Electricity supply due to power supply	I would like to provide e-learning material to the school to help our pupils through life experience
1005	M	<30	2-5 years	Shortage of tablets Absence of electricity in other schools	Teachers and pupils especially in rural areas must be provided with the subject concern e-learning facilities
1006	M	<30	0-2 years	It will be risk if you will use in bad way (own issues) It will cause bad manner if used in bad way	e-learning should be allowed to school for better learning Users of social networks will help each other to get new knowledge Grouping children without supervision is not good We should make better environment for better education
1007	F		2-5 years	Most of pupils they are using digital media for watch (*unnecessary*) need	I would like to say children are motivated to learn through tablets
1008	M	<30	5-10 years	Sometime if the pupils are themselves they can download a bad thing	No
1009				For those who has visual problem it give them risk issues It make student to need the digital media when these is not around. So every time the teacher must use all digital media	I add something the process if using digital media in various school within our nation is so important because it make student learn practical and get more concept of what is going (*on*) within our country or outside of our country practices not learning in theories
1010	M	<30	2-5 years	It is very expensive (costfully) It is not enough because many pupils they are sharing one tablet	Please Mr. Arnd help us to add more tablets because ist not enough compared to the (*many*) of pupils here at school Digital media save the time during teaching and learning
1011	F	<40	2-5 years	If children they focus on another things out of what they suppose to learn	e-learning is very important if it will conducted well under supervision of teachers
1012	M	<30	5-10 years	Most of pupils are not aware about the using of digital devices (e.g. tablets) If no supervision pupils can focus on unmannered videos, pictures and other blogs with irrelevant message	E-learning to be a continuous process among the Tanzania schools Pupils should be taught about the proper way of using digital devices like tablets, computers in every class from Baby class If possible, a school should have more tablets or computers according to the number of classes (if possible, every pupil should have tablet) so as to motive them towards independent learning
1013	M	<30	>10 years	If no supervision children will not use as it supposed Moral decay Bad customs	Nothing I can add
1014	M	<40	5-10 years	The risk of fault of electricity The digital media when get damage the cost to repair is high	For the teaching and learning to be effective, the motivation to learners is important as well as use of computers in teaching

1015	M	<30	0-2 years	It can load bad pictures if not used well Some can fail to understand Lost time to understand Moral decay	Yes
1016				Moral decay because some pupils their not using for academic purpose but for negative things that are going in the world	Comment, about tablet Must be according to the number of learners and teachers because few one are not enough for all
1017	M	<30	0-2 years	Scratching of electricity Absence of enough electricity power	The curriculum must emphasize the using of network / E-learning during teaching and learning because it lead to improve Performance
1018	M	<30	5-10 years		
1019	F	<30	2-5 years	Some of people (teachers & pupils) they use this one for their own activities apart from the sake or aim of education, this are like be more in social networks	Individual help to the pupils is more important also for developing our education cause kids they can do anything without supervision
1020	F	<30	2-5 years	Some of pupils they don't know how to use it	Digital media help pupils to know a lot of things
1021	F	<40	5-10 years	Risks and problem I see with using digital media in school is to use group of pupils in class, lack of it It better every pupil to use one Ipad	E-learning help the teachers and pupils to do better: in process of learning and teaching
1022	F	<30	5-10 years	If the children (*they're*) not supervised well they starts to learn bad thing which is not helpful for their lives	To get more materials for e-learning (*in order to achieve*) the goals
1023	M	<30	2-5 years	Creating lazy people Destroying culture Losing our curriculum (??) new curriculum	Users of e-learning should be motivated and educated by (??) the use of E-learning
1024	M	<30	2-5 years	When there is lack of electricity power it can risk to run the school time table properly	Null
1025	F	<30	2-5 years	There are no problem in new digital media because it help us to give more question in teaching process	Yes!!
1026	F	<40	5-10 years	The challenges are that there are few devices	My suggestion is that the exercises should be added to make it easier for students to learn
1027	M	<55	>10 years	Lack of network Lack of (??) No electricity	
1028	M	<40	5-10 years	Students each want to learn things on their own rather than being assisted by teachers	Educational stakeholders should provide tools for each student to learn for himself
1029	M	<40	5-10 years	Internet addiction Not enough time	
1030	M	<40	5-10 years	Lack of IT professionals Lack of electricity Lack of Internet	
1031	M				
1032	M	<55	>10 years	Lack of reliable internet Regulation of online advertising A mix of cultures / foreign cultural content	
1033	M	<55	>10 years	Have wrong information for students	Yes: I suggest the existence of cooperation between education stakeholders to meet important needs in society
1034	M	<40	5-10 years	The fact that it's an offline learning, I see zero risk!	Every school in Tanzania should adopt this programme! The Tz Gov and other educational stakeholders should intervene and shake hand to the programme!

1035	M	<40	2-5 years	Some pupils are not aware with the use of tablets, so they take long time to use them. It is not all learning and teaching contents are installed in the system.	Should be done through network acces as LAN. E- Learning should consider the disabled children. Should be used as one of teaching and learning facilities to all subjects.
1036				Not all teaching and learning content is installed in the system. Very few tablets compared to the number of learners.	Should be done through network acces as LAN. E- Learning should also consider the disabled children. Should be used as one of the teaching and learning facilities. Can you help to get the USB cable charge if possible we can pay and you can help us to deliver to us.
1037	M	<30	2-5 years	Pupils to break devices (tablets)	ICT and computer studies at school is highly needed since theory learning is outdated

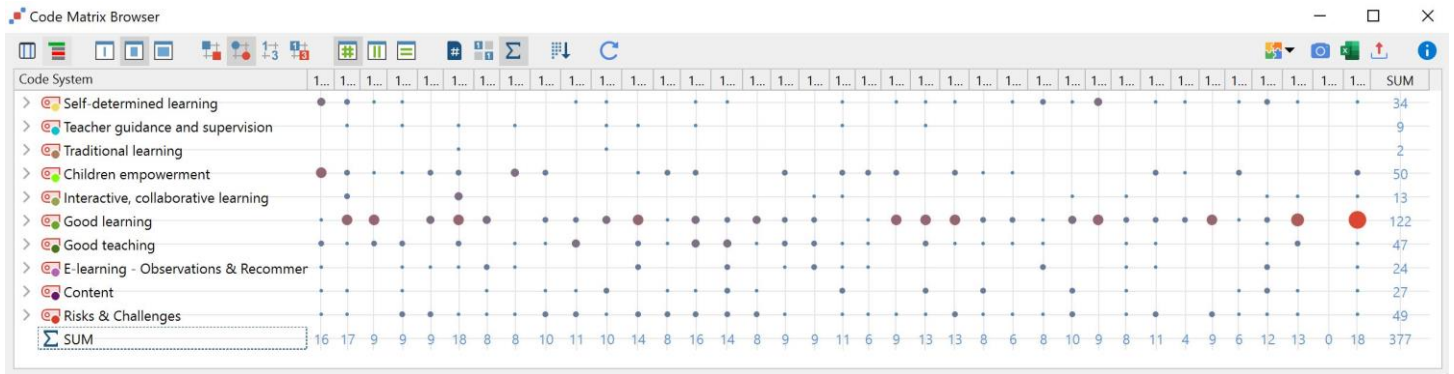


Figure 13.1: MAXQDA Code Matrix Browser: Number of coded segments in teacher survey per code category

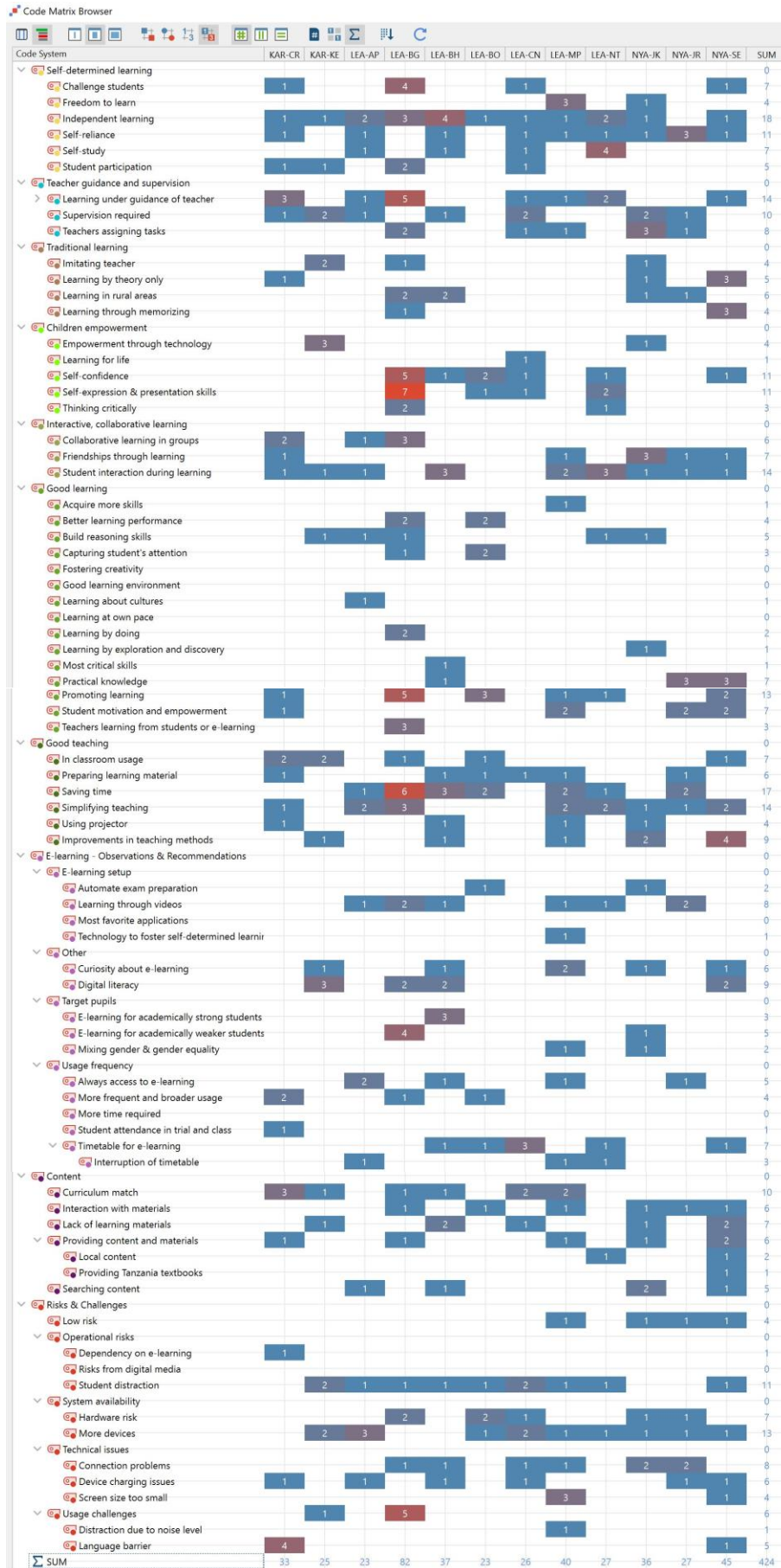


Figure 13.2: Code Matrix Browser – Heatmap of coded segments in interview transcripts



## APPENDIX H: TEACHER SURVEY – PART 2

1. What skills and abilities are important to learn for children in Tanzania?

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2. Please summarize the key points of your observation during the e-learning study:

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3. What worked well during the e-learning study:

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4. What was difficult during the e-learning study:

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5. How could the digital learning system be improved to better empower children for life?

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6. What is your opinion about independent learning of children in school?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
Learning always needs supervision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-determined learning without teacher is unrealistic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self-determined learning works, but only in small groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Children are motivated to learn on their own if they have the means to do so	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Learning happens best if no adults intervene	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Group learning needs strict rules in order to work effectively	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. How can new digital media (e.g. tablets) help fostering more self-determined learning?

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8. How can new digital media help you as a teacher in your daily routines and in the classroom?

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9. Which statements best describe the main value of digital learning?

(Please rate each statement based on the scale below)

	Do not agree at all	Do not agree	Agree	Fully agree	Don't know / no answer
The main purpose of e-learning is to provide reading materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-learning will help the academically weaker children to repeat subject matters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-learning will help the academically stronger children to develop themselves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digital learning provides an opportunity for individual, interactive learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The main purpose of e-learning is to provide teachers materials for visualization in the classroom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
An e-learning system must be aligned with the curriculum to be effective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. What risks and problems do you see with using new digital media in school?

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11. What would be your preferred setup for an e-learning system?

(Please rate different setups based on the scale below)

	Not Important	Little important	Rather important	Very important	Don't know / no answer
Individual use of tablets in school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In classroom use with large screen or projector for visualization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In classroom use of tablets for exercises	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of classroom group exercises with one large screen per group	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Individual access to learning tablets at home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of school access in the villages for the whole community	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Would you like to add any further comment or observation?

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## APPENDIX I: TEACHER SURVEY PART 2 - RESULTS

DOC ID	M/F	Age	Experience as teacher	Question 1a: Important skills and abilities	Question 2: Observations	Question 3: Working well
1050	F	<40	2-5 years	To be independent and have ability to express themselves in front of the audience about different knowledge	Pupils they were able to search different materials without the help of the teacher Pupils they were freely interacting (*with*) each other Pupils like to learn through videos	Tablets were enough for the learners Learners were able to ask questions where they did not understand or (*were*) not able to access the information from the device
1051	M	<40	5-10 years	To be self-reliant Acquiring new knowledge that will foster new skills	Pupils were able to cooperate (*cooperative*) among themselves and were freely interacting during the study program	Interaction among pupils in groups Cooperation among pupils in groups Children were freely asking questions and help where necessary Devices were well working
1052	M	<30	0-2 years	Important skills and abilities for children is to learn skills that can help him or her for self-reliance. That means to prepare pupils for life, not only for testing.	Pupils like to learn through videos Pupils like to learn things which are attractive Pupils are able to learn independently in the absence of teachers, but under supervision / guidance	Good cooperation among pupils in order to solve problem. Also program worked well i.e. device and internet. Thus generally everything worked well.
1053	M	<30	0-2 years	The important skills and abilities to be learned from the pupils is pupils they can learn themselves and cooperate themselves	Pupils they learn under supervision Pupils watch Ubongo Kids Pupils they (*are*) able to open program Pupils study themselves	Program was working well During the e-learning program and (??) of many program Interaction among pupils in groups
1054	M	<30	2-5 years	Reading skills Listening skills Writing and counting skills and ability to relate what you have learnt to real life	Pupils were able to operate devices themselves Pupils were able to access different materials from the devices Pupils were learning through videos	Pupils behaved well Devices were working well Pupils cooperated well Teachers were guiding pupils where necessary

ID	M/F	Age	Experience as teacher	Question 4: Difficulties	Question 5: Improvements	Question 7a: Self-determined learning & digital media
1050	F	<40	2-5 years	Some pupils were not able to access the information from the device, therefore they asked for help from the teacher / facilitators Interruption of timetable during exams and holidays	To upload more content to the server that relate with the current curriculum To use large screen or projector for visualization	Tablets contain visual programs like videos that help learners to memorize what they have learned
1051	M	<40	5-10 years	The learning timetable was sometimes interrupted with other school events like exams During the study most pupils were watching videos with loud voice that made a lot of noises to the learners	Increasing the number of learning devices The programs should relate with current contents of the syllabus	Makes pupils to have more curiosity in accessing the device at any time and anywhere Makes pupils to recall on what they have learnt by watching more videos
1052	M	<30	0-2 years	Some time there was no internet, interruption of e-learning time table and (??) school schedule. These were the most difficult for both teachers leading group and pupils.	To add material according to the syllabus. Also to add number of tablets. Also to have time table for e-learning system that can not disturb the normal school schedules.	Through adding materials so that pupils can read and discover new knowledge
1053	M	<30	0-2 years	During the study most pupils were watching videos with loud voice that made a lot of noise to the learners who study other subjects	The programs should relate with current contents of the syllabus	By helping pupils to have a capacity of recalling on what they have learnt
1054	M	<30	2-5 years	Timetable interaction Some days we experienced Internet problem Shortage of time Tiredness of pupils	There should be fixed time table for e-learning program Devices to be available all the time to pupils	It helps pupils and teachers to get new knowledge and skills Pupils develop the ability to learn independently It helps pupils to recall

DOC ID	M/F	Age	Experience as teacher	Question 8a: Digital media as help for teachers	Question 10a: Risks and problems with digital media	Question 12a: Further comments
1050	F	<40	2-5 years	It simplifies teaching and learning process It saves time that the teacher could use in preparing material for teaching	If not well supervised pupils will be using most of their time doing their own things that are not aimed at, e.g. watching Ubongo Kids instead of studying other things that are required	With e-learning, students / learners can learn at their own pace from anywhere and at any time through delivery methods such as games and social media. E-learning also makes the learning process more immersive and interactive.
1051	M	<40	5-10 years	By installing more programs that relate with the current contents of the syllabus to be more effective	The devices are more delicate and can easily break when fall down or hit with any obstacles	The program is good for both pupils and teachers and foster learning and teaching process
1052	M	<30	0-2 years	Digital media can help me to cover large area of a topic within a short time	The risks that may occur include breakage of devices. Also if no guidance can cause pupils to do unimportant things at a given time.	Generally this program can help both pupils and teachers. For the side of pupils it helps them to gain extra knowledge and to be able to discover new knowledge independently.
1053	M	<30	0-2 years	Help me in simplifying a lesson through digital electronic learning	Shortage of digital materials example tablet, computer, projector compared to the number of pupils in the school	The program did function well. So if possible I would like to add more tablets to the pupils and accessibility of Internet in order the pupils to learn in conclusive environment.
1054	M	<30	2-5 years	We get different teaching and learning materials from different sites It saves time	I think some pupils will be busy for their own business apart from the targeted goal	The program is useful to pupils as well as to teachers. I think much time is needed to run the program.

## **APPENDIX J: TEACHER INTERVIEW GUIDELINES**

**Structured as “problem-centered interview” according to Andreas Witzel** (“qualitative, discursive interview technique of collecting and reconstructing knowledge about relevant problems in the perspective of interview partners”)

The setup is a semi-structured interview. Special focus is given to open, narrative questions. But the interviewer should make sure that all relevant topics are covered during the interview. The survey questions may be used as interview guideline but while all topics should be part of any interview there is no need to cover every question specifically.

### **Opening: Teachers’ perception of “good learning”**

- If you look back at your experiences as a pupil: What did you like about school? What was difficult for you?
- What is “good learning” or “quality education” (from your own experience)?

### **Topic 1: Children empowerment through education**

- What skills and abilities are important to learn for children in Tanzania?
- Which is most important to prepare children for their life?
- How did the eight week trial help the children within their life context? (or not)

### **Topic 2: Self-determined learning (minimally invasive education)**

- Do you think children can learn by themselves with little or no support from teachers? Why do you think so?
- How could your school foster more self-determined learning?
- How can new digital media (e.g. tablets) help fostering more self-determined learning?
- Did you observe changes in the way the children interacted with each other?
- What was your experience during the eight weeks trial? What changes did you observe in the way children learn when they use the tablets of the e-learning system?
- What changes in learning styles and teaching practices did you observe during the trial phase?



### **Topic 3: Usage of digital media for education (ICT4E)**

- What experiences and observations did you make during the 8 weeks trial?
- How can new digital media help you as a teacher in your daily routines and in the classroom?
- What could be improved from the current setup in the trial?
- What would be your preferred setup for an e-learning system?
- How could e-learning be better integrated into the school routine?
- What risks and problems do you see with using new digital media in school?
- Which challenges did you observe or experience during the eight weeks trial?

### **Open end**

- Would you like to add any further comment or observation?

## APPENDIX K: TEACHER INTERVIEWS – SAMPLE TRANSCRIPTS

<p>Promoting learning - Green          Self-confidence - Green          Benefits from e-learning - Green          Interaction - Blue          Student interaction during learning - Blue          Self-reliant learning - Yellow          Self-expression &amp; presentation skills - Yellow          Requirements, Risks &amp; Challenges - Magenta          Interruption of timetable - Magenta</p>	<p>11 LEA-NT: E-learning system enable pupils to have a confidence. They learn. They interact with each other. Then they share the information. They have the ability to introduce or to express in front of others.</p>
	<p>12 M: And what was difficult? What did not work?</p>
	<p>13 LEA-NT: Difficulties, maybe I can say the interruption with other timetables. Maybe during – we are on the program or the program is going on. Then there is another – maybe the pupils needed to do another task.</p>
	<p>14 M: So you mentioned already several times the independent learning. Yourself, when you were older, but also the children here. And this was part of the study trial here. What do you think now after this experience? Can children learn by themselves without a teacher?</p>
<p>Self-reliant learning - Yellow          Self-study - Yellow          Self-reliant learning - Yellow          Explanations - Yellow          Self-study - Yellow          Requirements, Risks &amp; Challenges - Magenta          Student distraction - Magenta</p>	<p>15 LEA-NT: (coughing) Ja. Children they are able to learn themselves. But to be supervised also it is important. Because sometimes they cannot understand. Maybe the content to be explained by a supervisor. So, they are able to learn themselves, but supervision also it is very important. Because sometimes if we give them hundred percent to be alone, then others they will do it on their own. Instead of studying, others they will play the game. Or others they will do their own activities. So, supervision also it is somehow important.</p>
	<p>16 M: And the digital learning system, how can that help with learning more independently? And what can the school do to foster that more effectively?</p>
<p>Timetable for e-learning - Green          Requirements, Risks &amp; Challenges - Magenta          Benefits from e-learning - Green</p>	<p>17 LEA-NT: (coughing) OK, the school maybe can prepare a timetable. The permanent timetable for e-learning so that it can be in the master timetable and every teacher knows that there is timetable of e-learning. So that it will help even us to – (.) the system to run effectively.</p>
	<p>18 M: So that would be a change in the learning styles ((mobile phone ringing)). You have also used the system already in the classrooms. So what changes did you observe in the teaching practices?</p>
<p>Benefits from e-learning - Green          Saving time - Green          Simplifying teaching - Green</p>	<p>19 LEA-NT: The use of the program, the system in the classroom it is very nice. Myself, I observed, maybe sometimes I have a testing. Instead of writing on the blackboard then I use projector and then I display questions on the wall and the pupils (unintelligible). So (coughing), the system it is very nice. Also it saves time.</p>

Figure 17.1: Broad-brush and micro coding - sample transcript (LEA-NT)

### Sample transcript: Interview with LEA-MP

**M:** [00:00:03] OK. Thank you very much for participating (.) in this study (**LEA-MP:** Yes). So, this was an interesting experience over the past weeks. Now we would like to share the results and observations. So my first question is more to your background. When you think back when you were in school as a pupil, where did you learn? What was good learning for you? And what was your experience where you really learned well?

**LEA-MP:** [00:00:39] OK. In my background at Primary School at (unintelligible) [00:00:46] the education system was quite different from this one that we are using. And also, when I call back, the teachers, they are different. They used different techniques than this one that we are using currently here. When I remember the teachers were using audio communication rather than having visual. Something that you can touch and also see. Compared to nowadays, that we are teaching. Currently when I look back I can see that teachers nowadays they are greatly improved than the other ones they had been teaching.

**M:** [00:01:40] Thank you. And if you now look – you said already things have changed, if you look for children today, what skills and abilities do you think are most important to learn for children today in Tanzania? What will prepare them for their life that they are experiencing today?

**LEA-MP:** [00:02:04] I hope the skills that children learn, that nowadays they are gaining are those skills that help them to be self-reliant. They can depend on themselves without teacher during studies. So, they can be self-determined and self-reliant to themselves.

**M:** [00:02:30] Any specific skills you would mention with that context?

**LEA-MP:** [00:02:40] Especially the skills I see is using different devices that can enable them to access something to acquire knowledge on their own, especially.

**M:** [00:02:58] So now, if you now look back at the experience of the last weeks, we go down into some detailed questions later. But first, what was your experience and your observations during the eight week trial?

**LEA-MP:** [00:03:16] OK, from the – what I observed the past eight weeks of study, pupils had that curiosity of coming in the class or in the lesson, studying for themselves. Because they were coming before even time. They were coming and telling teacher: „Teacher, it is time for e-learning“. So pupils have this curiosity that they want to learn for themselves without being forced. And I realized that during the studies when we were studying here, pupils were interacting each other. They were able to move from one place to another place, asking questions for themselves, even without engaging teachers for when they study. So they were able to move freely, interacting freely for themselves, stu– inquiring things for themselves.

**M:** [00:04:19] And because they have been working with the system already, not as much as there –

**LEA-MP:** [00:04:27] Most of them, they had been before in the program. In classes, they have been using the system. And so they had that knowledge of using the tablets and the devices.

**M:** [00:04:41] But that was more in the classroom under teachers' supervision and less on their own? (**LEA-MP:** Yes) So, what changes did you observe in these weeks when they were now able to learn on their own?

**LEA-MP:** [00:04:57] Changes that I saw: in classes they were not more thrilled the way they were here for themselves. When they are with themselves, they are more free than when they are with teachers or with other pupils in the classes. They are more freely compared to other classes when they are studying.

**M:** [00:05:18] And did you see that they were following up a lot from what they learned in class, like homework, and let them help with homework from the digital content? Or did they go totally different and do totally different things?

**LEA-MP:** [00:05:36] Most of them they went ahead without following the timetable that we had given them. So, they access a lot of things compared to what we intended. For example, if they wanted to check for example, they were studying Mathematics during that period. Instead of studying Mathematics some of them went ahead viewing videos from Ubongo Kids rather than sticking to the program scheduled.

**M:** [00:06:08] And when we think about empowerment, empowering children. How do you envision that e-learning is empowering the children?

**LEA-MP:** [00:06:22] This e-learning actually from what I've seen in empowering children, first and foremost I have seen that it gives them motivation. It motivates them to study and acquire some extra knowledge compared to when they could learn without this program. Because I remember when I was teaching in class without those materials, when you give them work, they don't bother to find (unintelligible) [00:06:56] from anywhere. So they just answer the questions without preparing somewhere. Or, when (unintelligible) [00:07:03] asking questions from other pupils what is supposed to be done there. So this program for me have known that most pupils are able to acquire more skills. And also to motivate them to find more skills or knowledge that would help them in getting more answers for the questions that I have been asking them or for any (unintelligible).

**M:** [00:07:35] OK, very good. So that was what worked well. What did you see was difficult for them? In the way it was setup here with the independent learning with the digital system. What was difficult or didn't work at all?

**LEA-MP:** [00:07:55] Actually, for what I saw that was difficult for them sometimes there was failure of connection in the Internet. So most of the pupils when I was around, they came asking for help. There I could help them to connect. That was the major difficulty that they contact. And apart from that, I realized that there were some pupils with that harm in their vision, was not such visionally, to see something was not – so they had to put something in their (unintelligible) [00:08:44]. That boy, I know you know him, he had a problem of vision. So he had to put something near, close to his eyes so that he can see clearly. And when you compare, the devices are so small for him, so I think he actually needed something that would have been large to display those pictures or the writings, so that he can see from distance. That was another problem that I discovered. And also, from what I saw, during the studying most pupils were playing videos loadly and others, few of them were reading. So, for those who are reading they got problem, it was a challenge for them. They could not, actually get the things that they couldn't study because of the noise that was being produced during others were playing videos (**M:** Mhm). And also, from our timetable that we had, there was interruption of the timetable for some days. We had the examination and also with the break for holidays. So that was actually a point as a problem or difficulty for the children, for them to go through the steps that they had. Because once you stop something you have to continue. So if you break it, it means now you will forget something that you have done. To start (unintelligible) [00:10:28] again it takes you – it cost you a lot.

**M:** [00:10:31] Ja. And in this study time they were able to work on their own, independently of teachers? You helped them sometimes practically with the setup. But what do you think about, were they really able to learn independently? Or do you think they would have learned better if they had more guidance?

**LEA-MP:** [00:11:00] Mmh, most of them they liked themselves independent without the help of the teacher. The most part that they needed the help of the teacher is when there was a break of the Internet actually. So most of them they were learning independently for themselves.

**M:** [00:11:20] And did you see them learning more on their own or more interacting with others?

**LEA-MP:** [00:11:26] Most of them they were interacting. Because there were some groups and from what I saw. If, for example, when they were in group, and the teacher goes there, they keep quite. When the teacher passes out or away from them, they continue talking, interacting each other. So I found that, as I said, when a teacher or someone is there looking at them while they are doing, they get that fear. So they let to stop, then they leave the teacher to go, then they continue talking for themselves.

**M:** [00:12:01] So, now, thinking again about empowerment of children, from the setup would you recommend to leave them even more independent?

**LEA-MP:** [00:12:11] It is good with that. Maybe you – when you are – they are free doing these things, they recommend that we only leave them with instructions on what to do and then leave them freely to do themselves.

**M:** [00:12:29] And this – let's say from the whole school, how can the whole school foster more of that self-determined learning?

**LEA-MP:** [00:12:39] That school? OK, for the school, I think, it is good to encourage pupils to – the first thing is to encourage them to use the devices that we have though they are few. We can use them in classes or lessons. And also during free time, pupils can access those devices that we have. And also, I think we can also find a way having something that can project those videos and other documents or materials that are found there, that can be seen from a distance, because we have some disabled pupils in our classes here, in our school here. So the school should work out on how we can also reach them because they are finding problems in learning during those things.

**M:** [00:13:44] So you mention already like displaying things in the classrooms. What changes did you see in the last weeks with regards to learning styles or teaching styles?

**LEA-MP:** [00:13:58] Changes that I saw, I realized that for those pupils who are not around in the research program, they have (unintelligible) [00:14:11] finding a way of sneaking inside, so that they can be with others. Some they were coming to me asking: „Teacher, may you add me in there“. But because it was a program that was set a focus on a special group I have to tell them that: „Please, wait, we are going to organize for you“. So, that's what I saw the changes because most of them they had that curiosity of coming and joining. And also for those who are inside the program, I realized that they have developed that friendship among themselves. Because in classes, when I see when we are teaching they can't mix. Boys they sit separately. Girls they sit

separately. But when we are here, I saw some boys moving from one place joining some girls there. They discuss together. So I realized that this program has created that gender balance. Or, they can do things freely without considering gender.

**M:** [00:15:16] Very good. Now to you as a teacher, how can digital media help you in your daily routines and in the classroom? (**LEA-MP:** Pardon?) You as a teacher, how can the digital learning, e-learning help you in your daily routines and in the classroom?

**LEA-MP:** [00:15:38] OK. I, myself as a teacher, this digital learning really from what I observed, it really helps me to save time. For example, instead of using a lot of time creating materials, or when out of the school funding materials, I can see that this devices or this program contain some materials that are available there and I can use them. So it doesn't consume a lot of time for me to go and find the materials because they are available there. Secondly, it make my teaching and learning process for the pupils to be easier because, for example when I explain something and then I ask the pupils: „Please find this one from there“ they quickly find something. For them it is also something that forces their minds. Or makes their mind master something because once something sticks (unintelligible) [00:16:46] observe something, it sticks in your head for a long time without vanishing. So, for me as a teacher I see that it saves time. And also, it's easing my teaching processes (**M:** And-). (unintelligible) [00:17:06] then I cannot use this materials.

**M:** [00:17:11] And which challenges did you observe from system and how could the system be improved? So that it can be even better integrated in the school routines, or for their independent learning?

**LEA-MP:** [00:17:28] Some of the challenge that I saw from the system is actually, the contents that are available in the system are not matching with the current curriculum for our school or for the country. So, there are some that are not there. And there are some that are there. So this that are there, are good. And those that are not there I think we need to do something that we can at least to upload more materials for that related with the current curriculum of our country. Because it's – I can take example (unintelligible) [00:18:13] curriculums from other countries like Asia, from Asia continent. So for the pupils, so they don't – for them they don't gain something that is found in their country. Most of them, so what they do it just to see the pictures. But I know that it helps them to interact or to learn more about other things. But also we need them to know something that is found in our country. Especially culture in our country. And the other topics are not related. So that was the most problem, that are challenges that I saw from the system.

**M:** [00:19:03] And do you see, let's say if we expand the system, even let's say more content and more Internet access. What risks or problems would you envision with digital media for future?

**LEA-MP:** [00:19:20] Problem for the –

**M:** [00:19:23] If you now expand it with more content or even access to the Internet, do you envision risks and problems?

**LEA-MP:** [00:19:33] The risks will be few compared to the content that we get. So I don't think that there are a lot of risks that we can find (**M:** Mhm). Maybe for those kids as I say that have low vision, we can certainly improve something there for them. And, from the skills during studying – during teaching I realized that going around the group showing them on how to access is more difficult because once I leave one to another group, those who (unintelligible, background voices) [00:20:16] already (unintelligible, background voices) you find that they have already gone further out, they are not following (unintelligible, background voices) [00:20:24]. So it is better maybe when a teacher is using, she has something that guides them, so that they see and direct them, either by projecting them (unintelligible, background voices) [00:20:35], so each group (unintelligible, background voices), or each individual should be follow from what the teacher is displaying on the wall.

**M:** [00:20:43] OK, so these were the questions I had in mind. Is there any further comment or observation you would like to add which we didn't cover?

**LEA-MP:** [00:20:56] Comments, maybe I would like to thank you for the program that you have supported us. It has been very helpful. And if possible that we find another way of increasing the number of the devices because in our classes we may find that we have more than forty pupils in our classes. The least that we have is thirty. So the (unintelligible) [00:21:26] devices we have twenty. So there are not enough for the pupils. And you may find that during the day someone has taken the devices. Another person, another teacher needs them. So if the teacher has to wait for the other teacher to finish, so that he can go and take them. So, it is good if we have more devices. It can be good for us.

**M:** [00:21:51] OK, thank you very much.

**LEA-MP:** [00:21:53] Thank you, too. Thank you.

## APPENDIX L: DOCUMENT PORTRAITS

Interesting insights can be discovered when using MAXQDA's Document Portrait tool. If categories and codes have been color coded during the Open Coding process, MAXQDA can visualize the content of any document, e.g. the process of a teacher interview. For example, the interview with teacher LEA-BG started with him explaining why he believes that children can learn self-reliantly based on his experience with digital learning (yellow color code). He explicitly mentions how he is challenging the pupils to work independently through exercises. He then highlights the success of the program by pointing out that pupils are able to cover topics much faster than previously without e-learning (green color code). He also talks about some challenges for the pupils and how the teachers have to deal with it (purple color code). The related transcript is illustrated in Figure 18.1:

Document Browser: LEA-BG (40 Paragraphs)

1 Interview with LEA-BG

2 M: So thank you for participating in this research. You have made a lot of experience already with e-learning in your school. So what do you think about independent learning? Do you think children can learn by themselves with little or even with no support from teachers? And why do you think so?

3 LEA-BG: What I know, children can learn for themselves. What is needed from the teacher is just to give them the subject matter and to direct them to the content which they are supposed to learn. And after giving them the instruction they can learn for themselves. And then later on, you'll check if the content which you give to them, they have really get it.

4 M: And how have you implemented that in your school routine? How can it be efficiently implemented? The self-determined learning.

5 LEA-BG: For our school and for my side in my subject, I have just tried to give the students the concept, especially the content which I cannot cover within a short period of time. I assign them the task, then they go to the computer lab, where there is server and tablets. They write the notes of that particular concept and summarize it. And then, when they be back in the next session in the class, I just pass through the exercises and mark them. That, I have experience in my subjects. And also some of the subject teachers, they are doing so. But in reality, in my subject, I witness that. And it was a great success, because the content which I was supposed to teach for more than three weeks, they learn it within two days. Was after two days, the third day, I mark the exercise. That's what I did. That's why I say the students, they can learn for themselves. After directing them which specifically part they can take from the server and write in their exercise books.

6 M: And did you see a learning curve from when you started to use the e-learning and now you have been using it for more than two years? Did you see improvement over time?

7 LEA-BG: I have seen the improvement over time since it has been started from our school for two years ago, because at the beginning many students are shy, are afraid to use even the tablet because most of them they are coming from rural areas. They never touch things like mobile phone, but now you are bringing them the tablet. It is something which is very new to them. And at the beginning there are few groups of students who are using it. As times goes on, up to the end of the last year, it is when the majority of the students from our site they started to use digital learning. Now almost the whole schools, the students can able to use the e-learning program, because they can go themselves in the computer room where there is a server and tablet. They can open themselves. What is the role of teacher? It's just to switch on the tablet and to see the safety of the tablet. As days go on, the number has been increased. Now, at this moment, the upper classes from Form 2 up to Form 4, they can operate themselves. Though the special consideration will be done for Form 1, where some of them, especially those who are coming from the families or the – in the rural areas where they did not meet with these technologies, they cannot (able?). In Form 1 there is sometimes somehow a challenge. But the rest of the classes, they can (able?). Though also my experience in – to some of the students who are not well equipped with the knowledge of digital, especially using the tablets, they are afraid. Some of them, they are afraid, maybe in the class. In this upper classes you can find maybe two or three or four students, they are afraid. But now also what the teachers are doing is to give them the task which make them, all of them, to go to the server and take the material. Therefore, there is positive mobility.

8 M: And once they learned how to search things, did you see if and how it was changing the ability of the students to present things and to express themselves?

9 LEA-BG: In searching of the things at the beginning, they need a person to guide them. Maybe a teacher. But now, at the moment, for the sum of this group, that were afraid, they use – they teach themselves on how to use. Because they are the students who are very competent in using the tablet and in connecting with the server. But when they see someone is getting the challenges and difficulties, the one who will have the knowledge and the ability instruct another students. And because sometimes you can find a student is getting a challenge to reach where the content is found in the server. But they, themselves, they are directing each other. But when it is more challenge, they needed the assistance of the teacher, especially the IT teacher, who is in charge in supervising the program.

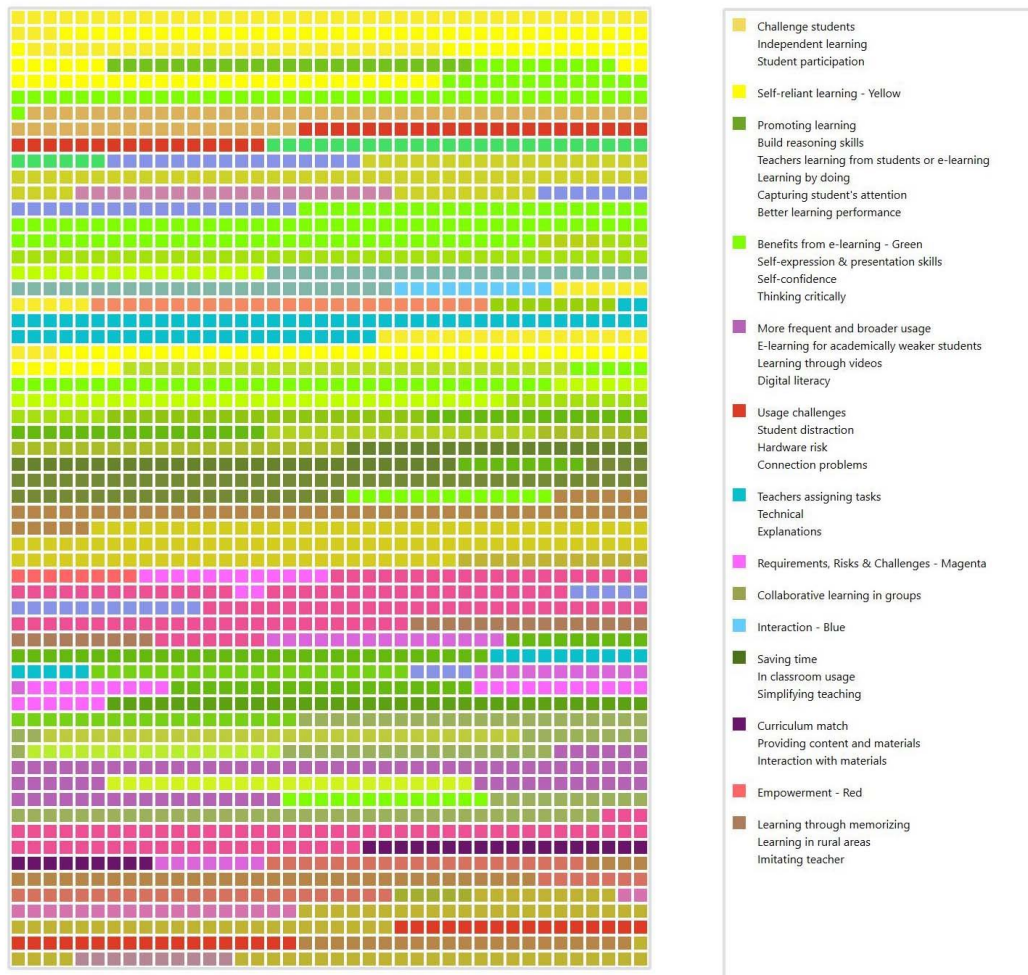
10 M: And did you see changes in their ability to present the results and express themselves?

11 LEA-BG: Yes.

Figure 18.1: Teacher interview transcript in MAXQDA Document Browser for teacher LEA-BG



While the interview is progressing, color codes change. MAXQDA also allows to mix colors for overlapping codes acknowledging the fact that sometimes the interview transitions smoothly from one topic to another. Figure 18.2 illustrates the progress of the teacher interview LEA-BG and which categories have been covered at what intensity.



**Figure 18.2: MAXQDA Document Portrait for teacher interview LEA-BG**

Other interviews may have a very different flow despite the fact that the interviewer was using the same questionnaire and guidelines. For example, teacher LEA-BH started to report about challenges that he faced himself when he was a child before he talked about his observations how digital learning has empowered children to learn self-reliantly during the trial (see Figure 18.3):



**Figure 18.3: MAXQDA Document Portrait for teacher interview LEA-BH**

## **APPENDIX M: FOCUS GROUP DISCUSSION GUIDELINES**

The setup is a semi-structured focus group discussion. Special focus is given to open, narrative questions. But the interviewer should make sure that all relevant topics are covered during the interview. There is no need to cover every question specifically.

### **Opening: Children's perception of "good learning"**

- What do you like at your school? What do you not like?
- What helps you to learn well? Why is that?

### **Topic 1: E-learning experience**

- What did you like in the e-learning system that you used during the past eight weeks?
- What did you not like or what was challenging?
- Which of the programs did you like most?
- Which ones did you use most frequently?
- How does it help you in your daily life? Or long term?

### **Topic 2: Unsupervised learning (minimally invasive education)**

- How was it to learn independently without your teacher?
- Did the tablets help you to learn together or do you prefer to learn on your own?
- How could your teacher help even further when you learn with tablets?
- Was the time with the e-learning system sufficient or where would you like more time?
- What changes did you observe in the way you learn?

### **Topic 3: Usage of digital media for education (ICT4E)**

- How could you use the tablets within your classroom lessons?
- What could be improved from the way you have been using the tablets so far?
- What would be your preferred setup for an e-learning system?

### **Open end**

- Would you like to add any further comment or observation?

## APPENDIX N: FOCUS GROUPS – SAMPLE TRANSCRIPTS

### Focus Group Discussion with LEA-B6

**M:** [0:00:01] OK, so you had a chance to work with that system for several weeks. Now we are here to share some of your experience and observations. So the first question is: What did you really enjoy? What did you like in that system? What was good in that system for you?

**LEA-B6-1:** [0:00:20] In that system the good thing was a lot. In some engines we can search something which we thought in the normal sessions. And you get a special answer.

**LEA-B6-2:** [0:00:44] In that session doing very important things. Example, when you go in Ubongo Kids you can learn different subjects like Math, Social. And in Math you can learn different topics. So this program helped us in different and in many things.

**LEA-B6-3:** [0:01:10] In this program, in Namibian content, for example, you can see how to conserve environment.

**M:** [0:01:28] (...) OK, ja.

**LEA-B6-4:** [0:01:30] It's about you search the information from Wikipedia. Example, when you are in your classroom, or when you are having a question. Example, homework. You can come and search the meaning of the question. Example: US federal government. We are given that in the class and then we came to search here. You get the real answer. It is the government which is under – is the state which is governed by one country. Many countries are under that branch. Example, United States of America. It has many states. UK, United Kingdom, many countries that are under one state.

**M:** [0:02:12] So that would be a follow up to the classroom. You can search for things from your homework, right?

**LEA-B6-4:** [0:02:19] Yes.

**M:** [0:02:20] And which of the programs did you like most? Which did you use most frequently?

**LEA-B6-1:** [0:02:29] The programs which I most used is Wikipedia and Ubongo Kids.

**LEA-B6-2:** [0:02:40] The program which I like most, it is Sikana.

**M:** [0:02:45] So, why Sikana?

**LEA-B6-2:** [0:02:47] Because in Sikana we learn different things like games, and how to cook, how to play football game, and in health.

**LEA-B6-3:** [0:03:00] In this system I like to click for Touchable Earth and Namibia Content.

**M:** [0:03:09] Touchable Earth and?

**LEA-B6-3:** [0:03:12] Namibia Content.

**M:** [0:03:15] Sorry?

**LEA-B6-3:** [0:03:17] Pictures from Namibia.

**M:** [0:03:19] Namibia?

**LEA-B6-3:** [0:03:20] Yes.

**M:** [0:03:22] Ah ja. And why?

**LEA-B6-3:** [0:03:25] Because in Touchable Earth you can see different cultures of different countries.

**LEA-B6-4:** [0:03:35] In that program of e-learning I always prefer Wikipedia because if there are some questions, hard questions in the class. Teachers are teaching. You cannot understand well. Then you can come here to the Wikipedia and search. And then you get the real answer. Then you understand well by the explanation given there.

**M:** [0:03:55] OK, thank you. And what comes to your mind what didn't work? Where were things missing? Or, where you would say you would love the system would be somewhat different?

**LEA-B6-1:** [0:04:14] Sometimes when I miss Kolibri and I get there is no Internet.

**LEA-B6-2:** [0:04:29] (.) Sometimes in this program there is shortage of power supply. And sometime other people are – it is difficult to get some coordinate in different things. Example, when some people search Rachel Home they don't know how to get that program of Rachel Home.

**M:** [0:04:54] And sometimes they want to search for something but they don't know how to find it?

**LEA-B6-2:** [0:05:00] Yes.

**M:** [0:05:04] That's a very good point.

**LEA-B6-3:** [0:05:09] Shortage of time.

**M:** [0:05:14] Mhm, I will come back to that.

**LEA-B6-4:** [0:05:17] For example when you're here, some of the people when you are using your tablet, others they are, example review a video when you search information from Wikipedia. And then you are reading, others they are putting high volume there. And then you can not able to continue with your literature review. And sometimes there's issue of power. Connection is a problem. And the shortage of time.

**M:** [0:05:48] So, two of you mentioned „not enough time“. So what do you think? This time you had, like one hour a day, you would love to have more time? And what would you do if you had more time? Or do you say: that was time enough, or could have been even less. But if you want more time, what would you do with it?

**LEA-B6-1:** [0:06:15] We need more time because sometimes if we are late from the class, when we get here, the time got already consumed here. And then we cannot use the one hour. We maybe use half an hour.

**LEA-B6-2:** [0:06:36] Sometimes we need time, and there is some difficult that if we need time. If we get time, sometimes in the class the teachers are giving students work. And then it's better to do the time which there is no class. Because when we are in e-learning and then teachers are giving the students work. As we have reached there we can see there is work, and then we have no time to work.

**M:** [0:07:08] So you would sometimes need more time for homework?

**LEA-B6-2:** [0:07:11] (whispering) Yes.

**M:** [0:07:14] Ja?

**LEA-B6-2:** [0:07:16] Yes.

**LEA-B6-3:** [0:07:17] Repeat the question.

**M:** [0:07:19] You said „time, shortage of time“. So if you had more time, what would you use the time for with the e-learning system?

**LEA-B6-3:** [0:07:32] When we get more time we can gain different knowledges from different countries (unintelligible) [0:07:39] in the tablet.

**LEA-B6-4:** [0:07:49] (.) Example, when you have time for the e-learning program, sometimes when we are searching things, we have not finished to read that, the time is not enough. And then the teacher is saying „Shut off the tablets“. And then you are going through there, we are coming to the presenting sorts of view, what you have visited in the tablet. And sometimes you cannot explain well because we have not finished to read that because we had not enough time.

**M:** [0:08:19] OK, ja. Thank you. So how was it? Because this time was for you to learn independently. The teachers were there, but they didn't give you specific guidance. How was it for you to learn independently without the teacher? So how – because many times you get very specific tasks from the teachers. He tells you what to watch and what to read. Here you were free to do. How was that for you?

**LEA-B6-1:** [0:08:54] It was good for us because here in e-learning you are free in searching your (unintelligible, coughing) [0:09:01]. But there to the normal sessions you cannot able to (unintelligible) [0:09:05] because (unintelligible) is shared with the class.

**M:** [0:09:10] And you liked that?

**LEA-B6-1:** [0:09:12] Yes.

**LEA-B6-2:** [0:09:14] It is better when we study independently because when we are studying independently we can get many things done being guided by teachers. Because if we are doing things and searching things ourself is better than teachers guide us. But sometimes when we are independent, we can get many things from that. Thanks.

**LEA-B6-3:** [0:09:46] We can gain knowledge from – when we are studying independently I gain more knowledge than from normal classes. In normal classes they are following timetable.

**LEA-B6-4:** [0:10:06] (...) Example, we are here, we are studying independently. There are times in the normal sessions, there are teachers when they are teaching, example, the teachers were going slow, and sometimes they are going fast. Because of those who are very slow to understand, and sometimes teachers they are going slow. They are (unintelligible) [0:10:26] to understand. And you are to gain extra knowledge. But teachers they are (unintelligible) [0:10:30]. They are teaching until those that are slow to understand – But here, when we get the example, question there, teachers were slow. Example, when the exam start they are not able to answer questions. But when you are here, the knowledge you get from the class they will be confirmed from here. By how? We are going – example, when the teaching is giving questions you have not understand, or you have understand. Example, when you don't know the answer to that question when you come here, you search, you get your answer. Teachers in the classroom, they are teaching. There are those who are slow to understand. And the teachers are still teaching. When we are here we continue to finish the syllabas alone. By how, we are going to the – you are confirming the topic. We happen to have a list of topics. We are going – we already finished this topic because teachers in this topic, they don't want – they are slow to understand. We continue with the next topic. You read there. And if there is any difficulties you come to search here and then you get the answer.

**M:** [0:11:38] So you can go with your own speed?

**LEA-B6-4:** [0:11:41] Yes.

**M:** [0:11:42] What do the others think about that point?

**LEA-B6-1:** [0:11:46] It will be a real point because we may go with our own timetable searching different things. Not (unintelligible).

**LEA-B6-2:** [0:12:07] That point is good because when teacher is teaching something, you can know the things. And before you can know. For example, teacher is teaching whole number. And you, if you come here, you can know about other topics like decimals, and you can, when teacher is teaching in the class, it's simple to answer the questions and to answer different things.

**LEA-B6-3:** [0:12:33] It's good because in the class they are using slow motion. And here, when come use tablet, you can use time.

**M:** [0:12:46] Ja, OK. Thank you very much. (.) So, when you were here in the group, did you mostly learn on your own, like reading on your own, or watching specific videos on your own? Or did you go together in groups? Did you learn with your colleagues?

**LEA-B6-1:** [0:13:12] Sometimes we are ourselves for the own reading because when we are look sometimes another person will be – dislike what you said. Different from the Internet. We like on his own. Now for each matter to be for all. But sometimes in groups it may be you are leading the person who search for his own. Another person did not like that.

**LEA-B6-2:** [0:13:48] Sometimes it's not very good to search in groups because when you like to search something other person can say „I don't want that, I want this“. So sometimes can bring quarrels. It's sometimes better to be yourself. And some days yourself and some days we are in groups. Because there is sometimes shortage of power, then we can share. Even if we can share, it's good because we can gain many knowledge.

**LEA-B6-3:** [0:14:24] (.) It's good for (unintelligible) [0:14:26] together because when we are (unintelligible) we can gain more knowledge from our fellows.

**M:** [0:14:38] (.) So you say the time working in groups was even special value for you?

**LEA-B6-3:** [0:14:46] Yes.

**M:** [0:14:59] (...) OK, how about you?

**LEA-B6-4:** [0:15:01] When we are, example, when you are staying in your groups, sometimes there is shortage of power to the tablet. You can stay in groups. (unintelligible) [0:15:08] some of the people that remain in network, they are coming from one class. And there is a question which is difficult and you didn't understand in class, you can go to the tablet. We search together. (unintelligible) [0:15:20]. And some days, we have get this question one way



(unintelligible) [0:15:29]. In the class we are getting difficult question. So let's say we get difficult question. So it's (unintelligible) [0:15:34] to state in one tablet as we discussed together.

**M:** [0:15:43] (...) So how much of the time you would say did you use to learn on your own versus learning in groups? In the time you had here in the e-learning system, how much of that time did you use to read on your own, alone, versus to discuss something in a group?

**LEA-B6-3:** [0:16:19] Time?

**M:** [0:16:20] Ja. Was the majority of time you used alone, or was the majority of time in groups? Like two people, three people, four people, or more?

**LEA-B6-4:** [0:16:34] How much time we used together or on our own?

**M:** [0:16:38] Yeah. What did you use more? More time alone? Or more time in a group?

**LEA-B6-4:** [0:16:43] More time we used to study alone. Because sometimes, when we are in the class and the person is having his own book, then you read the book and read some difficult question and come to use alone the tablet. Search yourself, use alone.

**LEA-B6-3:** [0:17:05] Repeat that question.

**M:** [0:17:07] So did you use more time to work in a group? Or more on your own, alone?

**LEA-B6-3:** [0:17:15] More on my own.

**LEA-B6-2:** [0:17:20] (.) I use more time on my own.

**LEA-B6-1:** [0:17:25] To me, I (unintelligible) [0:17:27] time on my own.

**M:** [0:17:33] (...) And now, in those weeks, you had specific time, extra time. More than you used to have in the past. Did you see changes in the way you used the e-learning system? (**LEA-B6-4:** Changes?) The way you used the system, did that change because of the time you had to work with it?

**LEA-B6-4:** [0:18:04] On my own I have seen change because I always bring the question which have the class to understand. And I come here and I get extra knowledge from (unintelligible) [0:18:16]. When I come I want to search only something. Example: unit number definition. One opportunity read the explanation (unintelligible) [0:18:26] and get extra knowledge from many examples I get.

**LEA-B6-3:** [0:18:34] When I found a difficult question in the class I bring the tablet then I search (unintelligible) [0:18:40] in different tabs.

**LEA-B6-2:** [0:18:46] There is changes to be independently, searching different things. And for that it can be easily to answer your questions , whatever hard question from the class, I can come here and search it and I can get the answer.

**M:** [0:19:03] So you would say you learned better to search for answers to the difficult questions?

**LEA-B6-2:** [0:19:11] Yes.

**LEA-B6-3:** [0:19:12] Yes.

**LEA-B6-1:** [0:19:17] (whispering) Yes.

**M:** [0:19:18] So did you see any change in the way you used the system over the last weeks?

**LEA-B6-1:** [0:19:24] Yes, I see changes because sometimes I get difficult question. If I ask teacher to tell me explain. Example, I didn't understand well. I will come to search here and I can understand on my own.

**M:** [0:19:45] (...) So, you also used the tablets in your classroom, right?

**LEA-B6-4:** [0:19:54] Yes.

**M:** [0:19:55] So how do you use it in the classroom? And what do you think about the usage in the classroom?

**LEA-B6-1:** [0:20:03] We used it in the classroom. Example, when the teacher writes exercises to the blackboard. Maybe we don't know any answer. We will search there and you may get answer. You can reply to the teacher.

**LEA-B6-2:** [0:20:22] It is good to use in the class because sometimes wherever books are used you can go to the tablet and you can see the books. When teacher said on which page number. For example, you can see in the – containing any subject you want and you can gain many knowledge from the tablets. And you can see many things. For example, teacher ask to search about question containing or concerning Mathematics, you can go in tablet and you can see in book of Mathematic and you can get your answer or question, that what we want to get answered.

**LEA-B6-3:** [0:21:10] It is good, when teacher give exercise we can use tablet to answer questions.

**LEA-B6-4:** [0:21:21] (.) It is good because sometimes when there is teachers writing his questions on the blackboard, you can check the tablet. You go to – you can search the results and you go to the Tanzania Textbooks. There you search. You (unintelligible) [0:21:39] according to the question. You reveal the question related to the topic. And then you get right answer. You write the answer. You answer question or you may using tablets

**M:** [0:21:51] Ja. And if you compare, using the tablets in the classroom versus using the tablets independently, here, in your extra time, what do you prefer? (.) So if you compare the time you used the tablets in the classroom, where the teacher is guiding you, versus here, using the extra time for independent usage, what do you prefer?

**LEA-B6-1:** [0:22:23] I'm prefering to be independent.

**M:** [0:22:32] (...) And why is that?

**LEA-B6-1:** [0:22:36] Because if I am preferant related to the teacher. The teacher will say to do this while I am (unintelligible).

**LEA-B6-2:** [0:22:54] It is good to use independently because when you are in the class there (unintelligible) [0:23:00] this thing while you did not like that. So in here, to be independently is good because you can gain many knowledge and extra knowledge than in the class.

**M:** [0:23:16] (...) Mhm.

**LEA-B6-3:** [0:23:21] (unintelligible) to read independently in order to escape from disturbances in the class.

**LEA-B6-4:** [0:23:30] (...) I prefer when using it in the classes because in the classes teachers are teaching and then they agree to send here. We are just finding and then we are not cooperating according to what we understand. Example, teacher want to give you exercise. You gonna search things and then you are still gaining knowledge. According to those questions wanted. The research information from the tablets you can get. And then you can read. But when teachers give exercise then you can examine yourself how you understand. What research from the tablet (unintelligible) [0:24:14] is good.

**M:** [0:24:18] So if the system now would be only used for one thing. Either in the classroom, or in the extra time. Only one thing. What would you choose?

**LEA-B6-1:** [0:24:34] (.) Extra time.

**M:** [0:24:36] (repeating) Extra time.

**LEA-B6-2:** [0:24:37] I would chose to also use this thing in the class in order to be easier to find answers.

**LEA-B6-3:** [0:24:50] Extra time.

**LEA-B6-4:** [0:24:56] (.) I would prefer classes.

**M:** [0:25:02] OK. Thank you very much. That covered the questions I had prepared. Is there anything we did not cover? Any observation, or any further comment you would like to add?

**LEA-B6-3:** [0:25:18] Yes.

**LEA-B6-4:** [0:25:09] The difference between digital learning and the normal class sessions? Difference between this e-learning and whole class sessions?

**M:** [0:25:32] What the difference is?

**LEA-B6-4:** [0:25:36] Yes.

**M:** [0:25:37] Though, in the classroom the teacher is guiding everything.

**LEA-B6-4:** [0:25:40] Yes.

**M:** [0:25:41] You have a specific topic that everyone covers. (**LEA-B6-4:** Yes) In the free extra time, you choose the topic. You are more independent. So, both have advantages and disadvantages.

**LEA-B6-4:** [0:25:58] (unintelligible) the e-learning?

**M:** [0:26:03] Sorry?

**LEA-B6-4:** [0:26:04] Advantages of using digitally, and normally?

**M:** [0:26:10] Yeah, I mean you mentioned some parts already and others had mentioned before. There is a lot of time getting lost in the classroom with the teacher writing on the blackboard. So you save time. There is more visual to present for the teachers. You can have exercises, independently in the classroom. So that's good in the classroom setup. But here, in extra time, you are independent. You can search other topics that are not even covered (.). Does that answer your question?

**LEA-B6-4:** [0:26:47] Yes.

**M:** [0:26:48] And any other observation?

**LEA-B6-3:** [0:26:50] We need more (unintelligible) [0:26:52] programs in the tablet.

**M:** [0:26:55] More tablets and more content, you would say?

**LEA-B6-3:** [0:27:00] Yes.

**M:** [0:27:01] Which content? (...) What do you think was missing? (...) Specific ideas?

**LEA-B6-3:** [0:27:17] Yes. (unintelligible) [0:27:20] for different countries?

**M:** [0:27:23] So more like – about culture and countries?

**LEA-B6-3:** [0:27:27] Yes.

**LEA-B6-2:** [0:27:30] (...) I want different things to added like (unintelligible)  
[0:27:44] Kisuahili.

**M:** [0:27:49] So, content in Kisuahili?

**LEA-B6-2:** [0:27:52] (unintelligible) And other different things concerning history.

**LEA-B6-1:** [0:28:09] (...) Tablets to have enough charge.

**M:** [0:28:22] (...) OK, so thank you very much. I hope you enjoyed the time working with that system. And I hope you will continue to enjoy it in the weeks to come. The system is still there. So I hope you really can benefit from it.

# APPENDIX O: FOCUS GROUP ANALYSIS - HEATMAP

MAXQDA's Code Matrix Browser can visualize a heatmap of topics that were covered in the different focus group discussions (see Figure 21.1).

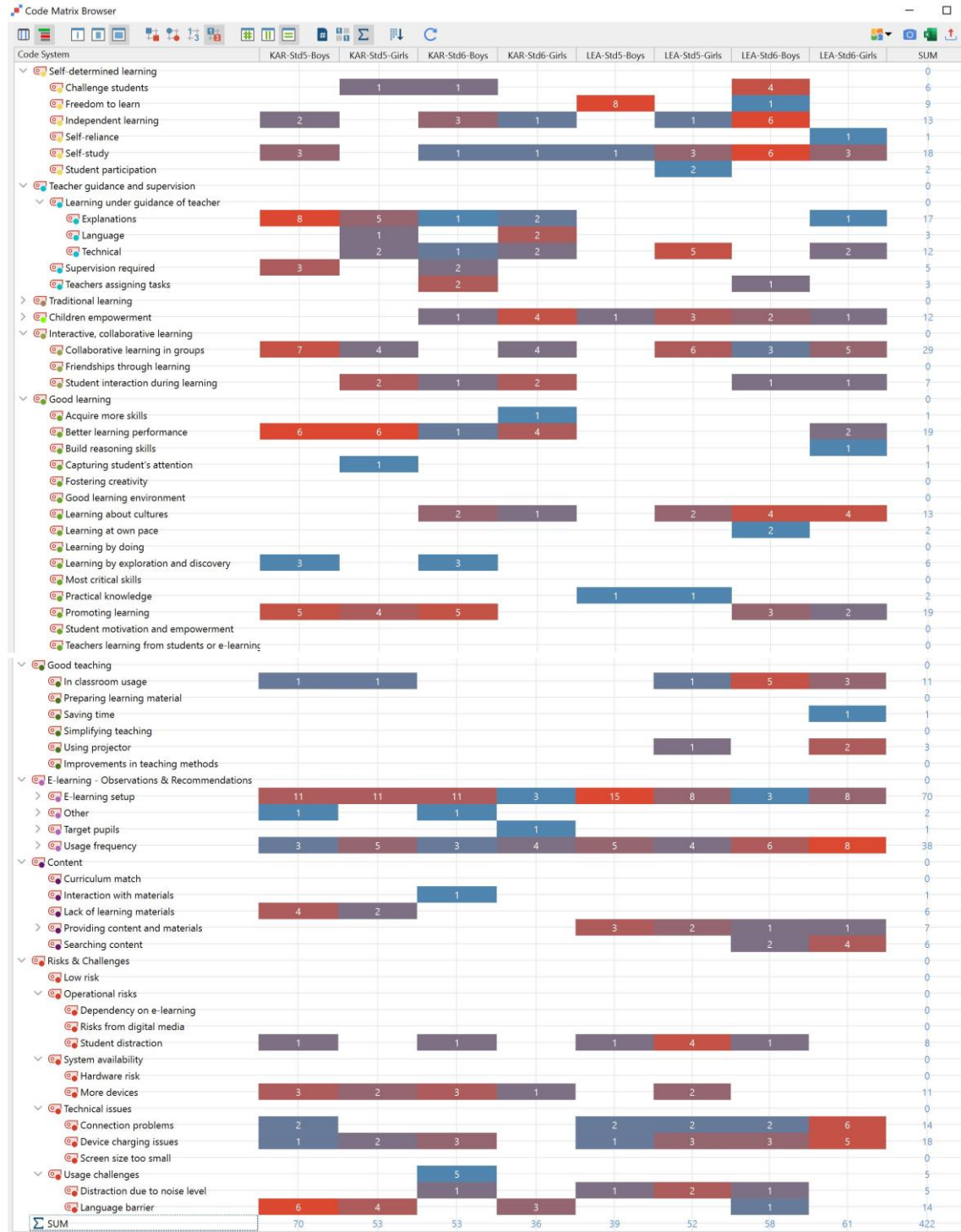


Figure 21.1: MAXQDA Code Matrix Browser: Heatmap of coded segments in focus group transcripts

## APPENDIX P: DOCUMENT CODELINES

When analyzing focus groups it is always interesting to explore the flow of the discussions. Who was talking for how long about which topics? Let's take the example of focus group discussion LEA-G6. An excerpt of the transcript is shown in Figure 22.1:

Document Browser: LEA-Std6-Girls (134 Paragraphs)

1 Focus Group Discussion with LEA-G6

2 M: [] OK, so thank you for joining the team, with working with the e-learning system over the past weeks. I hope you enjoyed the time with the system. And now it's time to share a bit about your experience and your observations. So my first question is easy: What did you like in the e-learning system? What was good for you? What worked well for you?

3 LEA-G6-1: [] (.) The system was good because we are free to look for things, to search what we want from the Internet and to gain extra knowledge.

4 LEA-G6-2: [] The system is good because we learn to look videos.

5 M: [] Sorry, could you repeat, please?

6 LEA-G6-2: [] The system is good because we learn to look videos and we search everything that we need. And to gain some knowledge.

7 M: [] (...) Mhm.

8 LEA-G6-3: [] This system is good because sometimes if you like to search any system to the tablet you get – and it gives us more extra learning.

9 LEA-G6-4: [] This system to us is good because we can search some questions from the tablets and it help us to see what something we don't know.

10 M: [] (...) Ja?

11 LEA-G6-5: [] This system is good to us because it help us to learn more than in class hours. It help us to search some things and it help us to look something in videos.

12 M: [] (...) Mhm.

13 LEA-G6-6: [] It is good because we learn through videos. We gain some knowledge. It's sometimes different from that we use to learn in our classes.

14 M: [] (.) OK. Thank you. And which of the programs did you like most? And which did you use most frequently? There are so many programs on the Rachel system. Which ones did you use mostly?

75 M: [] So when you were working in a group, did you watch a video together? Or did you also discuss things in the group?

76 LEA-G6-5: [] Yes, discussing things in the group. (bubbling, others confirm)

77 M: [] (...) Sorry, you were saying something? (...) Back to the question with the teacher. Would you have liked more guidance by the teachers during that extra hour? Or did you prefer to work on your own or with your fellows?

78 LEA-G6-6: [] No, we need to be in groups in order to get some cooperation to understand, with my fellow pupils.

79 M: [] Yeah, that's better than with the teacher?

80 LEA-G6-6: [] No.

81 M: [] Or, was it good for you that the teachers were not here? Or only, let's say, in the background? Or would you like to have more involvement of the teacher?

82 LEA-G6-6: [] It is good teachers will be – because sometimes internet is disturbing, we can't help ourselves, we ask the teacher to try and help us.

83 M: [] (...) So, what do you think? Teachers or own learning? What would you prefer?

84 LEA-G6-5: [] I prefer learning in groups.

85 M: [] (...) How about the others?

86 LEA-G6-2: [] I prefer to learn on our own.

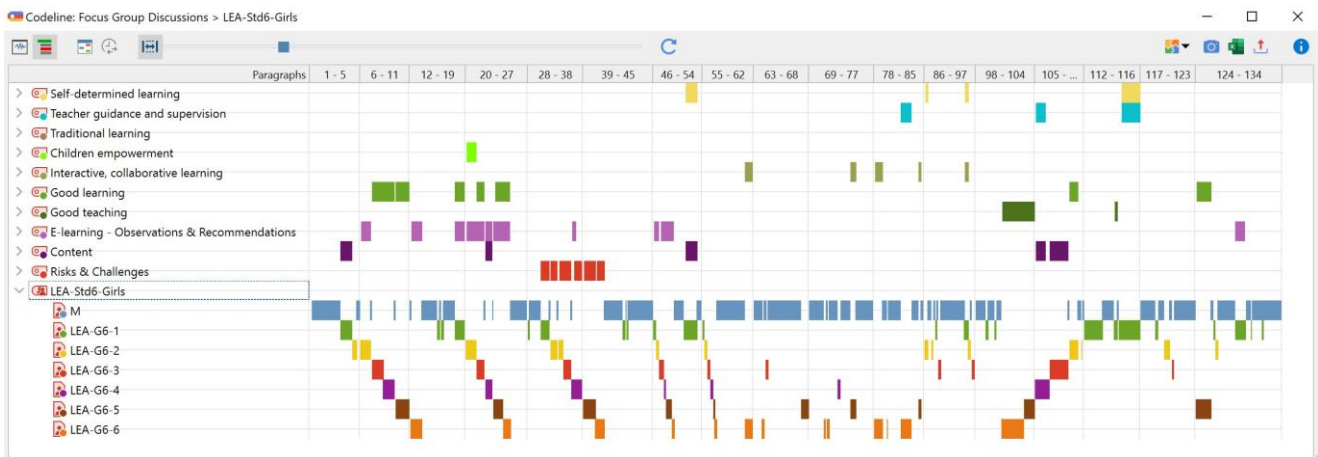
87 M: [] Because then you are free to choose?

88 LEA-G6-2: [] (whispering) Yes.

Figure 22.1: Focus group discussion transcript in MAXQDA Document Browser for focus group LEA-Std6-Girls

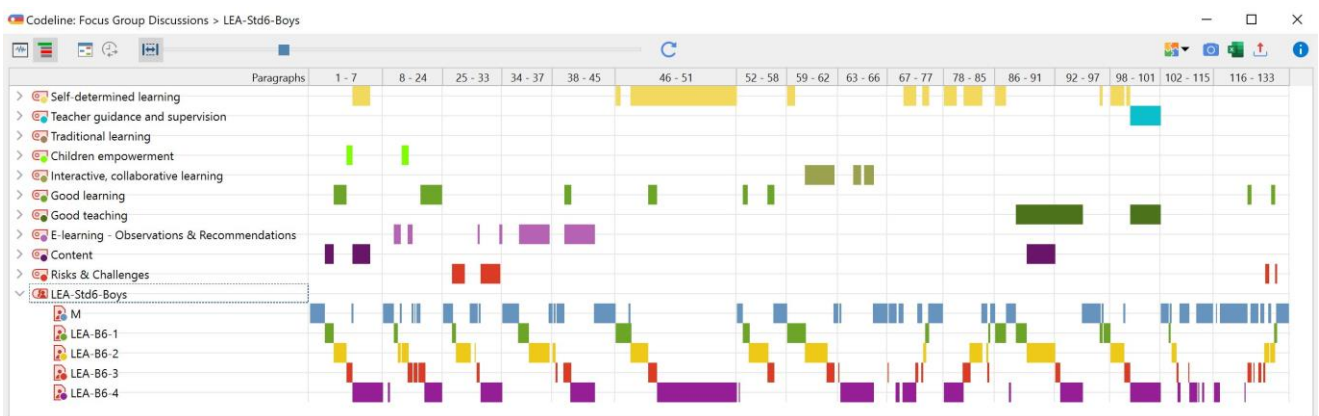
MAXQDA provides a visual tool called Codeline that captures such information for all focus group discussions. Two examples for LEA Primary School are presented below. Six girls participated in the Standard 6 focus

group. The lower part of Figure 22.2 shows that this discussion group run in a very organized way. Girls responded one after another, and all of them had a similar amount of speaking time. The discussion started with their observations from the e-learning trial and their perception of “good learning” (upper part of Figure 22.2). Interactive, collaborative and self-determined learning took more room later in the discussion.



**Figure 22.2: MAXQDA Codeline for focus group LEA Standard 6 Girls**

The focus group with four Standard 6 boys has some similarity but also some significant differences. Student LEA-B6-4 had much longer contributions to the discussion than all the other pupils (lower part of Figure 22.3). And self-determined learning has been a key topic throughout the whole discussion, more present than any other of the Top 10 categories (upper part of Figure 22.3).



**Figure 22.3: MAXQDA Codeline for focus group LEA Standard 6 Boys**



## APPENDIX Q: THE CODE SYSTEM

Section 5.2 introduces the code system that has been developed during the Open Coding Process.

Individual codes were added in a line-by-line *micro coding* process (Rädiker & Kuckartz 2018:74). Over 2600 codes were added. An extract of the unstructured code system after the first round of coding is shown in Figure 23.1.

Code System		2631
Missing content	1	
Self-awareness	1	
Risks from digital media	13	
Learning environment	10	
Giving tasks and observe	1	
Receiving knowledge	2	
Teacher as facilitator	1	
Fostering creativity	5	
Learning at own pace	4	
More time required	35	
Connection problems	28	
Slow system response	1	
Device charging issues	34	
Most favorite applications	66	
Learning beyond classroom sessions	3	
Student interaction	49	
Collaborative learning	33	
Searching content	18	
In classroom usage	21	
Using projector	7	
Learning by exploration	14	
Independent learning versus teacher guidance	1	
Improved teacher - student relationship	1	
Enjoying learning	2	
Seeking for job rather than learning	2	
Missing gender equality	1	
Dependency from teacher	1	
Uncertainty in learning alone	1	
Empowerment through technology	6	
Imitating teacher	4	
Split class and group work	2	
Dependency on e-learning	3	
Learning fostering values	1	
Content in Kiswahili	6	
Language barrier	15	
Better class attendance	10	
Learning by theory only	6	
Self-expression	2	
Learning for life	38	
Learning culture	17	
Always access to e-learning	4	
E-learning for academically strong students	4	
Most critical skills	5	
Digital literacy	14	
Changes required	1	
Long distance to school	2	
Lack of learning materials	11	
Practical knowledge	58	

**Figure 23.1: Unstructured Code System after first round of open coding**

The resulting unstructured code system was then further structured in MAXQDA's Creative Coding tool. This visual tool allows the researcher to easily group, aggregate, merge or subordinate codes. Sample code structures are shown in Figure 5.9. Figure 23.2 presents code structures for all ten top level categories.

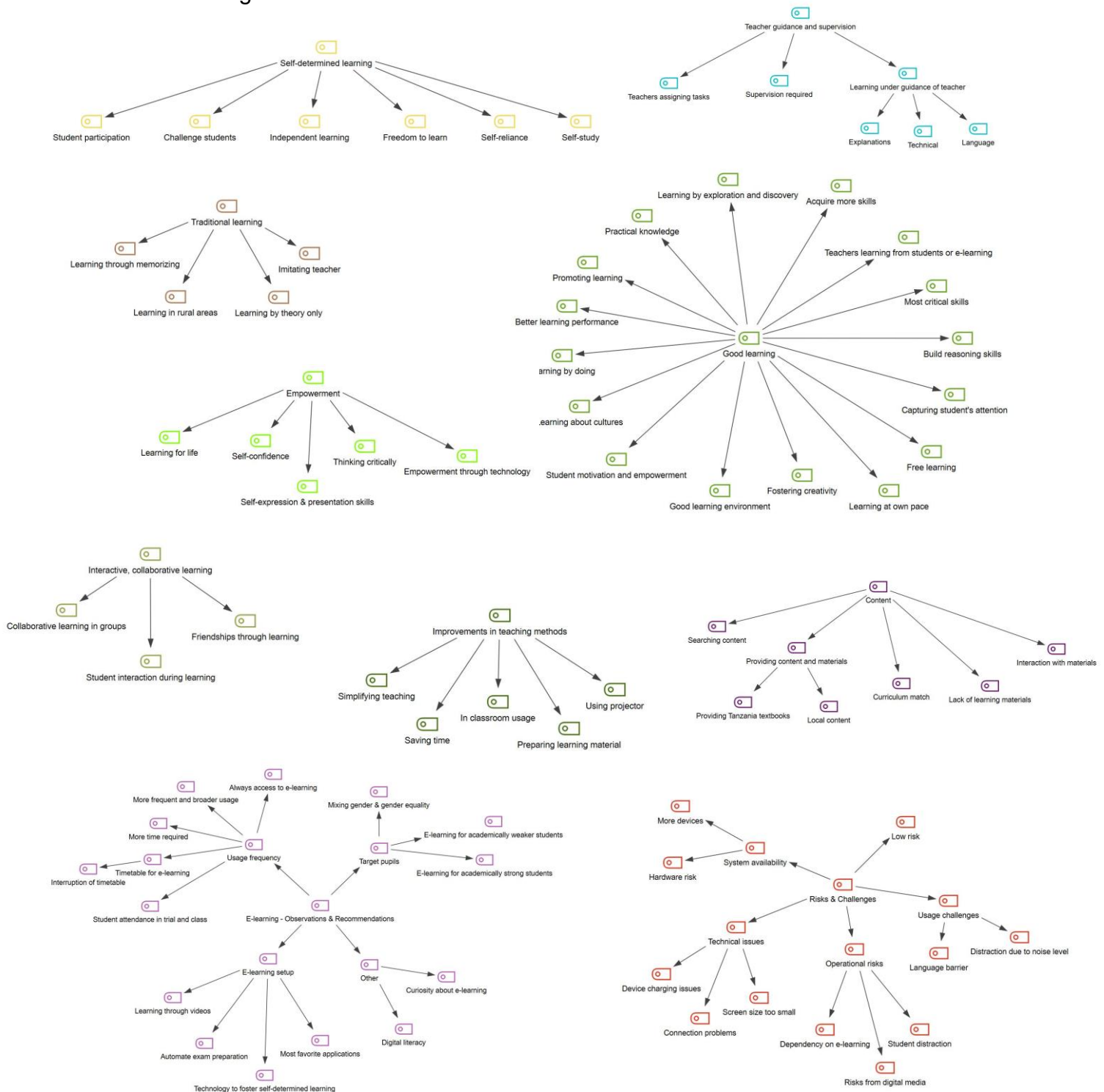


Figure 23.2: MAXQDA Creative Coding: structuring the code system

Figure 23.3 shows the details of the resulting structured code system, structured under these ten top level categories.

Code System		2588		
Traditional learning		0	E-learning - Observations & Recommendations	0
Imitating teacher		5	E-learning setup	0
Learning by theory only		6	Automate exam preparation	4
Learning in rural areas		6	Learning through videos	22
Learning through memorizing		4	Most favorite applications	66
Children empowerment		0	Technology to foster self-determined learning	14
Empowerment through technology		6	Other	0
Learning for life		38	Curiosity about e-learning	8
Self-confidence		23	Digital literacy	17
Self-expression & presentation skills		16	Target pupils	0
Thinking critically		12	E-learning for academically strong students	4
Interactive, collaborative learning		0	E-learning for academically weaker students	6
Collaborative learning in groups		47	Mixing gender & gender equality	4
Friendships through learning		8	Usage frequency	0
Student interaction during learning		40	Always access to e-learning	5
Self-determined learning		0	More frequent and broader usage	14
Student participation		10	More time required	35
Challenge students		16	Student attendance in trial and class	10
Independent learning		38	Timetable for e-learning	7
Freedom to learn		23	Interruption of timetable	5
Self-reliance		15	Content	0
Self-study		44	Curriculum match	11
Good learning		0	Interaction with materials	13
Acquire more skills		16	Lack of learning materials	15
Better learning performance		25	Providing content and materials	19
Build reasoning skills		6	Local content	4
Capturing student's attention		4	Providing Tanzania textbooks	8
Fostering creativity		5	Searching content	18
Good learning environment		10	Risks & Challenges	0
Learning about cultures		17	Low risk	6
Learning at own pace		4	Operational risks	0
Learning by doing		4	Dependency on e-learning	3
Learning by exploration and discovery		16	Risks from digital media	13
Most critical skills		6	Student distraction	24
Practical knowledge		57	System availability	0
Promoting learning		38	Hardware risk	11
Student motivation and empowerment		23	More devices	32
Teachers learning from students or e-learning		8	Technical issues	0
Good teaching		0	Connection problems	29
In classroom usage		23	Device charging issues	34
Preparing learning material		16	Screen size too small	5
Saving time		25	Usage challenges	15
Simplifying teaching		30	Distraction due to noise level	7
Using projector		7	Language barrier	19
Improvements in teaching methods		18	Interaction - Blue	71
Teacher guidance and supervision		0	Empowerment - Red	74
Teachers assigning tasks		12	Self-reliant learning - Yellow	187
Supervision required		21	Benefits from e-learning - Green	241
Learning under guidance of teacher		0	Requirements, Risks & Challenges - Magenta	269
Technical		19	Teacher Survey	322
Language		5	Observation Reports	115
Explanations		30	Sets	0
			Focus Group Speakers	824

Figure 23.3: Structured Code System at the end of the Open Coding Process

A summary of the final code system is illustrated in Figure 23.4:

























▼	 <b>Code System</b>	<b>2638</b>
>	 Self-determined learning	146
>	 Teacher guidance and supervision	87
>	 Traditional learning	21
>	 Children empowerment	95
>	 Interactive, collaborative learning	95
>	 Good learning	239
>	 Good teaching	119
>	 E-learning - Observations & Recommendations	221
>	 Content	88
>	 Risks & Challenges	198
	 Interaction - Blue	71
	 Empowerment - Red	74
	 Self-reliant learning - Yellow	187
	 Benefits from e-learning - Green	241
	 Requirements, Risks & Challenges - Magenta	269
>	 Teacher Survey	 322
>	 Teacher Survey 2	 50
>	 Observation Reports	 115
	 <b>Sets</b>	<b>0</b>
>	 <b>Focus Group Speakers</b>	<b>824</b>

Figure 23.4: Final Code System – Summary Overview

# APPENDIX R: CODE CORRELATIONS (TOP 18)



Figure 24.1: MAXQDA Code Relations Browser: Top 18 code correlations

## **APPENDIX S: ALL TRANSCRIPTS**

The following shows the transcripts of all teacher interviews and all focus group discussions.

- Interview with Teacher LEA-AP
- Interview with Teacher LEA-BG
- Interview with Teacher LEA-BH
- Interview with Teacher LEA-BO
- Interview with Teacher LEA-CN
- Interview with Teacher LEA-MP
- Interview with Teacher LEA-NT
- Interview with Teacher KAR-CR
- Interview with Teacher KAR-KE
- Interview with Teacher NYA-JK
- Interview with Teacher NYA-JR
- Interview with Teacher NYA-SE
- Focus Group Discussion with LEA-G5 (Standard 5, Girls)
- Focus Group Discussion with LEA-B5 (Standard 5, Boys)
- Focus Group Discussion with LEA-G6 (Standard 6, Girls)
- Focus Group Discussion with LEA-B6 (Standard 6, Boys)
- Focus Group Discussion with KAR-G5 (Standard 5, Girls)
- Focus Group Discussion with KAR-B5 (Standard 5, Boys)
- Focus Group Discussion with KAR-G6 (Standard 6, Girls)
- Focus Group Discussion with KAR-B6 (Standard 6, Boys)

### **Interview with Teacher LEA-AP**

**M:** [00:00:02] So thank you very much for participating in the study we have done over the past weeks. But my first question goes to you personally about 'good learning'. If you look back at your own life, what was good learning for you? What were moments when you were at school where you learned well?

**LEA-AP:** [00:00:22] Good learning? For my side, good learning, the learning which conducted through the class maybe, or by using digital learning, for example tablets, computer, phone maybe, yeah, good learning. But once I go back for the previous times, once I read, the things are not wide like now. There are, for example, for the previous times, once I read there, there is no (unintelligible) [00:01:00] source of information like that tablets. Computers, there are few. So, it is like this.

**M:** [00:01:11] So, you mention already the difference to the past. What skills and abilities are most important now for the children to learn – the children in Tanzania?

**LEA-AP:** [00:01:26] OK, the skills and the abilities?

**M:** [00:01:30] And also to prepare them for their life in this new world.

**LEA-AP:** [00:01:34] OK. Now the pupils they read and are able to read by using tablets. There are abilities in reading such materials through tablets. They're read themselves independently. Yes, they read. So they (recond?) new skills and abilities. They get experience through digital learnings, like those instruments which are used once there, such material.

**M:** [00:02:12] Now if you look back the past weeks, what – generally I have more detailed questions to follow, but generally, what was your experience and your observations during this trial with the children?

**LEA-AP:** [00:02:26] My observations at that weeks past, there the students they learn, they're discussing themselves by using – if they – once they, he or she failed to search materials or fail to enter to the program. They are able to ask themselves, they are able to search materials, they are able to read, they are able to ask even once they (unintelligible) [00:02:54]. They go to the teachers and then they ask. So for my observation, the system is good because the pupils read well, understand the questions, and then ask some questions to the teachers, ask themselves in good discussions, for the discussions.

**M:** [00:03:16] Did you observe changes in the way children interacted with each other? Did you see changes over these weeks of the trial?

**LEA-AP:** [00:03:25] Changes?

**M:** [00:03:27] Changes in the way the children interacted among each other?

**LEA-AP:** [00:03:30] Ja, changes among them? Among themselves? (**M:** Yes) Yes, there is changes. At the previous – once we started the program, our pupils they read and then they look more Ubongo Kids. And then, after days goes, they start to search materials, looking how to cook there. So, there is changes. But also, they mostly prefer to look our culture, which found to the tablet there. Yes, (unintelligible) [00:04:12] there is big changes in short.

**M:** [00:04:20] So what do you think explicitly worked well? What helped the children in their current context?

**LEA-AP:** [00:04:28] Can you repeat for me?

**M:** [00:04:30] So, the system as it is now, what do you think was really helpful for the children in their current context?

**LEA-AP:** [00:04:38] Ah, ja. What I think is very helpful for those students, it means, is to – maybe if it's possible to add more tablets in order whole school or all students, once you teach there to the class, they're able to manage and they're able to use tablets as a source of material which are used to find materials. Once the teacher think, they are able to search themselves. So that I think is helping our students and the learning through digital must be expanded to the whole wide.

**M:** [00:05:17] And what was difficult? Or didn't work at all in the current system?

**LEA-AP:** [00:05:24] Difficulties?

**M:** [00:05:26] Yes.

**LEA-AP:** [00:05:27] Which we – for the issue of difficulties I think is only timetable. Timetable are not fixed. Maybe today there is interruptions of timetable. There is maybe the issue of class hours. Other students they are needed here. The issue of power to the tablets. Yes, I think, these are the challenges which I see.

**M:** [00:05:55] Now, if we think about, because that was what the program was testing: can the children learn independently, even with little or no support from teachers? So what do you think now, after this experience? Can children learn by themselves without support of a teacher?

**LEA-AP:** [00:06:18] No. Without supporting the students, they are not learn independently, because once you leave them themselves, they are going to look videos and the other things which is not necessary for the issue of studying. The students, they need support from teachers. Even once you are not able to teach them. You sit there and then you help them once there is problem. You listen them and then, so for the issue of discussing themselves, or (unintelligible) [00:07:02] maybe, the teachers are very important there.



**M:** [00:07:09] And how do you think new digital media like the tablets can help to foster effective self-determined learning? And how could the school – what could the school do to foster more self-reliant learning?

**LEA-AP:** [00:07:26] (...) Can you repeat for me?

**M:** [00:07:31] So, how can digital media with the tablets for instance, how can that help fostering more self-determined learning? And what can the school do to foster that?

**LEA-AP:** [00:07:45] Oh, ja (coughing). According to my experience or according to my opinion, the school must improve the availability or source of the materials, which are able to help the students to access the materials through digital learning.

**M:** [00:08:19] And did you see changes in the learning styles during these weeks? Did you see changes in the way the children learned? What they were looking up, what they were searching for?

**LEA-AP:** [00:08:35] In this week the students or the pupils they like to study themselves. They are able to discuss. There are interactions, there is operations. Yes.

**M:** [00:08:51] So you saw that the interaction has increased over time?

**LEA-AP:** [00:08:56] Yeah, yeah. Yes.

**M:** [00:08:58] And you also used the system in the classroom sometimes.

**LEA-AP:** [00:09:04] Yes.

**M:** [00:09:05] So how did teaching practices change? What did you observe there?

**LEA-AP:** [00:09:10] In the classroom?

**M:** [00:09:11] Yes.

**LEA-AP:** [00:09:13] Ja, there in the classrooms, we go there with our tablets, we go there with our projector. And then, we project our material to the airboard there, to the wall there. And then our students or pupils, they are able to read there, they are able to write many things. So, there are big changes because once we use blackboard, we write and that consumes time. So if we take our projector, we project the material, we use a projector, we save time, and then minimum energy we use, once we use digital learning.

**M:** [00:09:54] And how does digital – so, the e-learning system help you as a teacher in your daily routines and in the classroom?

**LEA-AP:** [00:10:09] Yes, the issue of digital learning, me as a teacher, it help me due to the teaching and learning activities. Once I use those materials like tablets and the access to Internet, I don't explain more compared than that normal systems. Once I use normal system I explain more, a lot of concept without – but the students or my pupils are listening. But once they look to the tablets, themselves they are able to search and they are able to enter to the system, or to the site, where the material found. And then it help me to minimize a lot of explanation – more explanantion. So they are able to self-study, study themselves by using those digital learning. So, me, it help me minimize energy, a lot of energy which I use once I teach there like this.

**M:** [00:11:27] And what do you think, what could be improved from the current e-learning system? And how could it be better integrated in the school routine?

**LEA-AP:** [00:11:41] What could be improved?

**M:** [00:11:43] How could the system be improved? And better integrated in the school.

**LEA-AP:** [00:11:47] My advice here, according to my opinions, if there is ability or there is a way to be improved, maybe is to add more equipment or source which are used. For example, maybe to add more tablets, because once I go there to the class I provide those tablets to my students. For each student, he or she able to operate the system and then be able to search. But it is to increase the equipment, availability of material, which are used to whole class. For example, our class contain only fortyfive pupils. So we have only twenty tablets. So you see? This is not enough. So what we did to be improved there, is maybe for further study. Is to improve or to put the – so many material like tablets, server maybe, which I used to access Internet, whatever the case.

**M:** [00:13:02] And if you have more resources, would you still see some risks and probelems associated with digital media in the school?

**LEA-AP:** [00:13:11] Apart from –

**M:** [00:13:14] If you have enough devices and you have, let's say, the system setup, but do you still see any other risks or problems with e-learning?

**LEA-AP:** [00:13:26] Other problem, I think, no. The system was good.

**M:** [00:13:32] OK, so these were the questions I had in mind. Is there anything you would like to add? Any further comments or observations?

**LEA-AP:** [00:13:42] According to my observations all things gone well. Things are moving. But research we done is good. I study many things. So I would like to say it is a good system. But I would like to say, maybe for further study, once you come again back, make sure we take almost one whole class to

improve the system to our students. And our students to know how well did you study our material through e-learning, through digital learning? Is like this.

**M:** [00:14:33] OK, thank you very much.

### **Interview with Teacher LEA-BG**

**M:** [00:00:02] So thank you for participating in this research. You have made a lot of experience already with e-learning in your school. So what do you think about independent learning? Do you think children can learn by themselves with little or even with no support from teachers? And why do you think so?

**LEA-BG:** [00:00:24] What I know, children can learn for themselves. What is needed from the teacher is just to give them the subject matter and to direct them to the content which they are supposed to learn. And after giving them the instruction they can learn for themselves. And then later on, you'll check if the content which you give to them, they have really get it.

**M:** [00:00:53] And how have you implemented that in your school routine? How can it be efficiently implemented? The self-determined learning.

**LEA-BG:** [00:01:05] For our school and for my side in my subject, I have just tried to give the students the concept, especially the content which I cannot cover within a short period of time. I assign them the task, then they go to the computer lab, where there is server and tablets. They write the notes of that particular concept and summarize it. And then, when they be back in the next session in the class, I just pass through the exercises and mark them. That, I have experience in my subjects. And also some of the subject teachers, they are doing so. But in reality, in my subject, I witness that. And it was a great success, because the content which I was supposed to teach for more than three weeks, they learn it within two days. Was after two days, the third day, I mark the exercise. That's what I did. That's why I say the students, they can learn for themselves. After directing them which specifically part they can take from the server and write in their exercise books.

**M:** [00:02:24] And did you see a learning curve from when you started to use the e-learning and now you have been using it for more than two years? Did you see improvement over time?

**LEA-BG:** [00:02:37] I have seen the improvement over time since it has been started from our school for two years ago, because at the beginning many students are shy, are afraid to use even the tablet because most of them they are coming from rural areas. They never touch things like mobile phone, but now you are bringing them the tablet. It is something which is very new to them. And at the beginning there are few groups of students who are using it. As times goes on, up to the end of the last year, it is when the majority of the students from our site they started to use digital learning. Now almost the whole schools, the students can able to use the e-learning program, because they can go themselves in the computer room where there is a server and tablet. They can open themselves. What is the role of teacher? It's just to switch on the tablet and to see the safety of the tablet. As days go on, the number has been increased. Now, at this moment, the upper classes from Form 2 up to Form 4, they can operate themselves. Though the special consideration will be done for Form 1, where some of them, especially those who are coming from the families or the – in the rural areas where they did not

meet with these technologies, they cannot (able?). In Form 1 there is sometimes somehow a challenge. But the rest of the classes, they can (able?). Though also my experience in – to some of the students who are not well equipped with the knowledge of digital, especially using the tablets, they are afraid. Some of them, they are afraid, maybe in the class. In this upper classes you can find maybe two or three or four students, they are afraid. But now also what the teachers are doing is to give them the task which make them, all of them, to go to the server and take the material. Therefore, there is positive mobility.

**M:** [00:04:49] And once they learned how to search things, did you see if and how it was changing the ability of the students to present things and to express themselves?

**LEA-BG:** [00:05:06] In searching of the things at the beginning, they need a person to guide them. Maybe a teacher. But now, at the moment, for the sum of this group, that were afraid, they use – they teach themselves on how to use. Because they are the students who are very competent in using the tablet and in connecting with the server. But when they see someone is getting the challenges and difficulties, the one who will have the knowledge and the ability instruct another students. And because sometimes you can find a student is getting a challenge to reach where the content is found in the server. But they, themselves, they are directing each other. But when it is more challenge, they needed the assistance of the teacher, especially the IT teacher, who is in charge in supervising the program.

**M:** [00:06:04] And did you see changes in their ability to present the results and express themselves?

**LEA-BG:** [00:06:10] Yes.

**M:** [00:06:12] And how? What did change?

**LEA-BG:** [00:06:14] I think the changes in the ability of presenting the results. One day I asked one student to write for me the advantages of using the e-learning or digital learning system in this school. He writes the two pages, I have the copy of the two pages. And that I think it is a positive – it is a positive mobility. It is a success. It is a progress because at the beginning, when you tell the students: „Can you explain the advantage of this?“ you can – maybe you can get two or three sentences. But now I think there is an improvement when you are asking the inputs. One day I ask them: „Can we stop this program or we can continue to improve more?“ They said: “Improve more, more”. And if the whole school will have the server to them, it is the best. I think we are improving for our sites.

**M:** [00:07:14] Do you use the system in a way that you give them tasks and they have to present it in front of the class?

**LEA-BG:** [00:07:23] I give them the task to use the system. And after going to the system, I need the presentation in the class through the work or the questions which I direct to them. And they come in the class to present it.

**M:** [00:07:36] And did you see changes over time in the quality of their presentation?

**LEA-BG:** [00:07:42] I've seen the changes over time because in the system, sometimes there are videos. They see how the others are presenting. And when they come, also, they are doing the same. There is a change in relating with the previous time. Because in the previous time when you assign a student, you give them a book. And sometimes at the school you can find we have two books or three books, which is quietly not enough for all the students. And what they are going to do, they are going to memorize their points. They are going to copy and pasting the same – the similar points. And when you reach to the part of the presentation, each and everything will be similar. There is no creativity. But when you go to the digital learning, there are different sources. Each group may be this. This, the first group of students they get in a certain source and other they go to the other source. Therefore, they are different sources you can – they can share. Different materials at once. And when they are sharing now they are presenting in the class, the other group or the other students are telling them: "Take what is new to you. What you did not get in the same?" Therefore is just the part of the sharing of the experience. And for that the knowledge is smoothly for me. And this I witness in my subjects.

**M:** [00:09:14] And another topic, the interaction between the students. You mentioned already, they learned a lot to help each other. How did you see the interaction in the group changing over time?

**LEA-BG:** [00:09:29] The interaction with the group over time. It is also of high. At this time when you pass through the weekend because our school is somehow a boarding school. Over the weekend when other students are playing, in the part of the entertainment interaction, other groups, they have their own interaction of going to the system and learn for themselves. And learning, maybe other they are listening some of the refreshment videos with other countries. And some of them, they are watching together and they are sharing some of the issues together. It is also building the friendships among the students. Because now the schools have been, especially over the weekend, it's just somehow of classes. Others are going to the sports and games. Others are in the system. And what they need now is that the room where there is e-learning system to be open all the time. So that they are free to enter there.

**M:** [00:10:42] And the way you implement that room is, they can ask teachers whenever they want, but this room is free for them, open for them, independent. There's no teacher.

**LEA-BG:** [00:10:52] This room is independent for them. It is free for them every time. What we are doing as the teacher in charge is to make sure there

is safety and security of the facilities which are there. And when they are being – because they are – sometimes the teacher give them the keys to hold them – their leader, the leader of the students. And when they want to enter there, they are free to open the door. And the one student is assigned to observe that – make sure that all the students, they are not making the damage and the breakout of the facilities. But the rest they can implement themselves. Teacher can go home, can leave them their room. They are free, I think, all the time. And now in between of the week for, especially for the upper classes, they have this what is called the optional subject. Maybe there is a certain subject in the classroom and the student is not taking that subject. Those group who are not taking that subject, they go to the room of the digital system. They continue with their other subjects.

**M:** [00:12:03] So, let's switch topic. This is a lot of, let's say, learning styles, but now talk about teaching practices and teaching styles. You are also using the system in the classroom. Teachers take the system into the classroom. (**LEA-BG:** Yes). So share a little bit, please. How are teachers using it in the classroom and what is your general observation there?

**LEA-BG:** [00:12:30] My general observation for the teachers who are using the system in the classes. We have – in Tanzania, there is an educational curriculum and syllabus which is directing the teachers and students what they are supposed to learn in a certain specific period of time. The teachers took the system in the classrooms and assign the students in groups to go to a certain page or site to learn. Maybe if it is an article, if it is a video program, if it is a book. Because firstly, the teacher has already passed himself or herself. Then he directing them to that specific area. Then the student will share in the groups and one group after another will present. But on my side, what actually I like, I am not using assigning in specifically in the classroom. I assign. I provide them the content, the questions before the session. And when you enter the session, we'll share together. And also I'm using it when I see, as I said before, a topic which could take a long time and take a much effort. I simplify by breaking down it in small groups. And maybe Group A, I assign them this part. Group B I assign this part. Group C, D, maybe up to F. Then each group will go to the digital system. They learn for themselves. Then we come together and make a presentation. That will simplify our teaching and learning. And what I need also for my student, I need every one of them to speak. And now, also this simplifies, speaking for those students who are shy, who don't like to speak, because you have been given the task, you must come and present. And also, from my experience about this, also for the teachers, maybe, it is not much allowed to use – Maybe I will find a content, to me it is very challenging. It is difficult. So students are – sometimes they can be creative than their teachers. I assigned them: „Go and learn this. And then you come with the answer.“ Then we share together. From that, when they come, also I can learn new things from them. Though this we are asking according to the educational system. We are being asked if there's something which to you it is a challenge. You find another teacher for you. But sometimes I can use the students to find the answers for me. That's also sometimes simplified to help me in my teaching.

**M:** [00:15:27] Yeah. You mentioned already the benefits for the teachers. How can the new digital media, e-learning help you as a teacher in your daily routines and in your classroom?

**LEA-BG:** [00:15:41] The advantages, the importance of the e-learning for the teachers. First, it simplifies the time. It is a method, to me it is a method which is very effective and efficient. Because I send (unintelligible) [00:15:58] task. You can assign to the students and be finished over a short period of time. That is the first advantage. The other issue, for our country, we are using the chalks in writing each and everything in the blackboard. Actually, in this year I use the chalk in very rare. Instead of writing and teaching each and everything in the classroom, I come just to summarize it, because students themselves, they have already passed through this. Because even the books now are in the server, in this what is called the local content, where we can upload and save. We have uploaded all the books which are used in our country in the server. Therefore, this when we come in the classrooms, we share that content in a summary. Sometimes we can minimize the use of chalkboard. (unintelligible) [00:16:53] And this, also, if the teachers, all the teachers have been interested, sometimes to using the chalk, it is not advised for the health, because of those dust. You can minimize the use of that. And another advantage is to get many material at once. Because when you go maybe to the Rachel home, I find there is the Wikipedia and all the other world books for, especially for those teachers who are teaching the arts subjects, Geography, exploring world map. The content which you are delivering in the classrooms can be of broad concept or can be broad in by using digital system. But when you are teaching using the books, you only remain on a single source. But single source it is not – it cannot broaden the student's thinking. While maybe because you are some – the book has been summarized and you summarize yourself a book, you cannot get the new knowledge. Therefore, the reasoning is to enable the students to get any new knowledge, different sources. Maybe the exam if they will be asked. Now, in our country there is what is called the competence based examination. The question need a student to think critically. And if, by using this digital system, if you give the student a concept which you need him or her to think critically. They go to the system and think, where can I get this concept? Because they have – they know all the program. Therefore, it is their task to think: „Where can I get the answer of this?“ It's that, also it is making the development of critical thinking of the students. It is empowering them to think critically and come up with the ideas of how to answer that question. That also it is helping the teachers and also it's helping the students. (**M:** Mhm, very good) Teach for development.

**M:** [00:19:20] So, these are a lot of benefits from the digital learning. But also, do you experience some problems, difficulties? What could be improved from the current system?

**LEA-BG:** [00:19:33] Maybe for the system, nothing, but maybe, what is a challenge according to the nature of Tanzanian students. The in-charge teacher, or either in subject or of the computer room must see frequently what the students are doing. Because when you leave them you can get the



breakage and the damage of the facilities. And also sometimes when the system fails. If the students are alone, to reconnect their tablet it might be a challenge. They need either a teacher. And also they need maybe a student who is very critical in digital system. We have such students of that kind. But another issue is to some of us teachers. Some of the teachers, they are assigning the students to use the digital system. But themselves, they cannot able to operate. That is a challenge because in many groups you cannot – you will find there are some of the groups who are not interesting, though they are few. You know, also the students want to see what a teacher is doing. If yourself as a teacher, you are operating and also they're motivated from you. This is challenge to some of the teachers. And I think as time goes on, as we see from the students at the beginning, they are few, and later on, I think they succeed.

**M:** [00:21:13] In the beginning of the program, some teachers were really excited and waiting for it. Others were more hesitant (**LEA-BG:** Oh, yes). Did you see big changes among the teachers? Are they – did all of them move to the digital learning system or are still a lot of them resisting?

**LEA-BG:** [00:21:31] In our side, at the beginning, when you are introducing this system two years ago, I remember those who had been motivated I think, six if not four or five teachers, they are very few. And some of them, they are not understanding at all at that time the advantage of this. But what I'm witnessing now at the moment, there are some of the teachers, at the previous times, they are not understanding what (is digital?), but now they are operating, they are using it in their classes. There is a big changes. Though I said, are not all. But even those who are not practicing using, they are using their students to practice it. Others also were still motivated. Maybe for me, if I go there, enter into the system and I connect the system with my phone. Then we are learning also. We are learning together. It's a part of motivation. Or, at the free time also, when I visit the students they are in the – without I don't have any subject. But when I see them, they are in the computer room and learning. I say: „What are you doing?“ „I'm doing this and this and this.“ „Any challenge for you?“ „Maybe, I get this, this, I fail to open this content.“ Then you help him or her. But that is a challenge to some of the – maybe to some of the teachers, when they see some they are not entering in that room. Maybe frequently they wait until the session. But there are flexible teachers like me and others who are going to see if the students are in the computer room. They enter there and looking what is going on. On the other side, we have the group of teachers who are following. But on the other side, we are not having some of the groups.

**M:** [00:23:35] Is there a split between how many of the teachers are using it and how many are not?

**LEA-BG:** [00:23:40] Actually, no one is resisting the system. They like the system. But other, according to the culture of teaching in the blackboard, they would like to teach many things in the blackboard. But those who understand very well the advantage of system, their work now has been minimized in the blackboard. For instance, of the teachers who are teaching in the classes of

examination, when the external examination will cover all the topics. And a teacher, throughout the year you cannot finish all the concepts, all the topics in the classroom. What do you do? You have this topic which you are teaching in the classroom. You are saying the students in the group who read the topics which are ahead, which you cannot reach within that time. It also simplify it. And I'm sure, through this maybe, at the end also those who are not going to they are doing this. Therefore, no one is resisting. All the people are liking the system because it is helping their learning. Yes.

**M:** [00:24:43] And back to the learners. Do you think the system is most valuable for the academically strong students or also or even more for the academically weaker students?

**LEA-BG:** [00:24:57] For me, I can say, for the weak academic student. For me.

**M:** [00:25:01] It's better for the weaker?

**LEA-BG:** [00:25:02] For weaker academic students. Because the weaker academic students, what I witnessed in the classrooms, sometimes they cannot understand you. They cannot understand you totally, but whenever you assign them a task: "Go and learn for yourself. Or with your friend." They are more free than being a teacher. They are more free. My concern is to those who are lower performing. Those, if they are free to learn themselves, they are more independent than having a teacher. Therefore, to me, to the lower performing student, the weaker student, it is the greater of success. We need to go to a certain classes in one of my class. Every time in this optional subjects, especially in the afternoon hours, you can find the group who is in the computer lab where there is digital system, are those students who are performing poorly, who are weak in academic. That means when they are there, they are free then when they have to be with a teacher. And again, when you assign them the task in the blackboard and together with the other students, they are writing. What they are doing, they are copying from the other students. But then they are going to the digital, they will learn for themselves. And even if they are weak, but they have something in their mind. That is (unintelligible) [00:26:41] for me. I'm not focusing to those who are performing better, because they actually know. And they can obviously operate, but the weaker they much more depending to the system.

**M:** [00:26:54] Yeah. Thank you very much. You also are considering to add Internet to the school. Do you see challenges, risks or problems when you use more and more digital media in the school?

**LEA-BG:** [00:27:15] Maybe this now, it depend. Using more digital system at school, at this world of science and technology, it is more better than the challenges. Advantages many than the challenges. Now, when you go, one day – I'm discussing with one of my colleague, especially when you are teaching the practical subject, science subjects in the classroom, the students want to see. The students want to observe. The students want to touch. If we have the digital system, like the Internet connection, where there is

accessibility of things like YouTube, the students, they can learn for themselves by watching different videos online. But the problem, the challenge it come, when you give them the task and they are going to learn, to read other things. Then there, you can fail. And according to the students, the nature of the students of Tanzania, we know, sometimes you can give them the (unintelligible) [00:28:17], then they go direct to the entertainment part. They want to watch the entertainment. That might be a challenge. Maybe for this new system, what we are supposed to do is to download maybe the video as the teacher. You put in the server. Then they can watch for their own time. To have you put enough bundle of megabytes in your phone or your computer, download the video, then you put in the server. If it is the practical, if it is a speech, if there is any certain activity. I think this will be helpful. And, it's only at our school and we are just planning, some of the IT group, to have this video. This we did not. We have very few videos. We need to have more videos in our system.

**M:** [00:29:08] OK, thank you very much. These were all the questions I had in my mind. Would you like to add any further comment or observation?

**LEA-BG:** [00:29:19] My comment or observation, according to this study of empowering our students through digital systems in rural Tanzania, as a country of Tanzania we need to change from this older system of memorizing and (craiming?) for the students. We need to give the students freedom to practice the things for their own. Learning by doing. Learning by observing. We must shift from teacher centered, we must go the learner centered. The curriculum is learner centered. But how we can reach the learner system, if we allow the system especially to be implemented in the country wide, especially the marginalized areas, the rural areas, the remote areas. The students will be more in. And also, is building the confidence of the students. The students who are coming from the rural areas, sometimes they are also fearing when they see maybe a phone, a tablet. What is this? But actually, when they understand this, and later on, when they go to the higher education, they are more free and independent. And they are confident when they are presenting, I think, in front of the others. Because they have been empowered since they are still young. We, especially, for example, I give you the example from my side. When I finished Form 4, I ever see a phone when I am too young. And in Standard 6. But I never touch a computer until the day I'm going to the university. When the lecturer now at the university gives us, us student, the task to go in the computer room to find some of the material and make a presentation in the classroom, I am obviously shy because I never practiced and I don't know how to touch a computer. Then I get a challenge to use it for six months, to practice computers using my friends. This was a challenge to me. How about if (unintelligible) [00:31:40] to other students. If I get the opportunity to have this digital learning system here, when I reach the upper level I am a competent person. And I will be more comfortable. But I loose the confidence, because I was never practiced this. From our school, for the students who passed from this school, it is more advantageous to build confidence, they will be confident and more independent. Generally, let us (unintelligible) [00:32:13] this system to other

parts. (unintelligible) the nearby schools, the nearby teachers to be aware for these issues. Thank you.

**M:** [00:32:24] OK, thank you very much for your valuable input.

### **Interview with Teacher LEA-BH**

**M:** [00:00:02] So thank you very much again for participating in that study over the last weeks. So, now we share a bit the observations and experiences. The first question goes for you and your past. So when you think about 'good learning'. Where did you experience good learning in the past? What were moments, when you were still in school, where you learned well?

**LEA-BH:** [00:00:30] OK, thank you. First of all, to me good learning means that kind of learning which can enable pupils to get and discover new knowledge which he or she can use it in his or her own life later. So if she can use that knowledge to solve different problems in the society. And to my side, the experience, from what I experienced at the moment when I was a pupil, I remember at those days there was lack of learning materials. And once I compare the level of the documents currently and at the moment I was schooling there is big difference concerning on the issue of science and technology. Now we can see, we teachers and even pupils which we teach now, they are able. They have access to use the Internet devices compared to my time when I was schooling. At that time there was no this smartphones. Even these small phones were not there. And other devices which can give the pupils access to get different materials, for example (unintelligible) [00:01:48] tablets. Something which was not there at my time. And I remember also something of difference. I started in normal school, these public schools. And we know what's the challenge to these public schools compared to private institutions like this. So, in that time I remember we used to go from home to school like five kilometers. We have to go to school. And during break time there is no (unintelligible) [00:02:21] there. So you have to wait until – we were waiting until twelve o'clock in order to go home and get lunch. And then to walk maybe for five kilometers to go home, to get lunch and then back again to school. Then in the evening turn back again home until tomorrow. So, that's what I experienced. So from there though we were able to studying in that different environment and pass the final exams. But there was a big challenge concerning with the issue of learning materials, number of teachers, the long distance from home to school and the other difficulties of the way. So, once I compare now even to these government schools, somehow there is improvements. Remember recently the government give teachers tablets to use (unintelligible) [00:03:24]. So, I can see there is a difference.

**M:** [00:03:28] So you mention the changes that occurred in the society (**LEA-BH:** Yes). If you think now for today, what skills and abilities are most important for children in Tanzania today? What would prepare them really for their life in this new world?

**LEA-BH:** [00:03:45] Recently there is big changes. And once the world change, also, sometimes what we are teaching in the class also must change. So to let to the recent changes in the world. For example now, to my side, the skills which we must have, these pupils must be able to write, to read, counting skills and other. So as to know how to use computer, how to use smartphone, you should be able to read and write, especially Swahili and

English language and other languages in the world. So the first skills to pupils are those for learning writing skills, reasoning, counting and, writing. After there now, these challenge, once he or she come up close with these things, he or she can be in a good position to know: „Oh, this is smartphone. How can I write with smartphone?“ There is procedures, (unintelligible) [00:04:45] open, switch off, switch it on, then after there, what’s next? So, to run with those things these pupils must be able to read. And now we know we’re in the world of science and technology. So, once they want to develop we should not be back of – or should not (unintelligible) [00:05:08] sit aside. We should learn together, even if somehow we are (unintelligible) [00:05:14]. We must try to catch up with what is going on. So to me a child (unintelligible) [00:05:24] must master these four skills. So from there, he or she can develop competence after he or she must have mastered these skills. Reasoning skills, study skills, auditing skills, writing skills and the counting skills. From there these pupils can become across with all other skills.

**M:** [00:05:47] So now looking at the observations and the experience you made in this study time, what was your general impression about the way they interacted with the system here?

**LEA-BH:** [00:06:04] OK, good. Firstly, I became amazed with how pupils were able to interact themselves and to use devices. That was the first thing. The second one, I realized that pupils, especially those strong ones in academic, they’re able totally to run the system, that they are able to find the materials themselves from devices and to read themselves. That’s what I have (unintelligible) [00:06:38]. Starting what I learned again: most of pupils like to learn through using videos. By watching videos and then from there, if you ask them questions, concerning what they were doing, they were able to answer those questions well. So from there, the other thing they were able to learn, or they like to learn through videos. And also those strong pupils in academic they are able to search materials themselves and they like to read something. And some of them they were taking some notes through what they are learning from the devices (unintelligible) [00:07:16], taking notes (unintelligible).

**M:** [00:07:21] And did you see changes in the way the children interacted with the system but also among each other in the group?

**LEA-BH:** [00:07:30] Yes. There was big changes because, for example, one method and one group here and another group there. Maybe this group they have accessed something of different. They can go and share with another group. So there was sharing of knowledge among pupils themselves. If the group (unintelligible) [00:07:51] discover something they were able to move from this group to that group. Even, something of different which I realized that even those pupils who are not member of this program, later on they became much interested also, because those who are participating, after learning they were going to share information with their fellows that there we learned this and this and this. So for them, they became interested. Sometimes they used to come here. But because they were not member sometimes we do chase them. But what I realized also they were happy, or

they wanted to join the system after being taught by their fellows. Come there, read this and this, today I've learned of this, see. So, they become interested to know what's real in there.

**M:** [00:08:44] So that were a lot of points where the system worked well (**LEA-BH:** Yes). Did you also observe things where it was difficult? Or things that didn't work at all?

**LEA-BH:** [00:08:57] (coughing) What I observed in terms of difficulties of the system, sometimes we experienced with – or some days we are experiencing the Internet problem. Sometimes the Internet was not working. Another devices, they were not having charge power. So, that's what I realized, but generally the system went well.

**M:** [00:09:21] So, these are technical problems like access –

**LEA-BH:** [00:09:24] Yeah. But within a short time, then later on the system worked – were running well. So, the problem first needed for five minutes. What we were doing we just tell them: „Shut them down. Then switch them off, then switch it on again.“ Once they switched off, then they turn on again, then the system operating well.

**M:** [00:09:47] So this was not a point of, let's say, the content and the programs that are available?

**LEA-BH:** [00:09:53] The issue of content, the availability of content, it was well. There was no any problem on that. Maybe other content were taking long time to search, but after a while, they found them.

**M:** [00:10:10] And, because this program was meant for the children to learn independently, even without teachers – (**LEA-BH:** Yes). What was your experience with that? What do you think about that? Can children learn by themselves with no support from teachers?

**LEA-BH:** [00:10:29] Again?

**M:** [00:10:31] So, from all the experience you have made – (**LEA-BH:** Yes). Would you state now, children can learn independently, even without teachers?

**LEA-BH:** [00:10:41] Ah, these – to one side I can say yes. On the other side I can say they need supervision. Yes, from the side of strong pupils in academic. Totally, they were able. There was no need to supervise them. But these weak ones, for example we had that table, which was deal with two subjects, Civics and Mathematics. So, for example, you can tell them today, you're gonna to do Mathematics. So, class five, go through the content of your Mathematics subject. The same to class six. Then we leave. But unfortunately, when we come back again, you can find other pupils just they are doing the way the timetable has guided them to. But other pupils were just looking other parts. For example, I saw there was a program which showing

the cooking method, which I think is Indian food. They were much interested to see how they are preparing that food. So, but those strong ones they were busy doing, if it is Mathematics or Civics, they were really busy doing and searching different materials concerning the subject.

**M:** [00:12:02] And do you see specific value if they do something totally different? Like learning to cook or what? (**LEA-BH:** Yes). Would you see that as a strength or more as a distraction?

**LEA-BH:** [00:12:13] I saw something: one of the pupils he was learning something about (unintelligible) [00:12:18] I remember in history about Berlin conference. They chose that in your country. So, one of the pupils reading the history for this, Otto von Bismarck. He went through Wikipedia, and he was learning about him. He took a pen and a notebook, he writing some hints from the Wikipedia about Otto von Bismarck. So, from there, this pupil, he developed some new confidence of knowledge about the Otto von Bismarck through using these devices.

**M:** [00:13:00] And how do you think tablets and digital media could even more foster self-determined learning? And how could the school help with that?

**LEA-BH:** [00:13:13] Generally, digital learning it can foster individual learning because it is different from normal teaching which you must do. To conduct normal teaching you need a classroom like this. The area with (unintelligible) [00:13:30] environment to sit and to conduct a lesson. But digital learning, as long as you have devices, you can sit even in a certain tree and you are there yourself, you can access various information. As long as you have what? Devices. Apart from normal learning. So to me I think digital learning it is part, it can help a pupil to develop new competence and skills. Because anywhere you can access it as long as you have the Internet access and then, you can conduct it even without under supervision of teacher. Because there you can ask even questions which are difficult to you and you can get answers through the system. That's different from normal learning which you need a teacher of Primary to instruct pupils. Here you do this and this and this. But here, these devices, you can use them as your teacher, because you can ask them some questions and they can answer you through the assistance of Google. You can get answer.

**M:** [00:14:43] So, these are changes in learning styles. Now, from the teaching styles, did you also see changes, because you also use the system in the classroom? (**LEA-BH:** Yes) Do you see changes in the teaching styles when you now use these digital media?

**LEA-BH:** [00:15:02] Yes, changes were there. Changes were there that once we used them, for example, we do use that projector to give pupils access rights and their copy of questions. Pupils themselves they became happy with the system because normally, from the normal lessons teacher must give, they physically write on the board and the pupils copy. So these ones of projecting the questions on the wall and then the pupils they are copying questions, or they just doing just putting in answers. But they are reading



questions from the wall. I think it brought big changes especially to teachers. Also, we get time to do other things. At the same time, the lesson is going on. So there –

**M:** [00:15:58] What would you say are the biggest advantages for teachers?

**LEA-BH:** [00:16:00] It saves time for teachers. And it gives them enough time to do other work. From standpoint of academic, maybe that closed permission. You know sometimes you have a lesson. And you have to give these pupils exercises. You are writing things on the board, at the same time pupils they are copying exercise from the exercise books. So, other pupils they can cheat the answer. Once you are projecting, you prepare the projecting, you can stay there, then you see how the pupils are doing with the exercise without cheating. So it saves time for the teachers and it gives them much time to conduct that close supervision to pupils, to know that who is strong in these (unintelligible) [00:16:48] and who is weak. Because once you're writing on the board and the same time the pupils they are copying exercise, sometimes these things (unintelligible) [00:15:56] and they are writing some, so they can look at that part and cheat answers. So at the time we are making this, the pupils they understand. But next time, bring the same questions, but they don't have those exercise books. Just view them, and (unintelligible) [00:17:12] then you see the difference.

**M:** [00:17:22] So these are all good advantages. Did you see also problems with it? How could that system be improved? And how could it be better integrated in the school routines including classroom lessons?

**LEA-BH:** [00:17:41] For example, in that, what you will call, this projector, it seems it doesn't stay with the charge for a long time. For example, our sessions are just forty minutes. So within these forty minutes, that, I think, it cannot sustain to stay for forty minutes. And another challenge I experienced with this we don't have this sheet to cover windows (unintelligible) [00:18:05] to reduce the intensity of the light. Because you know, to project we (unintelligible) there should be some of the room must be dark. So, for example, now it's like day. You see the light, the sunlight is getting in the class. So miss those sheets to covert he windows, for us to reduce the intensity of the sunlight.

**M:** [00:18:33] So these are again technical problems. But do you see also problems with regards to the content or missing content?

**LEA-BH:** [00:18:41] There are other content I think, they're not running together with our syllabus. Yes, but most of them (unintelligible) [00:18:52] out of our syllabus.

**M:** [00:18:57] Ok, so that covered all the questions I had in mind. Is there anything else you would like to share? Any further comment or observation?

**LEA-BH:** [00:19:07] To my side, the system is good. But another things that I can see that we need – this thing must be accessible to pupils all the time

and, maybe we should have a fixed timetable only for this program. Rather than of being this maybe from this time to that time, and once you come to that time, most of the pupils, you know, once they came here from the normal lessons, they are too tired. So, I think, we could have a fixed timetable that maybe now it is e-learning timetable for class six, maybe, for this day. Maybe tomorrow again of the same time, maybe for forty minutes. But every day it can be useful to whole school, you see. And another thing also, maybe, which I hear is not the side of more positive, our pupils now they are – they become much close with how to use these devices. Almost the whole school they know how to run the system, know how to use the system. And now, what we can do? The devices should be accessible all the time. At any time once they wish to use them, they should access. Even without presence of teacher, or just they need to be certain how to use them and what should they do and not do (unintelligible) [00:20:45]. Only that after there they can use them well and, if possible, that timetable must be fixed. So then, they can have enough time to play with the system and to become familiar with it.

**M:** [00:21:04] OK, thank you very much.

**LEA-BH:** [00:21:07] Thank you, too.

### **Interview with Teacher LEA-BO**

**M:** [00:00:02] So, thank you very much for participating in this study. You have some experience with the e-learning in your school. So my first question to you is, what are general observations? What can you share after having used the system now for more than a year? What observations did you make?

**LEA-BO:** [00:00:25] Ja, from my experience, and it's more than a year now I've been using this learning program, and the observation which I have, try to get out from the pupils who are learning by using this devices, it has been promoting learning in the class. It has been really activating pupil's participation in learning in the class. Because by the time we use as teachers, we use in the class to deliver the concept in the class and the pupil's attention and participation has been very, very high compared to when we just teach in the class. We teach without – maybe using blackboards, it has not been interesting. But by the time we have been using this learning, for sure it has been a very interesting part.

**M:** [00:01:30] Do you think children can learn by themselves with little or even no support from teachers? And why do you think so?

**LEA-BO:** [00:01:40] I can say that it really – pupils can learn, absolutely learn even without teacher's supervision. Because the material present in the Rachel server and the devices we are using have been directing pupils to what exactly they need, because they get the material they need to get in the Rachel server. But at the same time it doesn't need much teacher's effort, because there are some of the videos which explains and audios and video plus the voices. It explains, it takes (unintelligible) [00:02:23] that the part of a teacher, than having teacher in the class. So the work which could be done by the teacher, then it is done by the – pupils can learn by themselves even without teacher's effort. For sure, it has been, it helps. On my side, I feel it helps a lot.

**M:** [00:02:40] And that's a specific advantage of digital media? And what can the school do to foster more of that self-determined learning with digital media?

**LEA-BO:** [00:02:54] I have not understood well the question.

**M:** [00:03:00] So what can the school do to foster more of self-dependent learning from the children?

**LEA-BO:** [00:03:08] Ja, the school can just encourage and have this, much of the dis– by the way the pupils are supposed to be educated much, and how the institution by using by themselves. When they're alone, because to have a safe direction, especially when using this to have self-learning. To understand why is it important to be learning. You see, when they're alone. So, as a school, maybe this school needs to have much of the devices that supports them during learning when they are alone. And use much of their time, when

they're alone. You see, to have the value of time when they are alone to know exactly what we need to learn. You see.

**M:** [00:04:06] Did you observe changes in the way children interacted with each other when using the digital learning system?

**LEA-BO:** [00:04:16] Yes, one of the changes that I have discovered or observed is first pupils to having confidence, having self-confidence. Self-confidence in terms of what? In terms of explaining some of the concepts. Because by the time they have been interacting with the material, because they have been learning alone. So, it has been giving pupils confidence while speaking with other pupils. Also, it has been raising self-explanation. Pupils can explain without any fear. You see. And they'll also have content because most of the time pupils are learning in the class without (cramming?). That means understanding of exactly what they are trying to deliver.

**M:** [00:05:04] And you used the digital learning system very frequently in the classroom. So what changes does this system make to the teaching practices?

**LEA-BO:** [00:05:17] Tja, we have been using, and also I have been using frequently in my teaching practices in the class. And the changes which I have seen, is that it has been helping me much in managing time. It has, because – and also, capturing the pupils' attention during learning, because the time I – instead of wasting much time writing, I just have to display and see. And pupils interact with the books that are available, you see. So it has been a very interesting class. And by the time I've been using it I use only short period of time to deliver the content and concept, than the previous time, where I have to use a lot of time, wasting much time, trying to make pupils to understand, and then they don't understand. But after all when I've using these methods in teaching, for sure, even the class performance has been raising.

**M:** [00:06:20] So you mentioned already the advantages for you as a teacher with regards to saving time ((mobile phone ringing)). So how can digital media help you as a teacher in your daily routines and in your classroom?

**LEA-BO:** [00:06:38] Pardon?

**M:** [00:06:40] So how can new digital media help you as a teacher in your daily routines and in the classroom?

**LEA-BO:** [00:06:47] Tja, it helps me by learning different – I mean, implementing different activities. By the way, about ours – for instance preparing learning material. It's been saving time. And also when pupils are – they manage time in terms of implementing our daily routine, our daily life as called generally.

**M:** [00:07:30] And what could be improved from the current system? How could it better be integrated in your school routines?

**LEA-BO:** [00:07:40] Ja, because school has a daily routine which needs to be implemented. And also the daily routine is meant to facilitate pupils' learning. Therefore, when I try to check on (unintelligible) [00:07:56] using the system, generally, there are few things that I maybe recommend, if improvement can be done. For instance we have like exams, see. So, most of the time when we are composing the exams, we need to get rid of these paperworks. Then, we need to have a program that at least we can prepare the exams and the exams can be visible in the systems. And even the marking modality, which simplifies the working, I mean, paperworks. And also, there are some of the program which are much good for learning in the class. For instance, like having the Excel programs which can help pupils learn and use this, because this is one of the important programs, especially this electronic devices, computers, and learn and improving much knowledge on how to use these devices. But, also, much of the improvement, for sure, I've tried to check out and see, really, the system covers the means of our learning environment. So the more we keep on using, we discover maybe, we can get something new, but for now, it at least covers the needs of our learning.

**M:** [00:09:42] And what risk and problems do you see when using new digital media more extensively in the school?

**LEA-BO:** [00:09:52] One of the risk I can talking to different perspectives. One is the safety of the devices. But another risk is in terms of time. Most of the pupils will be interested much on those programs which capture their attention. So they will waste much time maybe sometimes on watching or concentrating on the programs that won't help them at the moment. But maybe they need to be worked on during free time. So during learning time, one of the risks is wasting time, especially when pupils are left free without teacher's control. But if they are under teacher's control, then they'll all much well. But another risk maybe is, the devices are sometimes delicate. That is another risk if they are not well handled.

**M:** [00:11:01] Thank you very much. These were all the questions I had in mind. Would you like to add any further comment or any further observation?

**LEA-BO:** [00:11:11] Yeah, for sure, on my side, I have to – since we started using this systems, I can say that for sure it has been working very well. Especially in improvement of learning and teaching activities in the class. So I recommend much on improvement to be done more. More improvement, because we need to improve the learning activities. And regarding to this generation pupils are much interested to this electronic devices and (unintelligible) [00:11:51] systems. So, most of the time, I am thankful for these devices, because for sure they have been – the system has been helping a lot in improving, capturing pupils' attention during learning. And also, so it facilitates learning, generally, which improves – which leads to pupils' development academically, school development academically, and also society development academically, especially to those remote areas, because here we are not using – no Internet, but at least we can access everything that is just found all over the world. It's not costful, so, it's cost efficient on our

side. After getting all the devices required, like computer and all the tablets we have been very, very helpful. So, I am thankful for this program, for being installed to our school. And we expect to get more. To get more, because we have been enjoying and the devices are not enough. Pupils are much enjoying, and we have been scrambling for to get the service. So, really we shall help for more devices. Will be happy to have it.

**M:** [00:13:23] OK, thank you very much for your input.

**LEA-BO:** [00:13:26] Thank you very much, too.

### **Interview with Teacher LEA-CN**

**M:** [00:00:01] Ok, so thank you for participating in the study we have done over the past weeks. My first question goes more to you personally, and if you look back in the past. If you think about 'good learning', in your life, what was good learning when you were still in school? What were moment and setups where you learned very well?

**LEA-CN:** [00:00:30] When I was at Primary level, for what I remember, was the life of government school. What I remember, the environment of government school at that time was not supportive compared to this time. So at that time it was difficult. So, materials and devices that can help me to gain knowledge, go to discover knowledge independently, was difficult. So when I compare with life for this time, there is big changes. So there is different from where and the actual now.

**M:** [00:01:16] So you mention the changes. Now the children in that new world, what skills and abilities do you think are most important for the children in Tanzania? And what would be most important to prepare them for their life in this new world?

**LEA-CN:** [00:01:36] Important abilities and skills to help pupils is to teach them about the things that can help them to prepare them for life and not for testing. So if we'll teach them about knowledge that can help them for life will be important compared to teach them, then you test by examination, these things are not important. So the important abilities and skills is just to prepare them for life, not for testing.

**M:** [00:02:13] Ja. And, now looking back at your experience and observations for this trial we did the past weeks. I have some specific questions, but generally asking, what was your impression, your experience during these weeks?

**LEA-CN:** [00:02:36] About pupils?

**M:** [00:02:38] And this study trial.

**LEA-CN:** [00:02:41] OK. I think this system for pupils is good, but they need guidance. Because when we leave themselves, no guidance, others they can go to do their business or unimportant things concerning to the subject. So in order to learn themselves, you have to give them at least guidance, maybe questions, then give devices in order to find answers.

**M:** [00:03:16] And did you see changes in the way, over these weeks, in the way the children used the system? And in the way they interacted with each other?

**LEA-CN:** [00:03:30] Of course, there is big changes for them. Before, when we start, and as the time goes, there is big changes. Before, the ability of pupils to stand in front of mass of people to express themselves was difficult. But

as the day goes, you can see now, pupils are able to explain, even if to say anything. But before it was difficult. So what I can say, this system helped them to change. So they can stand in front of people and express themselves.

**M:** [00:04:13] So these are all things that worked well. Did you also discover difficulties? Or things that didn't work at all?

**LEA-CN:** [00:04:24] On my side, I think the challenge is that if some days there was problem of network. And some of tablets there was no power. But I think this is not big problem. So we can sometimes decided to charge it. For the case of network decided to switch off, then to switch on. I think there is problem like that. Only two problems.

**M:** [00:05:01] These are technical questions. If you now think about the content that was available and the programs that was available, you think that was sufficient? Or any problems with that?

**LEA-CN:** [00:05:16] For the side of pupil?

**M:** [00:05:23] So from the content that is in the system, do you think anything was missing?

**LEA-CN:** [00:05:30] Of course, according to our syllabus, I think we have to add more materials in order to help them according to the syllabus of our country. So when you check to the programs you can see there is few materials, so it's not enough at all. So in order to improve can say to add more materials according to the syllabus of our country. This would be good.

**M:** [00:06:02] And this trail was designed so that the children had the time to learn independently, even without teacher. What do you think about that? Did that work? Can children learn by themselves, even without support from teachers?

**LEA-CN:** [00:06:24] Mmh, I think it's not possible. Why? Because as I said earlier, I said pupils they are able to learn themselves, but if we'll give them guidance. That ways we can show them, we can give them work, give them questions, or what. So by looking question they can start finding materials by using tablet. So what I mean is to our guidance (unintelligible) [00:06:55] then you leave them. After providing guidance, you can leave them, OK. What I mean is answers. So from there they can start to find materials by using tablet and they will discover new knowledge.

**M:** [00:07:09] And how can digital media like the e-learning help with this more self-reliant learning? And what could the school do to foster that?

**LEA-CN:** [00:07:22] In order to foster, this system we have to add – First of all we have to create timetable in order to avoid challenges. I think there was interruption normal school timetable and our program. So in order to use now tablet to help pupils it's better to create schedules so that it cannot interrupt with normal school timetable. Also, to add the number of devices according to



the number of pupils. You know classes of our country, for the case of government school you can see small class like this and have more than sixty pupils. But normally the number of pupils for a class should be at least fortyfive pupils. So if the number of tablets is not enough it will be difficult to use that system. So in order to improve also we have to add the number of tablets. And to have proper timetable that cannot interrupt with normal timetable.

**M:** [00:08:45] And did you see changes in the way children learn during these weeks where they had the chance to interact with the system?

**LEA-CN:** [00:08:54] Yes, of course, no any question raised by pupils according „How can I use this?“. But they tried to share themselves and to solve problems. So for that case I can say they are able to use tablets. But if there is problem of network it will be difficult for them. So from there you can see „Sorry, Sir, (**M:** confirming Mhm) no network here. No Internet here.“

**M:** [00:09:23] These are let's say the learning styles. Also teaching practices, because you also used the system in the classroom sometimes, do you see changes over time in the teaching practices?

**LEA-CN:** [00:09:40] Of course, we use it. But we can use it for (unintelligible) [00:09:46] time. So, when you teach normal session, it will be difficult according to the number of pupils. Because the number of pupils is large compared to the device present, so we can use it for (unintelligible) time.

**M:** [00:10:05] And if you had more devices, how could new digital media help you as a teacher? What would be your advantages to use it?

**LEA-CN:** [00:10:15] Of course, if there is large number of devices, would be simple because you can prepare guidance, can provide work for pupils. So they can use their times to go and be in a special room where they can use tablet. So I can prepare guidance. So by giving them guidance, they can use my guidance to discover new knowledge. As I said earlier, is it possible for pupils to learn themselves but they need guidance. Because when you leave them, other they can go to watch videos which is out of your work. So in order to avoid this issue it is better to provide guidance. Then you leave them, can you go out, then you come back if there is question. But if no guidance, it will be difficult.

**M:** [00:11:17] So, what do you think could be improved in the current system? So, also, that it is better integrated into the school routines?

**LEA-CN:** [00:11:29] As I said earlier, it is better to have timetable about e-learning system. That (unintelligible) [00:11:37] decide, OK, from this time, we need to have timetable for e-learning and normal sessions. So if you have timetable, also you have to add enough materials according to our syllabus. (unintelligible) [00:11:55] according to the setting of the tablet there is – I think, they like to use only two subjects, Mathematics and Civics. So if we add more subjects it will be simple for them to gain and to discover new

knowledge. So for this time, I can say we can only use for two subjects, Mathematics and Civics. Or we can decide to add materials like papers. I mean examinations, so I can say „OK. Sit in groups. Now switch on. Now try to check that paper. You will see paper. Now write the answer.“ From there you can use it. But if no materials, also it will be difficult. They will switch on, then they will go direct to videos.

**M:** [00:12:51] And if we had all this contents for all the different school subjects, and you may even at some point have Internet access, do you see major risks and problems when using these new media in the school?

**LEA-CN:** [00:13:10] Of course, according to the nature of our pupils there is problem that can happen. For example, breakage of devices. Even if it's small number of devices everyone can decide „OK, let me catch it, let me catch it“. (unintelligible) [00:13:32] they fight in order to take devices. Sometimes it can fall down and cause breakage for devices.

**M:** [00:13:41] OK, so these were all the questions I had in mind. Is there anything you would like to add? Any further comment or observation?

**LEA-CN:** [00:13:51] Generally, this system is good for pupils. Also, it can help pupils to discover new knowledge in absence of teachers. As you know, in your country there is large number of teachers. But sometimes you cannot get chance where to library or knowledge. So if there is small number of teachers, pupils can decide themselves to find tablets. Where there is Internet access, then they can try to find materials and to discover new knowledge. So generally, I can say, this program is good. This system is good for pupils in order to discover new knowledge and to read independent.

**M:** [00:14:45] OK, thank you very much.

### **Interview with Teacher LEA-MP**

**M:** [00:00:03] OK. Thank you very much for participating (.) in this study (**LEA-MP:** Yes). So, this was an interesting experience over the past weeks. Now we would like to share the results and observations. So my first question is more to your background. When you think back when you were in school as a pupil, where did you learn? What was good learning for you? And what was your experience where you really learned well?

**LEA-MP:** [00:00:39] OK. In my background at Primary School at (unintelligible) [00:00:46] the education system was quite different from this one that we are using. And also, when I call back, the teachers, they are different. They used different techniques than this one that we are using currently here. When I remember the teachers were using audio communication rather than having visual. Something that you can touch and also see. Compared to nowadays, that we are teaching. Currently when I look back I can see that teachers nowadays they are greatly improved than the other ones they had been teaching.

**M:** [00:01:40] Thank you. And if you now look – you said already things have changed, if you look for children today, what skills and abilities do you think are most important to learn for children today in Tanzania? What will prepare them for their life that they are experiencing today?

**LEA-MP:** [00:02:04] I hope the skills that children learn, that nowadays they are gaining are those skills that help them to be self-reliant. They can depend on themselves without teacher during studies. So, they can be self-determined and self-reliant to themselves.

**M:** [00:02:30] Any specific skills you would mention with that context?

**LEA-MP:** [00:02:40] Especially the skills I see is using different devices that can enable them to access something to acquire knowledge on their own, especially.

**M:** [00:02:58] So now, if you now look back at the experience of the last weeks, we go down into some detailed questions later. But first, what was your experience and your observations during the eight week trial?

**LEA-MP:** [00:03:16] OK, from the – what I observed the past eight weeks of study, pupils had that curiosity of coming in the class or in the lesson, studying for themselves. Because they were coming before even time. They were coming and telling teacher: „Teacher, it is time for e-learning“. So pupils have this curiosity that they want to learn for themselves without being forced. And I realized that during the studies when we were studying here, pupils were interacting each other. They were able to move from one place to another place, asking questions for themselves, even without engaging teachers for when they study. So they were able to move freely, interacting freely for themselves, stu– inquiring things for themselves.

**M:** [00:04:19] And because they have been working with the system already, not as much as there –

**LEA-MP:** [00:04:27] Most of them, they had been before in the program. In classes, they have been using the system. And so they had that knowledge of using the tablets and the devices.

**M:** [00:04:41] But that was more in the classroom under teachers' supervision and less on their own? (**LEA-MP:** Yes) So, what changes did you observe in these weeks when they were now able to learn on their own?

**LEA-MP:** [00:04:57] Changes that I saw: in classes they were not more thrilled the way they were here for themselves. When they are with themselves, they are more free than when they are with teachers or with other pupils in the classes. They are more freely compared to other classes when they are studying.

**M:** [00:05:18] And did you see that they were following up a lot from what they learned in class, like homework, and let them help with homework from the digital content? Or did they go totally different and do totally different things?

**LEA-MP:** [00:05:36] Most of them they went ahead without following the timetable that we had given them. So, they access a lot of things compared to what we intended. For example, if they wanted to check for example, they were studying Mathematics during that period. Instead of studying Mathematics some of them went ahead viewing videos from Ubongo Kids rather than sticking to the program scheduled.

**M:** [00:06:08] And when we think about empowerment, empowering children. How do you envision that e-learning is empowering the children?

**LEA-MP:** [00:06:22] This e-learning actually from what I've seen in empowering children, first and foremost I have seen that it gives them motivation. It motivates them to study and acquire some extra knowledge compared to when they could learn without this program. Because I remember when I was teaching in class without those materials, when you give them work, they don't bother to find (unintelligible) [00:06:56] from anywhere. So they just answer the questions without preparing somewhere. Or, when (unintelligible) [00:07:03] asking questions from other pupils what is supposed to be done there. So this program for me have known that most pupils are able to acquire more skills. And also to motivate them to find more skills or knowledge that would help them in getting more answers for the questions that I have been asking them or for any (unintelligible).

**M:** [00:07:35] OK, very good. So that was what worked well. What did you see was difficult for them? In the way it was setup here with the independent learning with the digital system. What was difficult or didn't work at all?

**LEA-MP:** [00:07:55] Actually, for what I saw that was difficult for them sometimes there was failure of connection in the Internet. So most of the

pupils when I was around, they came asking for help. There I could help them to connect. That was the major difficulty that they contact. And apart from that, I realized that there were some pupils with that harm in their vision, was not such visionally, to see something was not – so they had to put something in their (unintelligible) [00:08:44]. That boy, I know you know him, he had a problem of vision. So he had to put something near, close to his eyes so that he can see clearly. And when you compare, the devices are so small for him, so I think he actually needed something that would have been large to display those pictures or the writings, so that he can see from distance. That was another problem that I discovered. And also, from what I saw, during the studying most pupils were playing videos loadly and others, few of them were reading. So, for those who are reading they got problem, it was a challenge for them. They could not, actually get the things that they couldn't study because of the noise that was being produced during others were playing videos (**M:** Mhm). And also, from our timetable that we had, there was interruption of the timetable for some days. We had the examination and also with the break for holidays. So that was actually a point as a problem or difficulty for the children, for them to go through the steps that they had. Because once you stop something you have to continue. So if you break it, it means now you will forget something that you have done. To start (unintelligible) [00:10:28] again it takes you – it cost you a lot.

**M:** [00:10:31] Ja. And in this study time they were able to work on their own, independently of teachers? You helped them sometimes practically with the setup. But what do you think about, were they really able to learn independently? Or do you think they would have learned better if they had more guidance?

**LEA-MP:** [00:11:00] Mmh, most of them they liked themselves independent without the help of the teacher. The most part that they needed the help of the teacher is when there was a break of the Internet actually. So most of them they were learning independently for themselves.

**M:** [00:11:20] And did you see them learning more on their own or more interacting with others?

**LEA-MP:** [00:11:26] Most of them they were interacting. Because there were some groups and from what I saw. If, for example, when they were in group, and the teacher goes there, they keep quite. When the teacher passes out or away from them, they continue talking, interacting each other. So I found that, as I said, when a teacher or someone is there looking at them while they are doing, they get that fear. So they let to stop, then they leave the teacher to go, then they continue talking for themselves.

**M:** [00:12:01] So, now, thinking again about empowerment of children, from the setup would you recommend to leave them even more independent?

**LEA-MP:** [00:12:11] It is good with that. Maybe you – when you are – they are free doing these things, they recommend that we only leave them with instructions on what to do and then leave them freely to do themselves.

**M:** [00:12:29] And this – let’s say from the whole school, how can the whole school foster more of that self-determined learning?

**LEA-MP:** [00:12:39] That school? OK, for the school, I think, it is good to encourage pupils to – the first thing is to encourage them to use the devices that we have though they are few. We can use them in classes or lessons. And also during free time, pupils can access those devices that we have. And also, I think we can also find a way having something that can project those videos and other documents or materials that are found there, that can be seen from a distance, because we have some disabled pupils in our classes here, in our school here. So the school should work out on how we can also reach them because they are finding problems in learning during those things.

**M:** [00:13:44] So you mention already like displaying things in the classrooms. What changes did you see in the last weeks with regards to learning styles or teaching styles?

**LEA-MP:** [00:13:58] Changes that I saw, I realized that for those pupils who are not around in the research program, they have (unintelligible) [00:14:11] finding a way of sneaking inside, so that they can be with others. Some they were coming to me asking: „Teacher, may you add me in there“. But because it was a program that was set a focus on a special group I have to tell them that: „Please, wait, we are going to organize for you“. So, that’s what I saw the changes because most of them they had that curiosity of coming and joining. And also for those who are inside the program, I realized that they have developed that friendship among themselves. Because in classes, when I see when we are teaching they can’t mix. Boys they sit separately. Girls they sit separately. But when we are here, I saw some boys moving from one place joining some girls there. They discuss together. So I realized that this program has created that gender balance. Or, they can do things freely without considering gender.

**M:** [00:15:16] Very good. Now to you as a teacher, how can digital media help you in your daily routines and in the classroom? (**LEA-MP:** Pardon?) You as a teacher, how can the digital learning, e-learning help you in your daily routines and in the classroom?

**LEA-MP:** [00:15:38] OK. I, myself as a teacher, this digital learning really from what I observed, it really helps me to save time. For example, instead of using a lot of time creating materials, or when out of the school funding materials, I can see that this devices or this program contain some materials that are available there and I can use them. So it doesn’t consume a lot of time for me to go and find the materials because they are available there. Secondly, it make my teaching and learning process for the pupils to be easier because, for example when I explain something and then I ask the pupils: „Please find this one from there“ they quickly find something. For them it is also something that forces their minds. Or makes their mind master something because once something sticks (unintelligible) [00:16:46] observe something, it sticks in your head for a long time without vanishing. So, for me as a teacher I see that it

saves time. And also, it's easing my teaching processes (**M:** And–). (unintelligible) [00:17:06] then I cannot use this materials.

**M:** [00:17:11] And which challenges did you observe from system and how could the system be improved? So that it can be even better integrated in the school routines, or for their independent learning?

**LEA-MP:** [00:17:28] Some of the challenge that I saw from the system is actually, the contents that are available in the system are not matching with the current curriculum for our school or for the country. So, there are some that are not there. And there are some that are there. So this that are there, are good. And those that are not there I think we need to do something that we can at least to upload more materials for that related with the current curriculum of our country. Because it's – I can take example (unintelligible) [00:18:13] curriculums from other countries like Asia, from Asia continent. So for the pupils, so they don't – for them they don't gain something that is found in their country. Most of them, so what they do it just to see the pictures. But I know that it helps them to interact or to learn more about other things. But also we need them to know something that is found in our country. Especially culture in our country. And the other topics are not related. So that was the most problem, that are challenges that I saw from the system.

**M:** [00:19:03] And do you see, let's say if we expand the system, even let's say more content and more Internet access. What risks or problems would you envision with digital media for future?

**LEA-MP:** [00:19:20] Problem for the –

**M:** [00:19:23] If you now expand it with more content or even access to the Internet, do you envision risks and problems?

**LEA-MP:** [00:19:33] The risks will be few compared to the content that we get. So I don't think that there are a lot of risks that we can find (**M:** Mhm). Maybe for those kids as I say that have low vision, we can certainly improve something there for them. And, from the skills during studying – during teaching I realized that going around the group showing them on how to access is more difficult because once I leave one to another group, those who (unintelligible, background voices) [00:20:16] already (unintelligible, background voices) you find that they have already gone further out, they are not following (unintelligible, background voices) [00:20:24]. So it is better maybe when a teacher is using, she has something that guides them, so that they see and direct them, either by projecting them (unintelligible, background voices) [00:20:35], so each group (unintelligible, background voices), or each individual should be follow from what the teacher is displaying on the wall.

**M:** [00:20:43] OK, so these were the questions I had in mind. Is there any further comment or observation you would like to add which we didn't cover?

**LEA-MP:** [00:20:56] Comments, maybe I would like to thank you for the program that you have supported us. It has been very helpful. And if possible

that we find another way of increasing the number of the devices because in our classes we may find that we have more than forty pupils in our classes. The least that we have is thirty. So the (unintelligible) [00:21:26] devices we have twenty. So there are not enough for the pupils. And you may find that during the day someone has taken the devices. Another person, another teacher needs them. So if the teacher has to wait for the other teacher to finish, so that he can go and take them. So, it is good if we have more devices. It can be good for us.

**M:** [00:21:51] OK, thank you very much.

**LEA-MP:** [00:21:53] Thank you, too. Thank you.



### **Interview with Teacher LEA-NT**

**M:** [00:00:02] OK, thank you for participating in the trial for the past weeks. But my first question is actually further back to your own life and to your own learning. What do you think has been 'good learning' in your life? What were moments when you were still in school where you learned well?

**LEA-NT:** [00:00:23] OK, when I was – maybe I can start from Primary school. When I was in Primary school, most of the time, especially in lower classes, I was like – most of the time I depend on teachers to teach you, so that I can understand maybe some subjects. But as I grown up, especially from Standard 6, 7, I usually liked to stay somewhere and do revision on my own time (coughing). And also, in those days I liked only two subjects in primary education. I liked Mathematics and Kiswahili. And it was my best subject. And thereafter I go to Secondary. In Secondary, then, I liked Mathematics, Geography and then most of times, sometimes I can not understand maybe the (unintelligible) [00:01:37] teach you. Then after been told by the teacher and then I find a place maybe like library and then I do a revision on my own. So, it's like that. Even in University, sometimes I like to stay somewhere and to google some topics. And then I learn through media.

**M:** [00:02:01] And if you look at today, what skills and abilities do you think are most important to learn for children in Tanzania? What is most important to prepare them for their life in this new world?

**LEA-NT:** [00:02:17] The most important skills for the children or for the pupils nowadays, it is to teach them or to supervise them in how to study independently. And to build them in how to reasoning. Maybe they can learn maybe about, let's say about Ethics. Then we have to instruct them to have an ability to explain, or to think critically about it. And to introduce or to explain in front of the people without any problem.

**M:** [00:03:03] And if you look back now at the experience you had in this trial, experience or any observations. ((background noise from door)) I have more detailed questions to follow, but what is your general observation for the past few weeks?

**LEA-NT:** [00:03:24] OK, my general observation during the e-learning program here at school, I observe, sometime pupils they like to learn through videos. Because sometimes videos help them to memorize easily and to capture different ideas easily. And they like also to be independent, so that are free to join with their other pupils, to ask some questions themselves and to interact each other.

**M:** [00:04:03] And did you see or observe changes in the way the children interacted with each other during these weeks?

**LEA-NT:** [00:04:13] (coughing) Yeah. There was changes because when the program started they're like everyone treating him- or herself by using tablets. But as the days goes on then they (unintelligible) [00:04:31] interacting. You

can see that they are moving from one place to another to share some ideas. Sometimes maybe ((knocking door)), when is looking maybe Ubongo Kids and another one is reading in other chapter or other program. Then they interact, they share information (coughing).

**M:** [00:04:54] Very good. So what worked well from the system, from the e-learning system? (**LEA-NT:** Mh?) So what was working well with the e-learning system in this trial?

**LEA-NT:** [00:05:09] E-learning system enable pupils to have a confidence. They learn. They interact with each other. Then they share the information. They have the ability to introduce or to express in front of others.

**M:** [00:05:26] And what was difficult? What did not work?

**LEA-NT:** [00:05:32] Difficulties, maybe I can say the interruption with other timetables. Maybe during – we are on the program or the program is going on. Then there is another – maybe the pupils needed to do another task.

**M:** [00:05:50] So you mentioned already several times the independent learning. Yourself, when you were older, but also the children here. And this was part of the study trial here. What do you think now after this experience? Can children learn by themselves without a teacher?

**LEA-NT:** [00:06:13] (coughing) Ja. Children they are able to learn themselves. But to be supervised also it is important. Because sometimes they cannot understand. Maybe the content to be explained by a supervisor. So, they are able to learn themselves, but supervision also it is very important. Because sometimes if we give them hundred percent to be alone, then others they will do it on their own. Instead of studying, others they will play the game. Or others they will do their own activities. So, supervision also it is somehow important.

**M:** [00:07:00] And the digital learning system, how can that help with learning more independently? And what can the school do to foster that more effectively?

**LEA-NT:** [00:07:14] (coughing) OK, the school maybe can prepare a timetable. The permanent timetable for e-learning so that it can be in the master timetable and every teacher knows that there is timetable of e-learning. So that it will help even us to – (.) the system to run effectively.

**M:** [00:07:41] So that would be a change in the learning styles ((mobile phone ringing)). You have also used the system already in the classrooms. So what changes did you observe in the teaching practices?

**LEA-NT:** [00:07:59] The use of the program, the system in the classroom it is very nice. Myself, I observed, maybe sometimes I have a testing. Instead of writing on the blackboard then I use projector and then I display questions on

the wall and the pupils (unintelligible) [00:08:20]. So (coughing), the system it is very nice. Also it saves time.

**M:** [00:08:27] So that leads a bit to the next questions. How can the e-learning help you as a teacher in your daily routines or in your classroom?

**LEA-NT:** [00:08:37] E-learning helps me as a teacher, because I can summarize my topic and then I upload to the server, then we use in the classroom. And also, there is a lot of materials in the system. So it helps me as a teacher to simplify my work.

**M:** [00:08:59] And what do you think could be improved from the current setup of the learning system? How could it also be better integrated into the school routines? You mentioned timetable already, but are there other things you think that could be improved?

**LEA-NT:** [00:09:19] (...) Maybe, because we have large number of pupils (.) we add more tablets so that it can meet our needs.

**M:** [00:09:40] So assume you had now a lot more tablets in the school, maybe even additional servers. Would you still see any risk or any problems using these new digital media?

**LEA-NT:** [00:09:57] (...) Can you come again?

**M:** [00:10:10] So, assume from the technical setup, you have enough devices, enough servers. But would you still see any risks or any problems when using e-learning in the school? Even, let's assume you had Internet access. You have the system, enough servers, enough tablets, you have access to Internet. Would you see any problems or risks?

**LEA-NT:** [00:10:40] For me no problem. It is good.

**M:** [00:10:44] So these were all the questions I had in mind. Is there anything else you would like to add or share? Any further comment or observation?

**LEA-NT:** [00:10:55] Maybe I can comment that the system it is very good because sometimes a learner can access anywhere and anytime. If maybe sometimes we are tired at the noon, maybe I want to relax but in the normal class there is no time to pause until you go to lunch. But for e-learning it is easy. You pause the system. And then you go, you'll refresh. After there you come back and you proceed. So the e-learning system it is very nice and very good.

**M:** [00:11:37] Thank you very much.

**LEA-NT:** [00:11:40] Thank you.

**Interview with Teacher KAR-CR (English Summary Transcript)**

**M:** [00:00:02] Thank you for joining this study and all the work you have done in the last weeks. Now we summarize the findings, observations you have made, the experiences you have made. But before going there, if you look back when you were a child, how did you learn best? What were situations where you had 'good learning'?

**KAR-CR:** [00:01:04] He is saying that when he was a pupil the mode of instruction and learning was more theoretical than practical. So they were not able to learn practically with the Internet based systems. So they had to base on theoretical ways only. The best way during their learning was only based on theory rather than practical.

**M:** [00:01:39] And what was good learning for you at that time? These were challenges, but how did you learn? Now you are a teacher. So, where did you find good learning?

**KAR-CR:** [00:02:26] He says that the system of learning was much complicated and challenging. So, everyone had to enforce and practice personally on his or her own. So that they can make improvements. And that's why he was able to make it, now he's a teacher. Rather than relying on the ways teachers were instructing them they had to enforce on their own.

**M:** [00:02:59] And if you think now, the children of today, what skills and abilities are most important for children in Tanzania today? What skills and abilities are most important to learn for them? What will prepare them for their life in this new world?

**KAR-CR:** [00:03:50] He says that the most knowledge and skills which are important for children of Tanzania, and Karama inclusive, are those skills which are able to make the children rely on their senses rather than rely on other persons. So, everyone, teachers to empower children to rely on themselves.

**M:** [00:04:17] OK, thank you. And now back to the trial we did in the last weeks. Can you share a bit your experience, your observations? What did you observe the way the children learned with the tablets if they get time to learn on their own?

**KAR-CR:** [00:06:06] Firstly, he says that before the eight weeks trial you included some topics and subjects into the system which were reflecting those the pupils were learning in the class. So when children came learning through the system, they were much more surprised finding that what they were learning in the class was also found in the system. So even the class attendance raised. And the pupils were able to follow the class instruction and enjoy the system as well, because the topics and subjects covered in the class were also found in the system. Rather than before knowing that the system was more comprised of Ubongo Kids and some (unintelligible)

[00:07:03]. When you included some new subjects and topics which were really good for them.

**M:** [00:07:11] Very good, ja. Thank you. And did you observe changes along these weeks? Changes in the way the children interacted with each other.

**KAR-CR:** [00:08:03] He says, yes, changes were observed and (unintelligible) [00:08:09]. Because before teaching in the classes was much more personally based. During the classes and sessions running through the e-learning system pupils were able to collaborate and learn together. So through that collaboration, team up in the groups, pupils themselves in teacher's absence of no guidance were able to instruct and correct one another in their group. So some pupils gained more and are able to direct others learning in the groups. Changes were observed in the way that these students were able to interact (with one?) another.

**M:** [00:08:52] One problem the children raised in several discussions before is language. That a lot of the content was in English. And they didn't understand English. What was your observation there? Did they only rely on Kiswahili content? Or did they also learn over time to work through English content in the system?

**KAR-CR:** [00:10:31] He says, really, English language was a big problem for them. And that pupils were raising questions more frequently during learning. So teachers had to use more time directing them in finding programs. But when these pupils found instructions which were Kiswahili based they were more cautious and attentive. So that they were able to follow the instruction and do much more better. But during the English language instruction the teacher had to play a big part instructing the pupils.

**M:** [00:11:11] How did the eight week trial help the children in their context here, their life context in this area? What do you think? What does it do with the children when they had the chance now to work intensively with the system?

**KAR-CR:** [00:12:34] He says that the content in the system was good. And pupils were enjoying the content. But the system helped the pupils to learn about Civics, loving themselves, loving others. So, the love between students, pupils and pupils increase quite a bit. And (unintelligible) [00:12:58] the community as a whole. Good morals between pupils raised a bit compared to before. Because what they found in the system was a reflecting point of society. (unintelligible)

**M:** [00:13:18] This is very good. And what was difficult? What did not work well?

**KAR-CR:** [00:14:03] He says that the biggest challenge was the power. We are experiencing rainy season. So sometimes the whole day without sun. And when they get time to go for the session via the e-learning, but no power. So need to postpone the session. That was a big challenge.

**M:** [00:14:31] And do you think children can learn by themselves with little or no support from teachers? Why do you think so?

**KAR-CR:** [00:15:31] He says it's very much possible for pupils to learn on their own. Because when you give them instructions about how to go through the system, search for certain kind of sessions, when you give an introduction for a certain topic today. So tomorrow pupils can go on their own search for the next topic and learn on their own without any kind of guidance or supervision. And it was (unintelligible) working.

**M:** [00:16:03] So mostly you used the system here with the children. You gave them time for their, let's say, free search that they could do. But what do you think? Can this system also change teaching practices? Can you use the system in the classroom? Or how would the system have to be so that you also use it in the classroom?

**KAR-CR:** [00:18:03] He says that it is possible to use the system to teach other pupils on whatever subject, provided the subject is inserted in the system. And doing so, we can use projectors. With reliable power available we can project the subject being inserted. And sometimes the teacher cannot be available here. As long as the topic is inserted in the system, have got instructions, and there is a voice of a teacher giving good instructions, teacher can give instructions to the fellow staff over there. And when the teacher responsible for the given subject being not available, another teacher can handle the situation and pupils can still learn.

**M:** [00:19:00] And how can the system help you as a teacher in your daily routine?

**KAR-CR:** [00:19:48] He says that in teaching activities the system plays a (unintelligible) [00:19:55] role. The system can be used as a reference in modifying teaching materials to the subject of concern. The teacher can go through the materials in there and prepare teaching materials for student und student can learn very good.

**M:** [00:20:15] What could be done to improve it? From the way you currently see it. Except for the power issue. But the system itself, how could it be better? And also, how could it be better integrated in your school routines in future?

**KAR-CR:** [00:21:46] He says that the system can be improved by adding materials with more reliable classes, respecting classes. Also, despite of power you can add more applications. Also, you can modify the language of instruction, provided that English language is a greater barrier for our children. As most of them they know much local languages. And even they try a bit, they know Kisuahili. So if we improve the language of instruction from English to Kisuahili the student would enjoy more and pay more attention. The teachers will be free to use the system in the classes of their choice.

**M:** [00:22:35] Do you see bigger risks when using more e-learning in future?

**KAR-CR:** [00:23:44] He says that the percentage of risk is very small. Provided that, sometimes there can be a risk, but for a very minimum, when the system or tablets are not available in the future. And provided that pupils are now used to listen and look themselves on the tablet while the teacher is teaching, instructing. And in the future the tablets are not available, so teaching that writing on the blackboard and pupils are listening can be more challenging and can be risky. That pupils can not pay good attention to the instruction from the teacher because from the raw level they're used to use tablets and the e-learning. That's the risk he is cautious of.

**M:** [00:24:44] I'm coming back to one point you made earlier, because that is a very specific, interesting point. You mentioned that there is the possibility that, because you may not be enough teachers, so you send part of the class here to listen to instructions from the system while you teach then a smaller set of students over there. Did you actually do this several times? And what was your experience with that?

**KAR-CR:** [00:26:11] He says that despite of the small number of staff available at the school the system can, and has been used to simplify work. Sending a portion of pupils in here and listen to the instructions and attend the other class. And the system has been functioned and try to simplify work. Because sometimes teachers cannot be much enough attend all classes. So the system has been simplifying the work.

**M:** [00:26:42] These were all the questions I had in my mind. Would you like to add any further comment, any observation?

**KAR-CR:** [00:27:40] He says there is a bit of a challenge. When selecting a small portion of students who are coming here to attend the session would be (unintelligible) [00:27:51] in respect to the number of tablets available, being twenty. He was able to select twenty students to attend the class here. So, the selection process was much difficult. Some students were feeling isolated and classes developed between the same class. Something that those twenty students are the only ones who are supposed to attend the e-learning session. So, that was a bigger challenge selecting the students to attend the class here.

**M:** [00:28:29] So the others are looking forward to now get on as well?

**KAR-CR:** [00:28:54] He says that he is looking forward to try to mix. When the twenty students are now able to use the system, he should now pick other twenty. (unintelligible) [00:29:10] So that all of them can acquire the knowledge of using the e-learning system.

**M:** [00:29:17] Thank you very much. This is very valuable feedback.

### **Interview with Teacher KAR-KE (English Summary Transcript)**

**M:** [00:00:08] If you look back at your experience as a pupil, what did you like about school? What was difficult for you?

**KAR-KE:** [00:02:01] He says that the experience during his time as a pupil – he experienced different situations which were more challenging. And the main (unintelligible) [00:02:21] he was liking was making much efforts in learning. Being more and much closer to his teachers, try to learn from them. If find anything confusing, any problem, try to consult them and get appropriate instruction. But something which was a bit difficult for him as a pupil at that time was another availability of learning materials, especially books. Because at that time the main (unintelligible) [00:02:57] was books. So books were not enough at school and he was not able to access enough books. So that was a bit challenging. Provided that the given challenge was affecting him, but he tried as much as possible to try to look for extra learning time with other teachers in the streets. And his father was supporting him. Try to pay for (unintelligible) [00:03:24] extra times from morning to evening and when he came back from school at 2:30pm. He had to go for the special extra learning in the street with other teachers. And he was able to make it. Of now, he is a teacher.

**M:** [00:03:46] So then, what skills and abilities are most important today for children in Tanzania? What will prepare them for their life?

**KAR-KE:** [00:04:48] He says that the main tool and skill to empower these children is how they can use the technology in fighting the change situations of (unintelligible) [00:05:00] environment. As of now, if situations are more raising and the technology is on the way, we can solve the problem. So we should empower the children with the technological skills and knowledge. So that they can get the knowledge of technology at school and at home to try to reach a better life.

**M:** [00:05:22] Now looking at the past weeks, the trial here in this school, what were generally your experience and your observations?

**KAR-KE:** [00:06:16] He says that (the big of the vision observed was?) But pupils were able to use tablets on their own. But the bigger challenge was, some pupils outside the session were struggling to learn with the other students in the class in here. So there was a confusion between these two groups. The one being responsible to learn is of the arranged time, but the other want to learn also through the tablet. That was a bigger challenge.

**M:** [00:06:54] And did you observe changes in the way the children interacted with each other? ((mobile phone ringing))

**KAR-KE:** [00:07:39] He says that during the time of the eight week trial a bigger number of pupils were more possessive in learning on their own. They just wanted to learn things which they were more interested in. But every student was concentrating on the tablet of his or her own, try to explore more



on the programs and things they were interested in. So that's the bigger observation.

**M:** [00:08:15] And how did this interaction with the tablets and the system help the children for their life context?

**KAR-KE:** [00:09:18] He says that in the context of the environment pupils are living in, even just normal phones is a problem. So, being able to engage students using tablets was able to help the students „Be not afraid of using phones, be not afraid of using the technology in exploring and finding learning materials“. So, it has helped them in a way that these students are now not afraid of using the technology. So, they are now cautious of that technology can help them in learning, can help them in every kind of problem.

**M:** [00:10:04] And what was difficult? What did not work well?

**KAR-KE:** [00:10:49] He says that the bigger issue was how these pupils were able to use the system to learn effectively. Despite that they can solve one plus one is equal to two. But the assurance that the answer is two. And how to go manually to get these two. That was the bigger issue that he thinks it is challenging. As of today some of them cannot use the system effectively. To go through and find question, try to find answers using the system. And be sure that these answers are correct.

**M:** [00:11:29] Do you think children can learn by themselves with very little or even no support from teachers? Why do you think so?

**KAR-KE:** [00:12:43] He says that it is difficult for pupils to learn independently without any guidance or support from the teacher. Because sometimes you can elect the pupil that today we are going to learn this kind of topic. And try to help them find materials in the system. But if you leave the class and get to the other class, pupils will take the chance to logout and go to explore other materials of their interest. So with no guidance, you find difficulties for pupils to learn properly.

**M:** [00:13:20] And, generally, what do you think the school could do to foster more self-dependent learning?

**KAR-KE:** [00:16:13] He say that firstly, we should try to balance the ratio of tablets available and the number of students. So if we want to teach or try to instruct many twenty students, and we should have twenty tablets available. And with no supervision or guidance for our kind of pupils we have it is more complicated to assure all of them can learn perfect independent without guidance. So, with no guidance it is difficult. But also he is suggesting that we can try to make the system, that if someone or a teacher is opening a certain topic, a certain subtopic maybe. And all pupils are opening the same subtopic, no one can be able to logout or get back until the certain subtopic or topic is completed. That is the advice he is giving out.

**M:** [00:17:15] OK. How can the system, digital media help you as a teacher in your daily routines? And does it change teaching practices?

**KAR-KE:** [00:18:21] He say that it is help for teachers to ensure that all pupils in the class are concentrating on the topic of interest. For example, when the teacher is teaching a certain kind of topic, he can ensure and supervise that all pupils with tablet are opening the same topic and are following the topic, so that everyone can try to understand, unless kind of supervision is poor. But compared to before or the normal way of teaching, where the teacher is writing on the blackboard, some student can be lying or can be looking outside, can be looking down, but if we are using tablets with every pupil in the class and we open the same topic. Pupils can follow the instructions and learn from that perfectly.

**M:** [00:19:21] And do you see risk and problems in that system? Or what could be improved?

**KAR-KE:** [00:20:20] He is insisting that he is not obvious of any risk which can affect the usage of the system. But he is trying to insist that we can try to add the number of tablets compared to the ratio available of students. 469 – the ratio of twenty tablets available to the number of students in the school. Because some pupils for the environment they are from, everyone is trying to at least touch the tablet, but with the number of tablets available they are not able to do so. So this affect them psychologically and generally affects their performance in class, because only a slight number of pupils are able to learn through the tablets. So classes are developed among the pupils, which will affect their performance.

**M:** [00:21:21] Thank you. These were all the questions I had in mind. Would you like to add any further comment or observation?

**KAR-KE:** [00:22:05] OK, he is trying to question on the issue of server. If you can do some manouver to link the books available of the Ministry of Education and put in the server. So that pupils when they are logging into the system –

**M:** [00:22:24] Yes, we want to do this (**KAR-KE:** That is superb). (...) Thank you very much.

**Interview with Teacher NYA-JK (English Summary Transcript)**

**M:** [00:00:01] Thank you for participating in this interview. Before we start talking about e-learning I have a different question, personally. If you look back when you were a child what were situations where you learned well? What was good learning for you in the past when you were a student?

**NYA-JK:** [00:01:10] He's saying that back the days when he was a pupil ((noise from school bell)), they were struggling. And they always depend on their teacher. If the teacher was not available nothing will go on. And they were struggling just to be deployed.

**NYA-JK:** [00:01:58] He is saying that back in the days when he was schooling as a pupil the government was providing them with some materials. Books, pens and some (unintelligible) [00:02:09] staff. So he was staying away from the school. And the school is located away from home. So they are connected as pupils and they were settling in certain areas, coming from that area, going to class, and then get back from class. So they not stay at home. (unintelligible, bubbling background noise)

**M:** [00:02:33] And what were good learning for you? How did you finally become a teacher?

**NYA-JK:** [00:03:31] He's saying back days when he was at school they are struggling a lot to make sure that they can pass. But the pass marks were somewhere a bit high and very few number of students were passing exams. And he's saying that in his class there were 33 and only three pupils passed and went to Secondary school. So they are struggling a lot.

**M:** [00:03:56] And did you learn on your own if you were passing? Or what was different to the other thirty that were not passing?

**NYA-JK:** [00:04:50] He says that he was learned by his uncle who is a teacher. So when he get back home his uncle is gonna help him with some school staff. And also his parents were teachers. So he was trying (unintelligible) [00:05:03] to be like his parents. But also some other students who failed to continue with school, they're from low economy families. So they're struggling with background and parents use their family power (unintelligible, bubbling background noise) [00:05:20]. So, that's why they failed.

**NYA-JK:** [00:05:46] And he says priority in schools was being given to boys only. And the lower priority was given to girls. So ladies were supposed to stay at home, so that they can be married and the family can get some dowry. (unintelligible)

**M:** [00:06:08] What skills and abilities are most important to learn for children in Tanzania today? So which is most important to prepare children for their life today? What do you think?

**NYA-JK:** [00:08:32] He says that the Tanzanian education curriculum is well prepared to equip the students, pupils be able to rely on their (unintelligible) [00:08:42]. But the issue is, it relies more on theory than on practical. So he thinks that the theoretical knowledge and skills will be equipped to pupils to help them to be able to search the materials, learn the materials. But rather today students or pupils are equipped just to make sure they get a certificate to apply for jobs. And some low economy families are struggling, especially their pupils are not able to buy materials, proper materials to help them to learn.

**M:** [00:09:22] What is your experience now where you used tablets and e-learning in your school? What do you observe in the way children learn when they use the tablets of the e-learning system?

**NYA-JK:** [00:11:15] He says that pupils are enjoying a lot using tablets in learning. They are able to see, able to follow materials and sessions. Rather in classes when teacher gets live involved. So students have to listen just only. But now students are able to see what is going on, and reason from the materials. And he is explaining that some pupils were seen that they are not able to do anything in the class. But there is one pupil who in class is seen that it is not able to do a lot. But he's the one who is able to use the tablet (more?) effectively then the others. So despite the least number of tablets available pupils are struggling to ensure that they learn effective. And they make friendship with the teacher who is keeping the tablets. And try to help them carry the tablets. (unintelligible) [00:12:11] So they are enjoying a lot.

**M:** [00:12:19] Did you observe changes in the way children interacted with each other?

**NYA-JK:** [00:13:05] He says that the bond, the friendship among the pupils has raised a lot because those who are able to use the tablets effectively, and those who are not able to use tablets effectively are bound together forming groups in learning, rather than before. So now the friendship and the interaction between pupils have raised a lot. Those who know are teaching those who don't know.

**M:** [00:13:34] Do you think children can learn by themselves with little or even no support of a teacher? Why do you think so?

**NYA-JK:** [00:15:03] He says that pupils, children (unintelligible) [00:15:07] are raised to be guided. And be sure that they follow the materials. So he thinks that despite they can learn on theirselves and explore a lot in the tablets, find materials, he says that some pupils especially of Standard 7 are now able to explore and use the tablets more than some of the teachers (unintelligible) [00:15:27]. Because they have been using from the beginning. So till now they're able to read materials and explore everything. But the guidance and supervision of the teacher to pupils to ensure they learn effectively is more important.

**M:** [00:15:43] What was difficult when you work with the e-learning system? What does not work?

**NYA-JK:** [00:16:23] He thinks that for his side he is experienced using technology for materials. He's seen that it can disturb him for (unintelligible) [00:16:45]. But I think that if he was able to get a projector, something to project, and pupils can be able to follow on the projection, it will be much more good. Because there is a lot of numbers for their school want to improve the system. Despite that the Internet stability sometimes affect the learning.

**M:** [00:17:11] That leads already to the next question: How could the system, the e-learning system help you as a teacher? And how could that change your teaching practices?

**NYA-JK:** [00:18:01] He says that the bond between teacher and pupils is increased because the teachers and pupils are now closer, much more closer to each other. So the relation is raised.

**NYA-JK:** [00:18:58] He says that the e-learning system is improving his teaching skills and the ways to prepare materials. But he thinks that if you could ensure that the teacher is the one who take control of the system – In the tablets even if pupils are able to log in and find materials. But materials should be arranged in series. A teacher should arrange certain topic and all pupils are able to follow. Still right now, pupils are able to log in the system and find materials of his interest rather than a teacher being around a topic after the other.

**M:** [00:19:41] There is the free learning with the e-learning system, where the children are free to explore. And there would be the e-learning system in the classroom, where the teacher guides and shows and displays things with the projector. What would be more important for you?

**NYA-JK:** [00:20:48] He says that the two systems are all important. But it depends on the situation. For example, the system that a teacher is in control is much more important. Because if he's or she's directing a certain topic then all pupils have to concentrate on the topic and ensure that they understand the materials. And the other system where the pupils are able to explore everything they are interested in is also much more important. Because pupils can explore materials they are more interested and show their abilities on topics of their interest.

**NYA-JK:** [00:21:37] So that system can help the teacher explore and identify that a certain pupil is much more competent in a certain topic or a certain area and try to help student advance in a given area.

**M:** [00:21:53] And do you see any risks or problems using e-learning? Or how could the system be improved to mitigate risks and problems?

**NYA-JK:** [00:23:29] He says that currently he sees no risk for using the e-learning system in teaching the pupils. Because the technology is advancing

daily. So we should go with technological changes to ensure that we do each and everything with technology. Because they were in their time when their pupils they used to use hard materials, analogue. So now the technology is advancing, so is good. Go and practice everything with technology.

**NYA-JK:** [00:24:33] He's trying to give ((door slam)) explanation that during their time they used to write exams using the pens, but now they are printing exams. And during that time they used to walk long distance and try to find the examination class to the Regional Commissioner's Office. But now, special registration is been done in the system. Every kind of communication done in the system. Even results of the examination can be found in the system. So the technology is trying to modify and simplify live. So the e-learning is super.

**M:** [00:25:08] Thank you. These were all the questions I had in mind. Do you have any other observation or any other comment we didn't talk about? (**NYA-JK:** Yes)

**NYA-JK:** [00:26:14] He's explaining that he would wish the explorers and apps, those that are not around in the tablet to be free, so that teacher can try to use the explorer as in their Google phones and all the apps to move and find materials for teaching the students and pupils. So that he can create (unintelligible) [00:26:37] the tablet and try to set the password. So pupils when using the tablet are not able to assess the materials. If the teacher responsible for the materials can pick the materials and introduce to pupils. Also stable Internet, the Wifi, giving example that one that we are using at the office there at Rukoma AP would be much more to try ((door slam)) to explore materials, learning materials, which will be more helpfull for teaching and learning.

**NYA-JK:** [00:27:46] Again, he is saying that the number of tablets is not enough as pupils are eager. They want to learn through the system. And you see the class is sometimes being congested. One tablet can be used by a number of pupils. Some pupils of course are troublesome. So when using the tablets, it can be damaged. And the congestion of amount of pupils using the tablet and server sometimes is high. (unintelligible) [00:28:17] So he is suggesting that even two tablets per class would be at least enough (clarifying: **NYA-JK:** One per two pupils).

**M:** [00:28:34] OK, thank you very much.

### **Interview with Teacher NYA-JR (English Summary Transcript)**

**M:** [00:00:03] Thank you very much for participating in this study and being available for the interview. My first question is actually a personal question. When you were a child, what was 'good learning' for you? What were situations where you learned well?

**NYA-JR:** [00:01:52] She says that back days when she was a pupil, they were used to learn through major methods. The first method, when they were five to six, they were being taught by their older brothers and sisters and their home guardians or parents at home before joining the schools. But when they were seven to eight they do go in centers. Special centers like catholic centers where they were taught spiritual education. And the word education means class materials and the major ways they've been using in learning with children.

**M:** [00:02:32] And what was good learning for you in that time?

**NYA-JR:** [00:03:35] She says back days when she was schooling there are few pupils in the classes and teachers being available. So the class was composed of few pupils and only they're used in three subjects: counting, reading and writing. Just the three subjects. That's the way they used to study.

**M:** [00:03:59] What skills and abilities are most important to learn for children in Tanzania today? Which is most important to prepare children for their life today?

**NYA-JR:** [00:05:35] She says the government curriculum is insisting more on easing students with the knowledge to make them be self-reliant, so that they can depend on themselves sometimes like gardening, making bricks, cultivation. So that when they get back home they can cultivate and add some income, provided that currently the government employs only a small number of graduates. So pupils will be equipped and they are trying a lot to equip them with self-dependent knowledge.

**M:** [00:06:13] What is your experience and your observations in the way children learn with tablets with the e-learning system?

**NYA-JR:** [00:07:18] She says the e-learning system learning via tablets is more attractive. And pupils are more attracted to use these tablets in learning. But when their session – teacher has instructed them, the materials have been loaded in the system, a combination of audios, videos, that when, even if they are counting numbers, or when elephants or some animals are being taught, different kinds. So the voice audio popping up, they can listen, they can see, they are experiencing the reality. That is so super and more attractive for the pupils. So they like more using tablets during learning.

**M:** [00:08:01] Did you observe changes in the way the children interacted with each other?

**NYA-JR:** [00:09:25] She says that the interaction has been improving day to day. But those pupils who know how to use tablets, who know how to save the materials, find the materials. Sometimes a teacher can handle the tablets to those students who know how to use the materials in the tablets. And those pupils are acting like teachers, are going to instruct other pupils unless they know how to use the tablet. So they feel comfortable. And those who don't know how to use the tablet are more bonded to those who know. So the bond and the interaction has been improving day to day.

**NYA-JR:** [00:10:10] She says that a pupil who doesn't know how to use the tablets is more likely to form fellowship with the one who knows how to use the tablet, so that they can be able now to use it in the future.

**M:** [00:10:24] Do you think children can learn by themselves with little or even no support from teachers? Why do you think so? (**NYA-JR:** [00:10:38] SANA, SANA, SANA)

**NYA-JR:** [00:10:59] She says VERY, VERY, VERY much they are able to use the system on their own without any kind of supervision, provided that you can guide them how to view a certain kind of topic, that they should go through a certain topic. And you can leave them some hours and they can learn on their own.

**NYA-JR:** [00:10:28] She says that sometimes you need to supervise them because if you give the tablets to a big number of pupils and a small number of tablets available scrambling can lead to damage of tablets. So you need to supervise them sometimes.

**M:** [00:11:48] What was difficult? What did not work?

**NYA-JR:** [00:13:14] She says there are three main difficulties experienced using this system. The first one, the issue of power. There is no electricity, no power. So sometimes you find the tablets are not charged well, so sessions cannot go on. The other one is the issue of classroom. They would like to have a special room for the e-learning session. Because classes are much more congested with a big number of students. So they have to take some students who are responsible for the session, especially the e-learning session, so that they can plan the session for e-learning. So the ones who are not responsible for sitting in the class are being taken outside and just go in the environment. And the other one is the ratio between the number of students and the number of tablets.

**M:** [00:14:21] So how can the e-learning system help you as a teacher? Or can it even change your teaching practices?

**NYA-JR:** [00:15:15] She says the e-learning system is so advantageous for her and it saves a lot of time. Because sometimes she not get tired. And she can set materials, direct the pupils how to go and just learn. Try to guide



them, try to supervise them but with very least of time preparing materials, as materials are loaded to the system. So it's so advantageous.

**NYA-JR:** [00:16:03] She says that the tablets assist you, is the realistic best. They can see what they have been taught. When you're teaching something with certain kind of animals, certain (unintelligible) [00:16:15], certain Tanzania men, or East Africa men. But before they are just used to think „How is it? How is Africa map?“ But now they can see the reality. In the tablet.

**M:** [00:16:29] Do you see any risk or problems using more of e-learning in future?

**NYA-JR:** [00:16:50] She's saying that the use of these tablets and the e-learning system is super. There are no any kind of risks. The materials loaded in are just realistic and helpful for pupils.

**M:** [00:17:05] So these were all the questions I had in mind. Is there any other comment or observation you would like to share?

**NYA-JR:** [00:18:30] She is saying that the issue of the router ((children screaming)). She cannot access or use the tablet away from the school. The router is taken away only by one teacher in the school. When the teacher is not available in school or the teacher is away for travel, a journey, then the session for e-learning (unintelligible) [00:18:57]. So that is a bigger problem she has experienced.

**M:** [00:19:03] So, thank you very much for your feedback.

**NYA-JR:** [00:19:22] She says that the e-learning system is limiting teachers how to use it. She's providing the example that the tablets being provided by the government to teachers, they can just buy some Megabytes and use wherever they are. But these tablets are limiting them. They need to use around the campus.

**NYA-JR:** [00:20:01] She says she has a godchild who is more eager to learn. And she wants to learn by seeing pictures, hear voicing. And the tablets that are provided for e-learning are so super and can help the child well. But she's now not able to teach the child because if she's away at home then the system is limited.

**M:** [00:20:31] OK, thank you very much.

**NYA-JR:** [00:20:38] She's stating that despite of all what she said, they are most thankful you bring this system. It is so helpful. They thank you very much.

**M:** [00:20:51] Thank you. This is very good feedback.

### **Interview with Teacher NYA-SE (English Summary Transcript)**

**M:** [00:00:01] Thank you very much for joining this study and being available for the interview. My first question is more personal. If you look back when you were a child in school, what were situations where you learned well? What was ‚good learning‘ for you in the past?

**NYA-SE:** [00:01:38] He says that back days when he was a pupil in the school the teaching method was way more theoretical than practical, as practical is much more difficult. And teachers were just teaching and insisting just to repeating some materials and topics to ensure that the children are strong and can keep the materials in their mind. Practicals are much more difficult and teaching materials are not available.

**M:** [00:02:12] And how did you learn? How did you finally become a teacher?

**NYA-SE:** [00:03:20] He says that the only method they were using was ‚claiming‘, trying to – they can claim, trying to repeat materials rather than understanding them. So in some (unintelligible) [00:03:33] words that where when they’re exchanging knowledges and are able to at least know that this – for example, he explained, mushroom can be claimed, they claim mushroom is mushroom but not knowing what mushroom is. But through some discussion, that’s where they discovered: „oh, mushroom“, we all learn in Kiswahili. So he says that in Secondary schools, for example, when they get to Secondary school, practical was a bit, and theoretical and neutral teaching was more emphasized. And the language, English language was a barrier. So they are just claiming, trying to repeat the materials. And he was trying to make it and now he is a teacher.

**M:** [00:04:17] Looking today, what skills and abilities are most important to learn for children in Tanzania? Which is most important to prepare children for their life today?

**NYA-SE:** [00:07:22] He says that the practical way of teaching and equipping pupils to be emphasized and (unintelligible, children shouting in background) [00:07:29] a lot. To ensure that pupils cannot rely on others and can be self-dependent in the future. For example, he’s explained that when a pupil is equipped with farming technology or farming skills, in the future, when it was (unintelligible) [00:07:44] practically in the class, and did some practicals on how to cultivate let’s say cashew or coffee, in the future he can rely on him or herself. Rather than equipping that in the theories just in writing materials. We can employ officers (unintelligible) [00:08:05] who are more able to explain what to do in practice. So we should equip pupils more practical. More emphasizing on skills which will help them do something in practical way.

**M:** [00:08:23] What are your experiences and observations in the way children learn when they use the tablets of the e-learning system?

**NYA-SE:** [00:10:11] He says that from his observation point of view pupils enjoy and are more attracted to use the tablets. Now there is use of

smartphones in homes. And pupils at their home, there are a lot of smartphones. But pupils are not able to access them, the smartphones at home. So when they come at school and are able to use tablets, they are more encouraged to learn more. And the good thing about the tablets, there are a lot of materials, Mathematics, Kiswahili, Civics. So when pupils are interested in Mathematics they can just log in the system and find Mathematics materials and try to learn. A good thing is, in our environment sometimes they are teaching in the class, for example elephants, another day zebras, rhinos. So when they go in the tablet they are able now to check some pictures, some videos from elephants. And they are more encouraged and they learn very well.

**M:** [00:11:15] Did you observe changes in the way children interacted with each other?

**NYA-SE:** [00:13:13] He says that there are two groups. Those who are fast learners with these tablets and that are more competent in using the tablets. And there are those groups of pupils who are not able to use the tablet more effectively and are very slow in learning how to use tablets. So these groups are interacting in such way that those who are less able to use the tablets are more following those who are able to use the tablets so that they can learn from those who are able to use the tablets. So the bond and friendship and interaction has been improved.

**M:** [00:13:56] (...) Do you think children can learn by themselves, even with little or no support from teachers? And why do you think so?

**NYA-SE:** [00:14:55] He says that it is possible for children to learn on their own, independent without teacher's supervision. But directing them how to go, how to use the tablets, how to search materials can be more helpful for pupils. We don't need to supervise them to ensure that they go to the materials. If we instruct them how to log in, how to find materials, they can just learn on their own.

**M:** [00:15:27] And what could be improved? What could be better? What does not work well?

**NYA-SE:** [00:16:55] He says that the tablets are not enough. The number of pupils going through this system is big. So you find eight pupils, ten pupils congested around one tablet. And the tablet is small in size. So you find that some are not able to follow the materials, are not able to follow the session. (unintelligible) [00:17:23] The school has a number of people classrooms which are equivalent to the number of pupils. So when the class special for e-learning want to go for the session a certain class is to be moved out, going around in the streets. This effects the teaching sessions. So you find some sessions are being cancelled or postponed so that the session for e-learning can go on. So he is suggesting that special rules for e-learning should be prepared, at least to assure that the e-learning system cannot affect other sessions in school. Also, he's reminding that it was promised that there are

some modifications and changes to be done to ensure that teachers are able to use the materials in the system. But this has not been done yet.

**NYA-SE:** [00:19:22] He's saying that the charging of these tablets is now complicated because the school has no electricity available. To be able to charge the tablets they will have to take them to their homes, which is not safe for the tablets. So he is suggesting that if they could have a special area or a special source of power to charge the tablets around this would be much more better.

**M:** [00:19:52] And how can the e-learning system help you as a teacher? Or how could it even change your teaching practices?

**NYA-SE:** [00:21:08] He says that the teaching materials, books are not enough here in school. Some classes, for a specific subject have two books. So he is able now to load the materials in the system. And he saw some materials in the system through these tablets. So if he has fourteen tablets and loads materials of a certain subject in the tablets, this makes now fourteen books. And he can divide and distribute with pupils in the class in fourteen groups and try to instruct and direct them on learning a certain topic. So, the system has been so helpful for him as a teacher.

**M:** [00:21:49] And do you see risks or other problems? Or things to improve that you haven't mentioned yet?

**NYA-SE:** [00:23:22] He says that he was cautious of the problem or risk if these tablets have some system of programs that the pupils could be using to search from materials and videos. But he is not sure if the tablets and the system allows (unintelligible, children chorussing) [00:23:43] searching for the wrong things. So he does not see any risk in using these tablets.

**M:** [00:23:50] These were all the questions I had in my mind. Is there any other thing, further comment or observation you would like to add?

**NYA-SE:** [00:25:01] He says (of course?) no other observation. Rather than, he's much thankful to you for supporting this system. It is so helpful for them. And yesterday they had a session with all teachers, trying to pass them through how to use the system. Mathematics (unintelligible) [00:25:20], for example, a fraction question (unintelligible, background voices) [00:25:24]. The system can try to direct you to the answer. And if you are responsible for Mathematics, your pupils can just use the tablets for teaching the students.

**M:** [00:25:37] Thank you very much.

**Focus Group Discussion with LEA-G5 (Standard 5, Girls)**

**M:** [0:00:04] So, thank you for joining this study that we did over the last ten weeks. I hope really you enjoyed it. And now we gonna wrap it up and I ask you some questions. And then each of you can respond but you can also respond as a group. So the first question is: What did you like in the e-learning system that you have used over the last weeks? So think about, what you really enjoyed, what you liked. Let's go around first, you can answer one by one. And then you can also comment to what the others have said. Maybe you can start. What did you like most?

**LEA-G5-1:** [0:00:52] I like Ubongo Kids. (.) I like Ubongo Kids and how to help your friends and (unintelligible).

**M:** [0:01:12] So how about you?

**LEA-G5-2:** [0:01:16] I like thinking Sikana because it makes us to – how we can cook food.

**LEA-G5-3:** [0:01:38] (.) I like Ubongo Kids because in Ubongo Kids I learn Mathematics, also in Civics. In Mathematics I learn decimals and counting numbers. Also in Civics I learn how to maintain relationship in the society.

**LEA-G5-4:** [0:02:04] (...) In this system I like Ubongo Kids because I learn there in Math. I learn many things like addition, subtraction and multiplication. And in Civics I learned cultures of people and we learned the tribes. Thank you.

**M:** [0:02:49] Thank you. Very good. So, you mentioned already some of the programs you liked. Other than what you have said, what were the three programs, let's say, one, two, three, four programs, that you used most during your free time?

**SW:** [0:03:15] (...) Which you used?

**LEA-G5-1:** [0:03:18] Repeat the question

**M:** [0:03:21] Sorry?

**LEA-G5-1:** [0:03:23] Repeat the question

**M:** [0:03:24] OK, so, which of the programs on the e-learning system did you use most when you had the time here? Some of you mentioned Ubongo Kids. But not only. So what other programs did you use?

**LEA-G5-1:** [0:03:41] (.) Charge power

**M:** [0:03:53] (.) You know why? (...) You just looked into it? (...) And (unintelligible) [0:04:24] next?

**LEA-G5-2:** [0:04:24] Sometimes we can't enter, is hard to get Internet

**M:** [0:04:34] Mhm. (...) How about you?

**LEA-G5-3:** [0:04:46] I also learned in Sikana in health and in – because and why I like to look in health is because I want to protect others from several deceases. And to clean environment.

**LEA-G5-4:** [0:05:14] I liked looking (...) I like looking because – I'm looking many videos of those people who are cooking food. I like to cook.

**M:** [0:06:18] So you had like one hour a day during these last eight to ten weeks. Was that sufficient? Or how much time would you like to spend? Is it or was it too much? Would you say: no, like thirty minutes a day is sufficient. Or no, it could be three hours a day. So what do you think?

**LEA-G5-3:** [0:06:57] (...) Repeat the question.

**M:** [0:07:00] So, the time you have with the e-learning system, the extra time, like this was one hour a day. And do you think that was good? Or do you think it should have been more time? Or less time? Did you use the full hour? Or did you use less of it?

**LEA-G5-3:** [0:07:30] I did not understand the question. Translate.

**SW:** [0:07:35] (repeats in Kiswahili)

**LEA-G5-3:** [0:07:47] (...) The time it was enough. And our teachers once it's reached the time for learning they call us at the time which is responsible.

**M:** [0:08:03] So you would not say you needed more time? Or it was too long?

**LEA-G5-3:** [0:08:11] We need more time.

**M:** [0:08:13] So you could have used even longer?

**LEA-G5-3:** [0:08:16] Yes

**M:** [0:08:18] OK. What do the others think?

**LEA-G5-4:** [0:08:27] (...) I need more time because I want to look the things which are there in the tablet. Like I look Ubongo Kids.

**LEA-G5-1:** [0:08:43] I like more time because I also look health, (unintelligible) [0:08:54] and sports.

**M:** [0:09:02] So how was it for you to learn alone without the teacher? Because this was different from the classroom lessons. So you were more on your own. You were free to choose. How did you like that? Or what do you think about learning independently without your teacher?

**LEA-G5-1:** [0:09:30] (.) Please repeat the question.

**M:** [0:09:32] So in this time, the extra time, during the last weeks, you had the opportunity to use the tablets without the teachers, right? Teacher was there, but he didn't run a lesson. So you were free to choose what you do, right? So how was that for you? Did you like that? Or would you like more guidance? It's so different from just following the teacher, right? (to **SW**) You want to give some explanation?

**SW:** [0:10:09] Yeah. (explaining in Kiswahili)

**LEA-G5-1:** [0:10:18] Just to get help.

**M:** [0:10:22] Sorry?

**LEA-G5-1:** [0:10:25] Teachers to give help. (coughing) I like teachers to give help.

**SW:** [0:10:37] Teachers to guide you?

**M:** [0:10:39] So did you ask the teachers in this extra hour to help you? Or did you work alone?

**LEA-G5-1:** [0:10:47] Teachers to help us.

**LEA-G5-3:** [0:10:54] I like to be with teachers because once you be with teachers, sometimes we can get no Internet and teachers can help us to find it. Thank you.

**LEA-G5-2:** [0:11:10] I like to be with teachers because other times if no charge, will help us to give us other tablet which is there for me.

**LEA-G5-4:** [0:11:29] I like to be with teachers because sometimes if there is problem, if the teachers they are absent we can't know any person that can help us.

**M:** [0:11:44] So this would be a teacher that helps you to work with the system. Like, if you are not connected, or if your tablet has a problem. But how about choosing the programs you want to learn? Because you were free to choose on your own. The teachers didn't tell you: „Go here, go there.“ Right? So how was that for you?

**LEA-G5-1:** [0:12:14] (.) Repeat the question.

**M:** [0:12:17] So, the teachers helped you with the technical setup. They helped you with the tablets, if it didn't work. They helped you with connection to the server, if it didn't work. But the teachers did not tell you: „Go to this program and watch this video.“ You were free to choose on your own, right?

**LEA-G5-1:** [0:11:38] Yes.

**M:** [0:11:39] So how was that for you? Do you like this freedom that you choose whatever you like? Or would you like the teachers more to tell you: „Go here, go there, watch this, do that“?

**LEA-G5-1:** [0:12:52] In Ubongo Kids we learn about Math fractions, subtraction, multiplication, and addition.

**M:** [0:13:03] And did you choose that on your own? Or you like to be guided to there?

**SW:** [0:13:12] (repeating in Kiswahili)

**LEA-G5-1:** [0:13:21] Yes, teachers (unintelligible)

**LEA-G5-2:** [0:13:31] (...) In Ubongo – in Mathematics I learn about subtraction of numbers, addition of numbers, multiplication of numbers, fractions, and decimals. Example: addition of numbers: two plus two is got four.

**M:** [0:13:58] And you learned that on your own? You were choosing that on your own? Or you got help?

**LEA-G5-2:** [0:14:06] I was trying to choose my own.

**LEA-G5-3:** [0:14:13] I like to choose on my own because sometimes it helped me. For example, I want to look something. I can look. And also teacher cannot do anything. I like to do on my own.

**LEA-G5-4:** [0:14:32] I like to do on my own because if I want to look something, I can look. Because if there is teacher I can listen for teacher because I can't look myself.

**LEA-G5-4:** [0:14:52] I like to look my own.

**M:** [0:14:55] Very good. Thank you. So now another question is how you learn together. Each of you had an own tablet, right?

**LEA-G5-1:** [0:15:07] Yes.

**M:** [0:15:08] But sometimes you also, I heard from the observations, you were also grouping up. So with your neighbour or even a bigger group. (**LEA-G5-1:** Yes) Tell me a little bit about how you worked together. Not with the teacher, but among you. How was that working?

**LEA-G5-2:** [0:15:29] I like to cooperate with other people because if I could not understand I got to borrow my friend to understand me.



**LEA-G5-1:** [0:15:45] I like to cooperate with my friends because if I've not understand any place in the tablet my friend will help me.

**LEA-G5-3:** [0:15:57] I like to cooperate with others because sometimes, once for example, one tablet, for example it is mine, it has finished charge, I can go and cooperate with others.

**LEA-G5-4:** [0:16:13] I like to cooperate with my fellows because sometimes, if in the Internet – if my Internet is not as good, maybe I can tell my fellow to teach me.

**M:** [0:16:31] So, how often did you learn together and how much of the time did you use on your own? To read things on your own, or to listen on your own. How much was it that you grouped together? Most of the time? Or sometimes only?

**LEA-G5-1:** [0:16:52] Sometimes only.

**LEA-G5-2:** [0:16:55] Sometimes only.

**LEA-G5-3:** [0:17:00] Sometimes only because sometimes you can get other tablet that has not been charged.

**LEA-G5-4:** [0:17:08] Sometimes (unintelligible).

**M:** [0:17:14] OK. Thank you very much. (...) So, now, tell a little bit on what you didn't like. Or what you were missing. Something where you say: well, this was waste of time. Or, this would have been better if it would had been different. Anything comes to your mind?

**LEA-G5-4:** [0:17:52] Sometimes the people in the class they come to disturb us as we are looking tablets.

**LEA-G5-3:** [0:18:08] (.) In this digital learning the thing which I don't like is that once, for example, I'm reading something, another person can play a video. That can disturb me. Thank you.

**LEA-G5-1:** [0:18:29] (.) In this digital learning the thing which I don't want is that people from the other classes to come to disturb us.

**LEA-G5-2:** [0:18:46] In digital learning, for example, I am looking tablet, person will come to disturb me.

**M:** [0:19:08] (...) So most of the things you didn't like is more that is was disturbing. So you got distraction from outside, even people from other classes, or within the group. Would you like to have headsets when you sit there? Or, then you couldn't work with others so well. Or do you have any idea how it could be better?

**SW:** [0:19:38] (repeating in Kiswahili)

**LEA-G5-3:** [0:19:48] The time for e-learning, we must only people for e-learning to come here and once they come here they are not allowed to disturb. And they can also reduce volume for those people who are reading.

**LEA-G5-4:** [0:20:09] Additional tablets, because other classes (unintelligible) [0:20:14]. In the classes there are more people, then the tablets are not enough. We have to add tablets.

**LEA-G5-2:** [0:20:29] Because charge power is not enough.

**LEA-G5-1:** [0:20:42] (.) We need additional tablets because if that another is not enough charged to bring those which are having enough charge.

**M:** [0:20:54] And above the group sessions you had here in the afternoon, did you also use the tablets in the classroom? And what do you think about using the tablets in the classroom versus using it on your own?

**LEA-G5-3:** [0:21:14] Sometimes once teaching books are not enough, teachers can tablets and go and use like a lesson plan.

**LEA-G5-4:** [0:21:31] (.) Sometimes if the books are not enough and if there are five books and the child can take other (unintelligible) [0:21:48] of tablets and got to give those to those who are missed.

**LEA-G5-1:** [0:21:53] Sometimes if we are writing the test if the teachers are tired and don't want to write to the blackboard, he will take the tablets and the projector and he will give us test.

**LEA-G5-2:** [0:22:16] (...) Other time, (unintelligible) [0:22:19] there is not enough, teacher will come with other tablets and will give us story which we have missed.

**M:** [0:22:39] So what was more valuable for you? Using the tablet in the classroom or using it on your own? Where would you do more?

**LEA-G5-2:** [0:22:54] To use to my own.

**LEA-G5-4:** [0:23:08] To use my own because if I'm here in the class I'm using myself. No any person can disturb me when I'm looking at the tablet.

**M:** [0:23:21] So using it more in the classroom or using it more on your own, what would you prefer?

**LEA-G5-3:** [0:21:28] I like to use it with my fellows in the classroom because I like cooperation.

**LEA-G5-1:** [0:23:42] (...) I like to cooperate with my fellows in order if you have not understand well yourself.

**M:** [0:23:51] OK. So thank you very much. This was good input. Is there anything you want to add? Anything I haven't asked? Any observation? Anything you would tell me to help me to understand what is good and what is not good in this system?

**SW:** [0:24:19] You understand the question?

**M:** [0:24:21] If there is anything you want to add.

**SW:** [0:24:23] (repeating in Kiswahili)

**LEA-G5-3:** [0:24:32] Can I ask a question?

**M:** [0:24:34] Yes, sure.

**LEA-G5-3:** [0:24:36] Difference from (unintelligible, coughing)

**M:** [0:24:42] Sorry, could you repeat?

**LEA-G5-3:** [0:24:44] Difference from digital learning and normal learning.

**M:** [0:24:50] The difference?

**LEA-G5-3:** [0:24:52] The difference from here to the e-learning and to there in the class. (unintelligible) The difference.

**SW:** [0:25:04] The difference?

**LEA-G5-3:** [0:25:05] Yes.

**M:** [0:25:06] So, in the classroom your teacher would guide what you do. Because you have all the children in the class, it cannot just be that everybody is choosing on his own. In the classroom the teacher would give you a topic, to read something, to do an exercise, to watch something. And you would do all the same. Whereas here you are free to choose. (...) OK, any further comment? (...) If not, no problem. So thank you for all your input. And I hope you will enjoy even in future to work with that system. Thank you very much.

**LEA-G5-2:** [0:25:53] Thank you and you too.

**Focus Group Discussion with LEA-B5 (Standard 5, Boys)**

**M:** [0:00:01] OK, so thank you very much for participating in the sessions you had over the last eight to ten weeks. I hope you enjoyed this time with the e-learning system. And now I want to hear from you more about what you liked about it, and what you didn't like about it, where it could be better, or what was really helpful for you. OK?

**LEA-B5-1:** [0:00:28] Yes.

**M:** [0:00:29] So let's start. My first question to all of you is: What did you like in the e-learning system? What was fun? What was good for you?

**LEA-B5-1:** [0:00:42] Ubongo Kids.

**M:** [0:00:51] Ubongo Kids – and what did you like there?

**LEA-B5-1:** [0:01:01] I like Mathematics.

**LEA-B5-2:** [0:01:08] (whispering) Sikana.

**M:** [0:01:12] So, louder.

**LEA-B5-2:** [0:01:13] Sikana.

**M:** [0:01:16] Why?

**LEA-B5-2:** [0:01:17] Because it's – I can learn how to cook, cook all kinds of food.

**M:** [0:01:27] You like to cook?

**LEA-B5-2:** [0:01:29] (whispering) Yes.

**M:** [0:01:31] Very good.

**LEA-B5-3:** [0:01:34] Bino and Fino.

**M:** [0:01:38] Why?

**LEA-B5-3:** [0:01:42] Because it's teaching me cooperation.

**LEA-B5-4:** [0:01:53] (...) (whispering) Sikana. (louder) Sikana.

**M:** [0:02:03] What did you like?

**LEA-B5-4:** [0:02:06] How to play.

**M:** [0:02:08] How to play?

**LEA-B5-5:** [0:02:13] I like Rachel because there I start downloading textbooks.

**M:** [0:02:24] So because of – (coughing)

**LEA-B5-5:** [0:02:29] I read some books.

**M:** [0:02:33] Mhm. (...) So which of the programs did you use most of the time? You mentioned some already that you liked. But let's say, if you say two or three programs that you used most, what was that? (...) So which of the prog– There are so many programs in the Rachel system. Which of them did you use most frequently?

**LEA-B5-1:** [0:03:09] Ubongo Kids.

**M:** [0:03:11] And other than that? (...) Other programs?

**LEA-B5-1:** [0:03:22] Sikana.

**M:** [0:03:25] (...) And more?

**LEA-B5-1:** [0:03:30] And Bino and Fino.

**LEA-B5-2:** [0:03:37] (...) Tanzania Textbooks (...)

**M:** [0:03:46] So the school books. Anything else?

**LEA-B5-2:** [0:03:56] And the Wikipedia.

**LEA-B5-3:** [0:04:05] Ubongo Kids.

**M:** [0:04:10] And?

**LEA-B5-3:** [0:04:12] Bino and Fino.

**LEA-B5-4:** [0:04:20] Sikana.

**M:** [0:04:23] Other than Sikana?

**LEA-B5-4:** [0:04:26] Bino and Fino.

**M:** [0:04:28] Sorry?

**LEA-B5-4:** [0:04:30] Bino and Fino.

**M:** [0:04:31] (repeating) Bino and Fino.

**LEA-B5-5:** [0:04:35] (...) Tanzania Textbooks.

**M:** [0:04:46] OK. Different things you were using. So (.), what did you not like in the system? What was where you think it could have been better? Or something was missing? Anything that comes to your mind.

**LEA-B5-5:** [0:05:14] (...) Some days, no Internet.

**M:** [0:05:22] No Internet, or no connection to the server?

**LEA-B5-5:** [0:05:26] Yes (coughing) (...)

**LEA-B5-1:** [0:05:34] Some days other tablets, they don't have charge.

**LEA-B5-3:** [0:05:43] Interruption of timetable.

**M:** [0:05:47] So what do you think was wrong with the timetable?

**LEA-B5-3:** [0:05:56] This is when – if there is exam.

**M:** [0:06:03] So you had exams during that time? So time was not good sometimes?

**LEA-B5-2:** [0:06:12] Time to be added.

**M:** [0:06:18] So you think you could have used more time?

**LEA-B5-2:** [0:06:22] Yes.

**M:** [0:06:24] You agree?

**LEA-B5-1:** (nodding)

**M:** [0:06:30] So what do the others think? Was it enough time? Or do you think you could have – It was one hour a day, quite a lot. But you say you have used even more time?

**LEA-B5-5:** [0:06:50] (...) (all nodding) When we were reading – when others were reading, some of them they put video – They put noise pollution – Now others get –

**SW:** [0:07:09] (repeating in Kiswahili)

**M:** [0:07:16] So, I will come back to that point, but first about the timing: do you think it should have been more time? Or the time was even too much? What do you think?

**LEA-B5-4:** [0:07:34] (...) Is enough.

**M:** [0:07:36] Enough?

**LEA-B5-3:** [0:07:45] (...) Time is not enough.

**M:** [0:07:49] So was enough or not enough?

**LEA-B5-3:** [0:07:51] Not enough.

**M:** [0:07:52] Not enough?

**LEA-B5-3:** [0:07:53] Yes (nodding from others).

**M:** [0:07:55] So (.), some of you said „more time“. Why, what, where would you need more time? Because one hour a day is quite a lot.

**LEA-B5-5:** [0:08:13] (.) Because – we need more time because it's very easy to learn different things.

**LEA-B5-1:** [0:08:27] (coughing) As we are learning here and the others they (unintelligible) [0:08:33] in the class they are proceeding we (unintelligible).

**M:** [0:08:39] So you mentioned sometimes it was disturbing. You wanted to read, others were watching videos. Is there other things that you found disturbing or difficult in the study time with the e-learning system? (...) So what was difficult for you?

**SW:** [0:09:17] (repeating in Kisuhili)

**LEA-B5-4:** [0:09:30] (...) Connection.

**M:** [0:09:34] (...) Anything else? (...) OK. So, how was it for you to learn independently? Because you had your own time. You could choose what you want to do. It wasn't the teacher telling you which movie to watch or which program to go, right?

**LEA-B5-1:** [0:10:07] Yes.

**M:** [0:10:08] So, how was that for you? Did you like that? Or would you like more guidance?

**LEA-B5-5:** [0:10:19] (...) We like because in reading myself I can search anything which I want.

**LEA-B5-4:** [0:10:37] (.) I like because it did teach different questions.

**M:** [0:10:46] So you were free to choose the topic.

**LEA-B5-4:** [0:10:49] Yes.

**LEA-B5-3:** [0:10:58] (...) I like because we are free to search anything.

**LEA-B5-2:** [0:11:10] Because when I have (unintelligible, low voice) [0:11:17] any question I can search anything which I want and gain the knowledge from that thing.

**LEA-B5-1:** [0:11:27] I like because there is freedom to search any subject that you want to study.

**M:** [0:11:40] (...) And you also used sometimes the tablets in the classroom, right?

**LEA-B5-2:** [0:11:49] Yes.

**M:** [0:11:50] So, what do you think about using the tablets in the classroom? How could it be best used?

**LEA-B5-2:** [0:12:00] Because if books are not enough we can use to see books in the Tanzania Textbooks.

**LEA-B5-1:** [0:12:16] Because when the books are not enough in the class the teacher will bring and then we will study.

**LEA-B5-5:** [0:12:28] It is easier to get books.

**M:** [0:12:39] (...) If you compare how you use it in the classroom, where the teacher more or less tells you what to do, right, versus having your own time HERE, where do you think is better value for the e-learning? In the classroom, or with your free learning?

**LEA-B5-5:** [0:13:02] In e-learning free time is better because here in e-learning you see, you search, anything which we want.

**M:** [0:13:16] Mhm. (...) What do you think? (...) What do you think? It's better in the classroom? You prefer that, with more guidance? Or more the free searching?

**LEA-B5-1:** [0:13:47] Free learning is better because we get extra knowledge.

**M:** [0:13:58] (.) Beyond the classroom.

**LEA-B5-2:** [0:14:03] Because if (unintelligible) [0:14:04] a person is distracting us and we are doing our business and if we are reading (unintelligible).

**LEA-B5-3:** [0:14:28] (...) Free e-learning is better because we are allowed to search anything.

**LEA-B5-4:** [0:14:40] E-Learning is good because you can search any topic you want.



**M:** [0:14:51] Thank you very much. So, is there any further comment you have? Anything you want to share? Any observation you have made we have not talked about yet?

**SW:** [0:15:11] (repeating in Kiswahili)

**M:** [0:15:30] (...) Only if you have. (.) If not, also good. So I thank you very much that you have been part of that team. I hope you really enjoyed the time. And I hope you will enjoy even further in future.

**Focus Group Discussion with LEA-G6 (Standard 6, Girls)**

**M:** [0:00:01] OK, so thank you for joining the team, with working with the e-learning system over the past weeks. I hope you enjoyed the time with the system. And now it's time to share a bit about your experience and your observations. So my first question is easy: What did you like in the e-learning system? What was good for you? What worked well for you?

**LEA-G6-1:** [0:00:32] (.) The system was good because we are free to look for things, to search what we want from the Internet and to gain extra knowledge.

**LEA-G6-2:** [0:00:52] The system is good because we learn to look videos.

**M:** [0:00:58] Sorry, could you repeat, please?

**LEA-G6-2:** [0:01:00] The system is good because we learn to look videos and we search everything that we need. And to gain some knowledge.

**M:** [0:01:11] (...) Mhm.

**LEA-G6-3:** [0:01:13] This system is good because sometimes if you like to search any system to the tablet you get – and it gives us more extra learning.

**LEA-G6-4:** [0:01:33] This system to us is good because we can search some questions from the tablets and it help us to see what something we don't know.

**M:** [0:01:49] (...) Ja?

**LEA-G6-5:** [0:01:52] This system is good to us because it help us to learn more than in class hours. It help us to search some things and it help us to look something in videos.

**M:** [0:02:13] (...) Mhm.

**LEA-G6-6:** [0:02:16] It is good because we learn through videos. We gain some knowledge. It's sometimes different from that we use to learn in our classes.

**M:** [0:02:29] (.) OK. Thank you. And which of the programs did you like most? And which did you use most frequently? There are so many programs on the Rachel system. Which ones did you use mostly?

**LEA-G6-1:** [0:02:48] Lack of Internet.

**M:** [0:02:52] Sorry, which one?

**LEA-G6-1:** [0:02:54] Repeat the question.

**M:** [0:02:56] So which of the programs on the Rachel system, because there were so many different programs, which one did you use most, or like most?

**LEA-G6-1:** [0:03:06] Touchable Earth. I like Touchable Earth because we see culture of other countries like South Africa, China and India.

**LEA-G6-2:** [0:03:23] I always look Ubongo Kids because I learn about to care about others, how to maintain good relationship with others.

**LEA-G6-3:** [0:03:42] Always I look Touchable Earth because it help me to know the culture of different nations.

**M:** [0:03:53] (...) Mhm.

**LEA-G6-4:** [0:03:58] I like to go in Wikipedia because I can search for something which I don't know.

**M:** [0:04:08] (...) Mhm.

**LEA-G6-5:** [0:04:10] I like to go in Sikana because it's so interesting to me and I learn how to cook some other tribes' food.

**LEA-G6-6:** [0:04:20] I like Sikana also because I can see how people cook different kind of food (unintelligible).

**M:** [0:04:36] OK. Thank you very much. And what did you not like in this setup? The technical setup, or the way you had the time here. What was not good for you? What was not helping you? Or what could be better?

**LEA-G6-1:** [0:04:58] Repeat.

**M:** [0:05:00] What could be better in the e-learning system? Was there something missing? Or something where you say that wasn't presented well? Or –

**LEA-G6-1:** [0:05:12] We sometimes lack network. We lack Internet. And the other days, tablets they don't have charge power.

**M:** [0:05:25] (...) Mhm.

**LEA-G6-2:** [0:05:33] Sometimes no Internet. And when you are searching it's questioning time.

**M:** [0:05:39] It's slow?

**LEA-G6-2:** [0:05:41] Yes.

**LEA-G6-2:** [0:05:43] And sometimes no charge power.

**LEA-G6-3:** [0:05:47] Sometimes, if you are searching something, it can not come easily. It spend a lot of time.

**M:** [0:06:00] Ja.

**LEA-G6-4:** [0:06:02] To me sometimes there is lack of time. And when get tablets sometimes there is disturbance of Internet and charge power.

**LEA-G6-5:** [0:06:16] For me sometimes there is server disturbance of network, Internet and charge power. And also, other channels they are not found sometimes.

**LEA-G6-6:** [0:06:30] As my fellows said, sometimes we lack Internet. Other channels are not found. And also no charge power.

**M:** [0:06:46] OK. So these are all let's say technical problems. Was there anything, like programs, or any knowledge, any content, where you say: I would have loved to learn something about this topic, but it wasn't there. Anything missing?

**LEA-G6-1:** [0:07:16] (...) Nothing was missing.

**M:** [0:07:20] Nothing?

**LEA-G6-1:** [0:07:22] Yes.

**M:** [0:07:23] OK. (...) And you mentioned there was lack of time. Do you mean you could have spent more time? I mean it was one hour a day. Would you have loved to spend more time? Or would you say one hour a day is just too much. I would love to do thirty minutes or so. What do you think about timing, one hour a day?

**LEA-G6-1:** [0:07:55] To add more time.

**LEA-G6-2:** [0:08:00] (.) To me is to add more time.

**LEA-G6-3:** [0:08:06] And you need to – to me is to add more time (...)

**LEA-G6-4:** [0:08:14] Use more time.

**LEA-G6-5:** [0:08:16] To increase time because the time is not enough for us to search.

**LEA-G6-6:** [0:08:22] To add more time.

**M:** [0:08:24] So you all agree you would spend MORE time. So what would you do if you had more time? Where would you need more time?

**LEA-G6-1:** [0:08:36] I (unintelligible) that different things which teachers tell me in my class and I forget, then, or I don't know them, I can go to Wikipedia and search there.

**M:** [0:08:52] So repeating what you have learned in the classroom?

**LEA-G6-1:** [0:08:56] Yes.

**LEA-G6-2:** [0:08:59] Even to my side it was like that.

**LEA-G6-3:** [0:0:06] Also me too.

**LEA-G6-4:** [0:09:09] (coughing) And me too.

**LEA-G6-5:** [0:09:12] And me too.

**LEA-G6-6:** [0:09:14] And me too.

**M:** [0:09:16] OK. How was it for you to learn on your own? Because this was different than the classroom. The teachers were there to help you a bit with the setup, but the teachers did not tell you what to do. So how do you like learning on your own? Is that good for you? Or would you like more guidance from a teacher when you have this time with the e-learning system?

**LEA-G6-6:** [0:09:49] Not teacher, but cooperating with my fellow pupils because it's sort of cooperation to us.

**M:** [0:10:01] So you, when you were using the system in that extra time, you were working in groups frequently?

**LEA-G6-6:** [0:10:09] Yes. (all agree)

**M:** [0:10:11] You all agree?

**LEA-G6-3:** [0:10:12] Yes. (all agree)

**M:** [0:10:17] (.) So how was it to work in the group? Who was saying what you are doing now? Was that just somebody had something to show and others were joining? Or how was that cooperation working? (...) So, because nothing was guided, nothing was given, a topic. So how did you come up in a group to search for something in a group rather than alone? It was because your neighbour asked you to look at it? Or how did that work?

**LEA-G6-5:** [0:11:02] If you are interested in anything (unintelligible, low voice) [0:11:05] with your fellows.

**M:** [0:11:08] Mhm. (...) Any idea? (...) So how much of the time did you use to work in a group? With two or three people rather than alone. Was it most of the time? Or did you work mostly alone?

**LEA-G6-6:** [0:11:36] Most of the time.

**M:** [0:11:38] In groups?

**LEA-G6-6:** [0:11:39] Yes. (others agree)

**M:** [0:11:41] And, did you then watch videos together? Or did you discuss things? What was the group doing?

**LEA-G6-4:** [0:11:55] (.) Please repeat the question.

**M:** [0:12:00] So when you were working in a group, did you watch a video together? Or did you also discuss things in the group?

**LEA-G6-5:** [0:12:10] Yes, discussing things in the group. (bubbling, others confirm)

**M:** [0:12:18] (...) Sorry, you were saying something? (...) Back to the question with the teacher. Would you have liked more guidance by the teachers during that extra hour? Or did you prefer to work on your own or with your fellows?

**LEA-G6-6:** [0:12:44] No, we need to be in groups in order to get some cooperation to understand, with my fellow pupils.

**M:** [0:12:56] Yeah, that's better than with the teacher?

**LEA-G6-6:** [0:12:59] No.

**M:** [0:13:01] Or, was it good for you that the teachers were not here? Or only, let's say, in the background? Or would you like to have more involvement of the teacher?

**LEA-G6-6:** [0:13:13] It is good teachers will be – because sometimes Internet is disturbing, we can't help ourselves, we ask the teacher to try and help us.

**M:** [0:13:30] (...) So, what do you think? Teachers or own learning? What would you prefer?

**LEA-G6-5:** [0:13:38] I prefer learning in groups.

**M:** [0:13:47] (...) How about the others?

**LEA-G6-2:** [0:13:53] I prefer to learn on our own.

**M:** [0:14:00] Because then you are free to choose?

**LEA-G6-2:** [0:14:04] (whispering) Yes.

**M:** [0:14:06] What do you think?

**LEA-G6-1:** [0:14:08] On our own.

**M:** [0:14:13] Agree?

**LEA-G6-3:** [0:14:15] Yes (**LEA-G6-4:** Yes).

**M:** [0:14:20] (.) And is there anything – So, you said the teachers they were good to help with let's say there was a connection problem or with the tablets. Would you like teachers to be involved when you have a group discussion? Or would you say: no, it's better that we can discuss among us without teacher?

**LEA-G6-1:** [0:14:42] We can discuss ourself without teacher.

**LEA-G6-2:** [0:14:47] (unintelligible)

**M:** [0:14:50] You all agree?

**LEA-G6-3:** [0:14:52] Yes. (all agree)

**M:** [0:15:00] (...) So, that leads me to my next question. Because you also used the system in the classroom from time to time. Right?

**LEA-G6-1:** [0:15:11] Yes. (all agree)

**M:** [0:15:12] That is different. There, the teacher is guiding you, what to do, right?

**LEA-G6-1:** [0:15:16] Yes. (all agree)

**M:** [0:15:18] So what was good for you using the system in the classroom?

**LEA-G6-6:** [0:15:22] It was good because the teacher will (unintelligible) [0:15:26] will bring the projector in the class. We can use to do a deep test. This is better (unintelligible) [0:15:33] than teacher writing on the blackboard which will consume a long time. So it's good to use a projector system.

**LEA-G6-5:** [0:15:45] Also to me is good because sometimes teachers give us exercise using this tablet and also bring test using projector.

**LEA-G6-4:** [0:15:59] (.) To me it is good because sometimes we can search something which teachers told us we can search it through the tablet. And sometimes help us to – we can spend more time.

**LEA-G6-3:** [0:16:19] To me, if for example, if no books there is, but if there are not enough to all pupils, teacher will bring for us tablets and we'll go to the textbooks. We'll go to find textbook and we use it. It helps us very well.

**M:** [0:16:50] Mhm. Yes.

**LEA-G6-2:** [0:16:52] It helps us to give us questions and sometimes if you don't know the answers, they give us answers.

**M:** [0:17:01] The teachers helped with the answers?

**LEA-G6-2:** [0:17:05] Yes.

**M:** [0:17:12] (...) Mhm.

**LEA-G6-1:** [0:17:15] Search questions from the tablet, then we'll – there is (unintelligible) [0:17:22] check for us. And then, if it is written correct or incorrect. If it is correct, we continue with other questions. So it's also self-time.

**M:** [0:17:35] OK. Ja. Thank you very much. If you compare using the system in the classroom, or using it here, more independently, what do you prefer?

**LEA-G6-1:** [0:17:54] (.) I prefer using it in my class.

**M:** [0:17:59] Why?

**LEA-G6-1:** [0:18:01] Because it helps me in searching different – because I can go in different textbooks and look and search the information about the same topic. I can go to it. If it has exercises, I can do it. If there is a hard question I will ask my teacher to try and help me.

**M:** [0:18:32] (.) Before, we said: if you have questions, you better do group discussions with the fellows, and no teacher. But in classroom you have the teachers. But that's what you prefer?

**LEA-G6-1:** [0:18:48] I prefer going to my teacher.

**M:** [0:18:52] How about the others? Learning on your own or learning in the classroom?

**LEA-G6-2:** [0:18:57] Learning in the classroom. (bubbling, others confirm)

**M:** [0:19:01] You all agree with that?

**LEA-G6-3:** [0:19:02] Yes. (all agree)

**M:** [0:19:06] (.) OK, interesting. (...) Did you see any change? Because you have used the system before, not as frequently as in the last weeks. So only in the last weeks, you had time most days of the week. Did you see any change the way you worked with the e-learning system?

**LEA-G6-5:** [0:19:37] Yes. I think there're changes. Because in the classroom I was really happy because we used tablets frequently and enough. (unintelligible) [0:19:49] understand more than in the classroom.



**M:** [0:20:00] (...) How about the others?

**LEA-G6-1:** [0:20:05] As she said.

**LEA-G6-2:** [0:20:10] (whispering) Yes.

**M:** [0:20:12] Same thing? (all nodding) So, that concludes – One last question: Is there anything we have not covered? We have been missing? Any other observation you have? Or any comment you have, that we didn't talk about?

**LEA-G6-1:** [0:20:40] (...) Maybe interaction of timetable. For example, (unintelligible) [0:20:45] support examination, so we cannot use tablets. (unintelligible)

**M:** [0:20:53] So sometimes there were conflicts with the timetable?

**LEA-G6-1:** [0:20:56] Yes.

**M:** [0:21:02] (...) And, other than this one hour per day, you didn't have a chance to take a laptop than in that week, you just missed it?

**LEA-G6-1:** [0:21:16] Yes.

**M:** [0:21:17] OK. Alright. So thank you very much. This is very valuable feedback. I hope you enjoyed the time with the e-learning system. And I hope you will continue to enjoy it while you are continuing to use it here in the school.

### **Focus Group Discussion with LEA-B6 (Standard 6, Boys)**

**M:** [0:00:01] OK, so you had a chance to work with that system for several weeks. Now we are here to share some of your experience and observations. So the first question is: What did you really enjoy? What did you like in that system? What was good in that system for you?

**LEA-B6-1:** [0:00:20] In that system the good thing was a lot. In some engines we can search something which we thought in the normal sessions. And you get a special answer.

**LEA-B6-2:** [0:00:44] In that session doing very important things. Example, when you go in Ubongo Kids you can learn different subjects like Math, Social. And in Math you can learn different topics. So this program helped us in different and in many things.

**LEA-B6-3:** [0:01:10] In this program, in Namibian content, for example, you can see how to conserve environment.

**M:** [0:01:28] (...) OK, ja.

**LEA-B6-4:** [0:01:30] It's about you search the information from Wikipedia. Example, when you are in your classroom, or when you are having a question. Example, homework. You can come and search the meaning of the question. Example: US federal government. We are given that in the class and then we came to search here. You get the real answer. It is the government which is under – is the state which is governed by one country. Many countries are under that branch. Example, United States of America. It has many states. UK, United Kingdom, many countries that are under one state.

**M:** [0:02:12] So that would be a follow up to the classroom. You can search for things from your homework, right?

**LEA-B6-4:** [0:02:19] Yes.

**M:** [0:02:20] And which of the programs did you like most? Which did you use most frequently?

**LEA-B6-1:** [0:02:29] The programs which I most used is Wikipedia and Ubongo Kids.

**LEA-B6-2:** [0:02:40] The program which I like most, it is Sikana.

**M:** [0:02:45] So, why Sikana?

**LEA-B6-2:** [0:02:47] Because in Sikana we learn different things like games, and how to cook, how to play football game, and in health.

**LEA-B6-3:** [0:03:00] In this system I like to click for Touchable Earth and Namibia Content.

**M:** [0:03:09] Touchable Earth and?

**LEA-B6-3:** [0:03:12] Namibia Content.

**M:** [0:03:15] Sorry?

**LEA-B6-3:** [0:03:17] Pictures from Namibia.

**M:** [0:03:19] Namibia?

**LEA-B6-3:** [0:03:20] Yes.

**M:** [0:03:22] Ah ja. And why?

**LEA-B6-3:** [0:03:25] Because in Touchable Earth you can see different cultures of different countries.

**LEA-B6-4:** [0:03:35] In that program of e-learning I always prefer Wikipedia because if there are some questions, hard questions in the class. Teachers are teaching. You cannot understand well. Then you can come here to the Wikipedia and search. And then you get the real answer. Then you understand well by the explanation given there.

**M:** [0:03:55] OK, thank you. And what comes to your mind what didn't work? Where were things missing? Or, where you would say you would love the system would be somewhat different?

**LEA-B6-1:** [0:04:14] Sometimes when I miss Kolibri and I get there is no Internet.

**LEA-B6-2:** [0:04:29] (.) Sometimes in this program there is shortage of power supply. And sometime other people are – it is difficult to get some coordinate in different things. Example, when some people search Rachel Home they don't know how to get that program of Rachel Home.

**M:** [0:04:54] And sometimes they want to search for something but they don't know how to find it?

**LEA-B6-2:** [0:05:00] Yes.

**M:** [0:05:04] That's a very good point.

**LEA-B6-3:** [0:05:09] Shortage of time.

**M:** [0:05:14] Mhm, I will come back to that.

**LEA-B6-4:** [0:05:17] For example when you're here, some of the people when you are using your tablet, others they are, example review a video when you search information from Wikipedia. And then you are reading, others they are putting high volume there. And then you can not able to continue with your literature review. And sometimes there's issue of power. Connection is a problem. And the shortage of time.

**M:** [0:05:48] So, two of you mentioned „not enough time“. So what do you think? This time you had, like one hour a day, you would love to have more time? And what would you do if you had more time? Or do you say: that was time enough, or could have been even less. But if you want more time, what would you do with it?

**LEA-B6-1:** [0:06:15] We need more time because sometimes if we are late from the class, when we get here, the time got already consumed here. And then we cannot use the one hour. We maybe use half an hour.

**LEA-B6-2:** [0:06:36] Sometimes we need time, and there is some difficult that if we need time. If we get time, sometimes in the class the teachers are giving students work. And then it's better to do the time which there is no class. Because when we are in e-learning and then teachers are giving the students work. As we have reached there we can see there is work, and then we have no time to work.

**M:** [0:07:08] So you would sometimes need more time for homework?

**LEA-B6-2:** [0:07:11] (whispering) Yes.

**M:** [0:07:14] Ja?

**LEA-B6-2:** [0:07:16] Yes.

**LEA-B6-3:** [0:07:17] Repeat the question.

**M:** [0:07:19] You said „time, shortage of time“. So if you had more time, what would you use the time for with the e-learning system?

**LEA-B6-3:** [0:07:32] When we get more time we can gain different knowledges from different countries (unintelligible) [0:07:39] in the tablet.

**LEA-B6-4:** [0:07:49] (.) Example, when you have time for the e-learning program, sometimes when we are searching things, we have not finished to read that, the time is not enough. And then the teacher is saying „Shut off the tablets“. And then you are going through there, we are coming to the presenting sorts of view, what you have visited in the tablet. And sometimes you cannot explain well because we have not finished to read that because we had not enough time.

**M:** [0:08:19] OK, ja. Thank you. So how was it? Because this time was for you to learn independently. The teachers were there, but they didn't give you

specific guidance. How was it for you to learn independently without the teacher? So how – because many times you get very specific tasks from the teachers. He tells you what to watch and what to read. Here you were free to do. How was that for you?

**LEA-B6-1:** [0:08:54] It was good for us because here in e-learning you are free in searching your (unintelligible, coughing) [0:09:01]. But there to the normal sessions you cannot able to (unintelligible) [0:09:05] because (unintelligible) is shared with the class.

**M:** [0:09:10] And you liked that?

**LEA-B6-1:** [0:09:12] Yes.

**LEA-B6-2:** [0:09:14] It is better when we study independently because when we are studying independetly we can get many things done being guided by teachers. Because if we are doing things and searching things ourself is better than teachers guide us. But sometimes when we are independet, we can get many things from that. Thanks.

**LEA-B6-3:** [0:09:46] We can gain knowledge from – when we are studying independently I gain more knowledge than from normal classes. In normal classes they are following timetable.

**LEA-B6-4:** [0:10:06] (...) Example, we are here, we are studying independently. There are times in the normal sessions, there are teachers when they are teaching, example, the teachers were going slow, and sometimes they are going fast. Because of those who are very slow to understand, and sometimes teachers they are going slow. They are (unintelligible) [0:10:26] to understand. And you are to gain extra knowledge. But teachers they are (unintelligible) [0:10:30]. They are teaching until those that are slow to understand – But here, when we get the example, question there, teachers were slow. Example, when the exam start they are not able to answer questions. But when you are here, the knowledge you get from the class they will be confirmed from here. By how? We are going – example, when the teaching is giving questions you have not understand, or you have understand. Example, when you don't know the answer to that question when you come here, you search, you get your answer. Teachers in the classroom, they are teaching. There are those who are slow to understand. And the teachers are still teaching. When we are here we continue to finish the syllabas alone. By how, we are going to the – you are confirming the topic. We happen to have a list of topics. We are going – we already finished this topic because teachers in this topic, they don't want – they are slow to understand. We continue with the next topic. You read there. And if there is any difficulties you come to search here and then you get the answer.

**M:** [0:11:38] So you can go with your own speed?

**LEA-B6-4:** [0:11:41] Yes.

**M:** [0:11:42] What do the others think about that point?

**LEA-B6-1:** [0:11:46] It will be a real point because we may go with our own timetable searching different things. Not (unintelligible).

**LEA-B6-2:** [0:12:07] That point is good because when teacher is teaching something, you can know the things. And before you can know. For example, teacher is teaching whole number. And you, if you come here, you can know about other topics like decimals, and you can, when teacher is teaching in the class, it's simple to answer the questions and to answer different things.

**LEA-B6-3:** [0:12:33] It's good because in the class they are using slow motion. And here, when come use tablet, you can use time.

**M:** [0:12:46] Ja, OK. Thank you very much. (.) So, when you were here in the group, did you mostly learn on your own, like reading on your own, or watching specific videos on your own? Or did you go together in groups? Did you learn with your colleagues?

**LEA-B6-1:** [0:13:12] Sometimes we are ourselves for the own reading because when we are look sometimes another person will be – dislike what you said. Different from the Internet. We like on his own. Now for each matter to be for all. But sometimes in groups it may be you are leading the person who search for his own. Another person did not like that.

**LEA-B6-2:** [0:13:48] Sometimes it's not very good to search in groups because when you like to search something other person can say „I don't want that, I want this“. So sometimes can bring quarrels. It's sometimes better to be yourself. And some days yourself and some days we are in groups. Because there is sometimes shortage of power, then we can share. Even if we can share, it's good because we can gain many knowledge.

**LEA-B6-3:** [0:14:24] (.) It's good for (unintelligible) [0:14:26] together because when we are (unintelligible) we can gain more knowledge from our fellows.

**M:** [0:14:38] (.) So you say the time working in groups was even special value for you?

**LEA-B6-3:** [0:14:46] Yes.

**M:** [0:14:59] (...) OK, how about you?

**LEA-B6-4:** [0:15:01] When we are, example, when you are staying in your groups, sometimes there is shortage of power to the tablet. You can stay in groups. (unintelligible) [0:15:08] some of the people that remain in network, they are coming from one class. And there is a question which is difficult and you didn't understand in class, you can go to the tablet. We search together. (unintelligible) [0:15:20]. And some days, we have get this question one way (unintelligible) [0:15:29]. In the class we are getting difficult question. So let's

say we get difficult question. So it's (unintelligible) [0:15:34] to state in one tablet as we discussed together.

**M:** [0:15:43] (...) So how much of the time you would say did you use to learn on your own versus learning in groups? In the time you had here in the e-learning system, how much of that time did you use to read on your own, alone, versus to discuss something in a group?

**LEA-B6-3:** [0:16:19] Time?

**M:** [0:16:20] Ja. Was the majority of time you used alone, or was the majority of time in groups? Like two people, three people, four people, or more?

**LEA-B6-4:** [0:16:34] How much time we used together or on our own?

**M:** [0:16:38] Yeah. What did you use more? More time alone? Or more time in a group?

**LEA-B6-4:** [0:16:43] More time we used to study alone. Because sometimes, when we are in the class and the person is having his own book, then you read the book and read some difficult question and come to use alone the tablet. Search yourself, use alone.

**LEA-B6-3:** [0:17:05] Repeat that question.

**M:** [0:17:07] So did you use more time to work in a group? Or more on your own, alone?

**LEA-B6-3:** [0:17:15] More on my own.

**LEA-B6-2:** [0:17:20] (.) I use more time on my own.

**LEA-B6-1:** [0:17:25] To me, I (unintelligible) [0:17:27] time on my own.

**M:** [0:17:33] (...) And now, in those weeks, you had specific time, extra time. More than you used to have in the past. Did you see changes in the way you used the e-learning system? (**LEA-B6-4:** Changes?) The way you used the system, did that change because of the time you had to work with it?

**LEA-B6-4:** [0:18:04] On my own I have seen change because I always bring the question which have the class to understand. And I come here and I get extra knowledge from (unintelligible) [0:18:16]. When I come I want to search only something. Example: unit number definition. One opportunity read the explanation (unintelligible) [0:18:26] and get extra knowledge from many examples I get.

**LEA-B6-3:** [0:18:34] When I found a difficult question in the class I bring the tablet then I search (unintelligible) [0:18:40] in different tabs.

**LEA-B6-2:** [0:18:46] There is changes to be independently, searching different things. And for that it can be easily to answer your questions , whatever hard question from the class, I can come here and search it and I can get the answer.

**M:** [0:19:03] So you would say you learned better to search for answers to the difficult questions?

**LEA-B6-2:** [0:19:11] Yes.

**LEA-B6-3:** [0:19:12] Yes.

**LEA-B6-1:** [0:19:17] (whispering) Yes.

**M:** [0:19:18] So did you see any change in the way you used the system over the last weeks?

**LEA-B6-1:** [0:19:24] Yes, I see changes because sometimes I get difficult question. If I ask teacher to tell me explain. Example, I didn't understand well. I will come to search here and I can understand on my own.

**M:** [0:19:45] (...) So, you also used the tablets in your classroom, right?

**LEA-B6-4:** [0:19:54] Yes.

**M:** [0:19:55] So how do you use it in the classroom? And what do you think about the usage in the classroom?

**LEA-B6-1:** [0:20:03] We used it in the classroom. Example, when the teacher writes exercises to the blackboard. Maybe we don't know any answer. We will search there and you may get answer. You can reply to the teacher.

**LEA-B6-2:** [0:20:22] It is good to use in the class because sometimes wherever books are used you can go to the tablet and you can see the books. When teacher said on which page number. For example, you can see in the – containing any subject you want and you can gain many knowledge from the tablets. And you can see many things. For example, teacher ask to search about question containing or concerning Mathematics, you can go in tablet and you can see in book of Mathematic and you can get your answer or question, that what we want to get answered.

**LEA-B6-3:** [0:21:10] It is good, when teacher give exercise we can use tablet to answer questions.

**LEA-B6-4:** [0:21:21] (.) It is good because sometimes when there is teachers writing his questions on the blackboard, you can check the tablet. You go to – you can search the results and you go to the Tanzania Textbooks. There you search. You (unintelligible) [0:21:39] according to the question. You reveal the question related to the topic. And then you get right answer. You write the answer. You answer question or you may using tablets



**M:** [0:21:51] Ja. And if you compare, using the tablets in the classroom versus using the tablets independently, here, in your extra time, what do you prefer? (.) So if you compare the time you used the tablets in the classroom, where the teacher is guiding you, versus here, using the extra time for independent usage, what do you prefer?

**LEA-B6-1:** [0:22:23] I'm preferring to be independent.

**M:** [0:22:32] (...) And why is that?

**LEA-B6-1:** [0:22:36] Because if I am preferant related to the teacher. The teacher will say to do this while I am (unintelligible).

**LEA-B6-2:** [0:22:54] It is good to use independently because when you are in the class there (unintelligible) [0:23:00] this thing while you did not like that. So in here, to be independently is good because you can gain many knowledge and extra knowledge than in the class.

**M:** [0:23:16] (...) Mhm.

**LEA-B6-3:** [0:23:21] (unintelligible) to read independently in order to escape from disturbances in the class.

**LEA-B6-4:** [0:23:30] (...) I prefer when using it in the classes because in the classes teachers are teaching and then they agree to send here. We are just finding and then we are not cooperating according to what we understand. Example, teacher want to give you exercise. You gonna search things and then you are still gaining knowledge. According to those questions wanted. The research information from the tablets you can get. And then you can read. But when teachers give exercise then you can examine yourself how you understand. What research from the tablet (unintelligible) [0:24:14] is good.

**M:** [0:24:18] So if the system now would be only used for one thing. Either in the classroom, or in the extra time. Only one thing. What would you choose?

**LEA-B6-1:** [0:24:34] (.) Extra time.

**M:** [0:24:36] (repeating) Extra time.

**LEA-B6-2:** [0:24:37] I would chose to also use this thing in the class in order to be easier to find answers.

**LEA-B6-3:** [0:24:50] Extra time.

**LEA-B6-4:** [0:24:56] (.) I would prefer classes.

**M:** [0:25:02] OK. Thank you very much. That covered the questions I had prepared. Is there anything we did not cover? Any observation, or any further comment you would like to add?

**LEA-B6-3:** [0:25:18] Yes.

**LEA-B6-4:** [0:25:09] The difference between digital learning and the normal class sessions? Difference between this e-learning and whole class sessions?

**M:** [0:25:32] What the difference is?

**LEA-B6-4:** [0:25:36] Yes.

**M:** [0:25:37] Though, in the classroom the teacher is guiding everything.

**LEA-B6-4:** [0:25:40] Yes.

**M:** [0:25:41] You have a specific topic that everyone covers. (**LEA-B6-4:** Yes) In the free extra time, you choose the topic. You are more independent. So, both have advantages and disadvantages.

**LEA-B6-4:** [0:25:58] (unintelligible) the e-learning?

**M:** [0:26:03] Sorry?

**LEA-B6-4:** [0:26:04] Advantages of using digitally, and normally?

**M:** [0:26:10] Yeah, I mean you mentioned some parts already and others had mentioned before. There is a lot of time getting lost in the classroom with the teacher writing on the blackboard. So you save time. There is more visual to present for the teachers. You can have exercises, independently in the classroom. So that's good in the classroom setup. But here, in extra time, you are independent. You can search other topics that are not even covered (.). Does that answer your question?

**LEA-B6-4:** [0:26:47] Yes.

**M:** [0:26:48] And any other observation?

**LEA-B6-3:** [0:26:50] We need more (unintelligible) [0:26:52] programs in the tablet.

**M:** [0:26:55] More tablets and more content, you would say?

**LEA-B6-3:** [0:27:00] Yes.

**M:** [0:27:01] Which content? (...) What do you think was missing? (...) Specific ideas?

**LEA-B6-3:** [0:27:17] Yes. (unintelligible) [0:27:20] for different countries?

**M:** [0:27:23] So more like – about culture and countries?

**LEA-B6-3:** [0:27:27] Yes.

**LEA-B6-2:** [0:27:30] (...) I want different things to added like (unintelligible)  
[0:27:44] Kisuahili.

**M:** [0:27:49] So, content in Kisuahili?

**LEA-B6-2:** [0:27:52] (unintelligible) And other different things concerning history.

**LEA-B6-1:** [0:28:09] (...) Tablets to have enough charge.

**M:** [0:28:22] (...) OK, so thank you very much. I hope you enjoyed the time working with that system. And I hope you will continue to enjoy it in the weeks to come. The system is still there. So I hope you really can benefit from it.

**Focus Group Discussion with KAR-G5 (Standard 5, Girls)**

**(English Summary Transcript)**

**M:** Are you happy to be here for the session? Please feel happy, and speak loud please. I hope you have been enjoying learning with technological tools especially the e-learning system. So, would you tell me what you liked the most while learning using tablets and the e-learning as a whole? Just feel free, tell anything you liked the most.

**KAR-G5-1:** I liked calculating Mathematic problems.

**M:** Okay, so what do you prefer more while using tablets? When you instantly log in the system, what areas do you prefer or programs do you mostly use?

**KAR-G5-3:** I just liked numbers.

**M:** Very good.

**KAR-G5-4:** I mostly like programs on reading and learning Kiswahili.

**M:** Perfect. Which topic in Kiswahili do you liked most?

**KAR-G5-4:** I liked mostly Swahili proverbs.

**M:** And you? What did you like most?

**KAR-G5-5:** For me, I like Ubongo Kids.

**M:** On your side, what programs did you like?

**KAR-G5-5:** I liked Civics mostly.

**KAR-G5-4:** For me I liked Mathematics programs for calculations.

**M:** So, you learned Mathematics and now you are able to calculate Math problems effectively, right? Now, apart from Mathematics and Kiswahili, what did you like most?

**KAR-G5-3:** In this system I liked Social studies.

**KAR-G5-4:** Apart from Mathematics, I liked English language.

**M:** So we are having English people here now. Good.

**KAR-G5-5:** I like Science studies.

**M:** So you want to be doctors, treat us when sick? Nice. Now, tell me, how do you think the skills gained or learned using the e-learning has helped or is helpful for your life and learning?

**KAR-G5-3:** Yes, it helps us solve class problems and questions and tasks.

**KAR-G5-5:** It helps me to know how to read Kiswahili and Math.

**M:** Now and you?

**KAR-G5-4:** It also helps me go through and understand Math tasks and calculations.

**M:** Now, tell me, what did you not like about the use of tablets.

**KAR-G5-1:** I don't like passwords in tablets.

**KAR-G5-2:** I do not like the language, English language.

**KAR-G5-3:** English language.

**M:** Oh, so English is a major problem for you all? Apart from English language as medium of instruction in using tablets, what are other problems or something you do not like?

**KAR-G5-5:** The issue of power, charging difficulties.

**M:** Is the time for learning using these tablets enough for you to learn effectively?

**KAR-G5-1:** The time is not enough.

**KAR-G5-2:** Time is not enough.

**KAR-G5-2:** Three hour per day would be at least enough.

**M:** So have you ever learned for yourself without guidance from your teacher? How was it? Was it good? Please can you share your experience?

**KAR-G5-2:** It was not good indeed.

**KAR-G5-2:** Teacher must be available as if you go in wrong way, teacher is around to correct.

**M:** Okay.

**KAR-G5-4:** Teacher should be available and guide us so that we can go in the right way.

**M:** And you?

**KAR-G5-5:** Teacher should be there, if you go wrong for some questions he or she corrects you.

**M:** So, while learning using tablets, do you prefer learning on your own or in groups, forming team?

**KAR-G5-3:** I like learning in groups.

**KAR-G5-1:** I like learning together as we help each other. For example, fellows helped me with some difficult questions in the group.

**M:** So, are there any changes that you have experienced in the past eight weeks?

**KAR-G5-1:** Yes, I am now able to read correctly.

**M:** And you?

**KAR-G5-2:** I am now able to calculate Math problems properly.

**KAR-G5-3:** Kiswahili was a problem for me but now I can go through Kiswahili tasks right away.

**M:** So now, had your teacher given you some tasks using the tablets in your session after normal teaching class?

**KAR-G5-1:** Yes. (all agree)

**M:** What do you want now to be improved in learning using the e-learning with tablets?

**KAR-G5-1:** We want more books to be loaded in the system.

**KAR-G5-2:** I think school environment and learning environment should be improved, more classes should be built.

**M:** We are now talking on the e-learning system. What do you think should be improved or modified?

**KAR-G5-3:** I would like more tablets to be brought to facilitate effective learning with other fellows.

**M:** And you? Don't you like anything to be improved or modified?

**KAR-G5-2:** More teachers for this e-learning session should be trained, brought in.

**M:** So, how many teachers are there for e-learning?

**KAR-G5-2:** We have only one teacher available.

**M:** Thank you very much for coming and be ready to participate in this short discussion. We really appreciate your feedback. And please keep learning and working hard. May God bless you.

**SW:** [0:29:38] We thank that the Standard 5 girls they answer well the questions. And the question number one was: "What did you like in the e-learning system?" And they said, they like the e-learning system because it helped them in calculating Mathematics. And another one said it helps them in learning the whole numbers. Another one, she says she learned Kiswahili proverbs. And the last one, she says she studied Civics and Social studies. That is what they like in the e-learning system during the past eight weeks.

**SW:** [0:30:31] And the number two was: "Which of the programs did you like most?" And most of them they say they like Ubongo Kids. Also, they liked Mathematics session because it helped them to calculate, to add. That's what they said.

**SW:** [0:30:55] Number three was: "How does it help you in your daily life or long term?" They respond to specific question. They say they improved Mathematic and calculation skills. They didn't know calculation skills. Rather than three times three is equal to six. How did you get? Their teacher knows. But through e-learning they add other calculation skills that improve their learning. And another thing they say, improved reading skills. As you know we are (unintelligible). So through tablets they know how to read.

**SW:** [0:31:51] And number four was: "What did you not like or what challenges you?" One of the students says, password is a problem for her. And another one says, English language is a problem to do their learning. If she wants to search, she can't, because she doesn't understand the language. Another problem was power. In the solar system, the power is very small, because in the other day in the rainy season there is no light. So they get problem.

**SW:** [0:32:50] Number five was: "Was the time with the e-learning system sufficient?" And they say time is not sufficient for them. They need extra time. They use only one hour for that for three days per week. So they need more hours. And one suggests even three hours, she likes.

**SW:** [0:33:17] Number six was: "How was is to learn independent without your teacher?" They say to learn independently is a challenge. We lack special and important guidance or correction. Because the language is a barrier. So they can't learn themselves. Independently they can't.

**SW:** [0:33:49] And number seven was: "Did the tablets help you to learn together? Or do you prefer to learn on your own?" And they respond that to learn together is good. Because my fellow they help me. My fellow can correct me in right way. So, they don't like disturbance from teachers because sometimes teachers they confuse. Even this, you don't know it? But when she study with her friends she can tell him in a polite language. One plus one is equal to two. But if there is a teacher: How you don't know to add one plus

one? So she likes that. And others they answer, teachers availability increase attention to learn and the concentration and their guidance. So, others they like teachers availability in the class because they correct them and they give them guidance.

**SW:** [0:35:21] And number eight was: “What changes did you observe in the way you learn?” They say, some were unable to read. Before this usage of tablets they don’t know how to read, but now they know how to read. And they are able and they can read fluently. Especially the girl, she says, especially Kiswahili subject. Now she can read well. And the girl there, she says she is able now to solve Mathematic problems. For her, Mathematics was a problem, but now Mathematics is not a problem again.

**SW:** [0:36:13] And number nine was: “How could you use the tablets within your classroom lesson?” And they respond that in their sessions they never used tablets. Maybe they find a specific problem, when they come here. But there in the class they never use it. And we like to include more books in the tablets. They share that they like to add more books in the tablet. They add, teacher’s guidance and supervision is more important for effective learning to them.

**SW:** [0:37:03] Number ten, which was the last question: “Would you like to add any further comments or observation?” They say, tablets were not enough for the suitable learning for them. Another thing they said, to add more teachers. That is what they like. {anonymized - sentence with names removed} Then they would be happy. That is their comments for the questions.

**R:** [0:38:04] OK. Thank you very much for your valuable feedback. Much appreciated. And I hope you will enjoy further to work with that e-learning in future.



**Focus Group Discussion with KAR-B5 (Standard 5, Boys)**

**(English Summary Transcript)**

**M:** OK, what did you like mostly in the e-learning system? What was good in that system for you?

**KAR-B5-1:** I like the Mathematics section. Khan Academy Kiswahili.

**M:** And you?

**KAR-B5-2:** I like the Ubongo Kids section. Example, when you go in Ubongo Kids you can learn different subjects like Math. I can be able to add and subtract numbers.

**KAR-B5-3:** Me, I like Civics subject.

**M:** OK.

**KAR-B5-4:** I like Mathematics to solve questions.

**KAR-B5-5:** I like Civics subject and shapes and figures.

**M:** OK. In the tablet, when you open, which program do you mostly like to use?

**KAR-B5-2:** I like to open Mathematics programs.

**M:** And you, which programs did you like to open?

**KAR-B5-3:** Me, I like Khan Academy Kiswahili.

**KAR-B5-1:** I like the figures program.

**KAR-B5-4:** I like Civics program.

**M:** OK, you said the tablets help you. What does this tablet help you with?

**KAR-B5-1:** Help to solve Mathematics questions.

**M:** Good.

**KAR-B5-4:** It helps me to study and to get knowledge.

**M:** Good, and you?

**KAR-B5-3:** It helps me to learn the Civics book.

**M:** When you study, did that learning help you in your home place?

**KAR-B5-2:** It helps me to learn Civics subject.

**M:** When you use tablets, which program is difficult for you?

**KAR-B5-2:** English language is difficult when you're in the e-learning section.

**M:** So, which program did you not like in the tablets? Or, when you open the tablets which program do you not like to open or to share?

**KAR-B5-1:** The place or section that is not allowed to open.

**KAR-B5-2:** I don't like to go to Ubongo Kids.

**M:** You don't like Ubongo Kids section? Why don't you like Ubongo Kids?

**KAR-B5-2:** Because it doesn't add any education to me.

**M:** And you, what things don't you like in tablets?

**KAR-B5-3:** The Internet is not available in the tablets.

**M:** So you were not interested due to lack of Internet?

**KAR-B5-3:** Yes.

**M:** And you?

**KAR-B5-4:** I don't like to go to Ubongo Kids.

**M:** So during learning session, when or which days are your learning sessions?

**KAR-B5-4:** On Monday, Wednesday and Friday.

**M:** So these are the days you learn?

**KAR-B5-4:** Yes.

**M:** OK. What time are you learning during those days you mention above?

**KAR-B5-3:** From 1:00 pm to 2:30 pm.

**M:** OK. During the session with teacher, was the time enough for you to learn?

**KAR-B5-3:** The time is not enough for us to learn in one hour and half.

**M:** So, do you want this time to be increased?

**KAR-B5-3:** Yes.

**M:** Good. So, for example, those tablets, did they help you during studying or learning session? And do you like to learn when you are alone? When the teacher is outside the session? Do you like to learn alone with your tablets?

**KAR-B5-5:** I like to study in groups of three students without a teacher.

**M:** And you?

**KAR-B5-2:** I like to sit alone during learning.

**M:** So you like to stay alone all one hour of learning.

**KAR-B5-2:** Yes.

**M:** Good. And you?

**KAR-B5-3:** To stay in groups.

**M:** So you like to learn through groups. Good. What about you?

**KAR-B5-4:** I like to learn with many people.

**M:** OK, so why do you prefer learning with other people?

**KAR-B5-4:** Because we help each other to study some lesson found in the tablets.

**M:** OK. So you say you like to learn alone. Why do you prefer learning alone?

**KAR-B5-2:** Because when I enter into Mathematics program I can be able to learn how to add and subtract the numbers.

**M:** That is great. So during learning alone without a teacher, what do you like mostly when you learn independently?

**KAR-B5-1:** Mostly I like stability because I learn more, especially difficult things.

**M:** True. Are you sure there is no one outside making noise or running?

**KAR-B5-1:** Yes.

**M:** So do you like to study alone or with your teacher?

**KAR-B5-1:** We like to learn with the presence of our teacher.

**M:** Why do you prefer the presence of your teacher?

**KAR-B5-3:** It's good to learn together because when we are (unintelligible) we can gain more knowledge from our fellows.

**M:** So you say the time working in groups was even special value for you?

**KAR-B5-3:** Yes. I prefer to learn with the presence of my teacher because he will ensure we both participated without fight to touch the tablets.

**M:** OK, how about you?

**KAR-B5-4:** I consider much the presence of teacher because he will help us to solve some difficult questions.

**M:** So you like the presence of teacher because he helps you to solve some difficult questions?

**KAR-B5-4:** Yes.

**M:** Good, you both are good children. OK, so after these eight weeks of learning, what changes did you notice? And how have you increased your capacity of knowledge? So what changes did you see?

**KAR-B5-1:** I did not know to solve Mathematics question but now I can solve the question even when I am alone.

**M:** Excellent. What about you?

**KAR-B5-4:** Me, because I can add and subtract numbers.

**M:** Good, so are you able to solve the questions alone?

**KAR-B5-4:** Yes.

**M:** Wow, great. And you? What changes do you see after using the e-learning system?

**KAR-B5-2:** I can multiply numbers rather than before. Now I know how to calculate numbers.

**M:** So you can solve numbers, right?

**KAR-B5-2:** Yes.

**M:** Wow, good. So when the teacher is in the session, how are you learning during the session time? Or how are you learning when the teacher is in the class? During the class time did the teacher use the blackboard in his session?

**KAR-B5-1:** Our teacher is not using the blackboard during the study time.

**M:** So the teacher is not using the blackboard, right?

**KAR-B5-1:** Yes.

**M:** OK, so what does the teacher do during class sessions?

**KAR-B5-2:** Teacher help us to find some maps in the tablets.

**M:** Good. Another thing?

**KAR-B5-5:** To find figures, teacher helps us to find some figures.

**M:** OK, what about you?

**KAR-B5-4:** The teacher helps us to solve the question of Mathematics.

**M:** Great, let us clap for ourselves. OK, thank you, good children. So do you like to add any comment regarding the e-learning system? Would you like to add anything? Or should your teacher add anything in this session?

**KAR-B5-5:** Yes.

**M:** What kind of that addition you want in this study?

**KAR-B5-1:** Teacher should add some time for learning so that I can cover more topics found in tablets.

**M:** Good, and you?

**KAR-B5-2:** Teacher should add other Mathematics questions because those which are in the tablet we have already covered.

**M:** So, another thing to add?

**KAR-B5-3:** If possible they should add more Kiswahili and remove English because the language of English is very difficult to us.

**M:** Good. So what other things do you wish to be done in the e-learning session?

**KAR-B5-4:** To add other subjects which are not available in tablets.

**M:** So which subjects do you wish to be added in the tablets?

**KAR-B5-4:** Kiswahili subjects.

**KAR-B5-5:** Science subjects.

**M:** Which subjects do you like to be added?

**KAR-B5-3:** To add Civics and Geography subjects.

**M:** OK, do you want every student to have his or her own tablet? Or do you prefer sharing tablets during learning? Or should every student have his or her own tablet?

**KAR-B5-5:** We want every student to have his or her own tablet.

**M:** Good, so do you like the teacher to be available during study?

**KAR-B5-5:** Yes, we like the presence of teacher.

**M:** Great, what do you want to be added?

**KAR-B5-5:** They should add for us other tablets so that every student can have its own tablet during class sessions.

**M:** Thank you for your cooperation, may God bless you.

**SW:** [0:19:14] OK, now, this is the summary for Standard 5 boys. For the question number one: „What did you like in the e-learning system that you used during the past eight weeks?“ Pupils were able to respond that they liked to answer questions through the e-learning system as they were able to use the tablets efficiently. And especially the tasks and questions in Kiswahili and questions on Mathematics. And they were able to explore through Ubongo Kids and learning Civics.

**SW:** [0:19:58] Also, for the question number two: „Which of the programs did you like most and used most frequently?“ They responded that they were mostly using Khan Academy Kiswahili and were able to explore Mathematics and Mathematic figures as well as Civics. So these were the parts they were mostly able to explore through the e-learning system.

**SW:** [0:20:34] Question number three was: „How does it help you in your daily live? Or long term?“ So, they said the e-learning system is much help for them. They are now able to explore Mathematic questions and tasks and are able to try to answer them, as well as self-studies in Civics books and they are able to explore questions on different kind of subjects.

**SW:** [0:21:09] Question number four: „What did you not like? What was challenging?“ They responded that language was a barrier, and it was mostly challenging. And they needed guidance and instructions from their teacher, especially when they are learning independently. And one of the pupils stated that Ubongo Kids was one of the programs he did not like mostly and was challenging for him in learning. Also, the Internet was unstable. So they were not able to learn effectively, as Internet was unstable. Also, when the sun did not shine, effected that they were not able to get power. So, the learning was difficult, especially in the rainy season.

**SW:** [0:22:21] And question number five was: „Was the time with the e-learning system sufficient? Or where would you like more time?“ And they stated that the time is not enough, sufficient for them. And they request that

time should be extended for them to learn more. Despite the learning in three days in a week, they ask for the time of learning to be extended.

**SW:** [0:22:56] For the question number six: „How was it to learn independently without your teacher?“. They declared that learning without their teacher was good. Sometimes they were able to group themselves in two or three people, learning together, ask one another. But it was sometimes challenging as English language was a barrier for them. Some students preferred to learn independently, to explore programs, questions and tasks and do them on his own. When he starts on his own he's able to explore task of his interest.

**SW:** [0:23:47] And question number seven was: „Did the tablets help you to learn together? Or did you prefer to learn on your own?“ They have responded to the question that a number of pupils declared that they prefer learning in groups, with two to three people in a group. But some preferred learning on their own. They were able to explore questions, tasks on their own.

**SW:** [0:24:20] Question number eight was: „What changes did you observe in the way you learn?“ After eight weeks of trial they declare that they're now experiencing changes in the mode of learning. Before, they were not able to turn on and turn off the tablets, but now they are able to do that. Before, they were not able to explore effectively the programs like Khan Academy and several programs of Mathematics and Civics. But now they are able to do that. So that is the major and a great change for them.

**SW:** [0:25:04] Question number nine was: „How could you use the tablets within your class lesson?“ In their class lesson teacher can teach on the blackboard and thereafter can distribute questions and tasks and try to guide them through their tablets and respond to the given question and learn together. Also, they like and they learn to draw maps through the tablets. And they try to find and solve Mathematic figures, learning through the system. They prefer the setup for an e-learning system that everyone in the class should have his or her own tablet. And the teacher should be available to guide them through. They prefer mostly using Kiswahili and a little bit of English. They are able to use Kiswahili more than English. So they prefer that kind of setup.

**SW:** [0:26:22] Also, on question number ten: „Would you like to add any further comment or observation?“ They are adding the comment that learning independently is good but teacher should be sometimes available. Some pupils outside the class come and interfere the session that they are not able to learn freely when the teacher is not around. So they prefer the guidance from the teacher. Or sometimes, when they are learning independently, teachers should be available to hear that the learning session is smooth and free from outside distraction. And they are commenting that the system should be improved in form of Internet and power system. When there is any problem with the power or Internet, the learning becomes distorted. So that is the summary for Standard 5 boys.

**R:** [0:27:35] Thank you very much. Very good feedback. Thank you.



**Focus Group Discussion with KAR-G6 (Standard 6, Girls)**  
**(English Summary Transcript)**

**M:** We are grateful, I think you are Standard 6 girls.

**KAR-G6-1:** Yes. (all agree)

**M:** You have learned about the use of tablets, right? And you have learned with teachers.

**KAR-G6-2:** Yes. (all agree)

**M:** Now we come to know the progress of what you have learned together with the teacher and when you were alone.

**KAR-G6-3:** Yes. (all agree)

**M:** When you are studying using the tablets, what did you liked most?

**KAR-G6-1:** Mathematics.

**M:** You liked Mathematics? So there in Mathematics, what are you doing?

**KAR-G6-1:** I like division.

**M:** Very nice. So you liked Mathematics because it helps you in division. And you?

**KAR-G6-2:** I like to read.

**M:** So you like to read? What do you like to read?

**KAR-G6-2:** I like to read Civics and Ethics.

**M:** So one likes Mathematics and one likes Civics and Ethics. Very nice. And how about you?

**KAR-G6-3:** I like Mathematics.

**M:** How does the system help you in Mathematics?

**KAR-G6-3:** It helps me to calculate things.

**M:** And you?

**KAR-G6-4:** I like Mathematics.

**M:** There is no other subject or lesson you love different from Mathematics? And you?

**KAR-G6-5:** I like Mathematics.

**M:** So, very nice. So tablets help you in calculation? Does the use of tablets help you to increase your performance in the class?

**KAR-G6-5:** Yes. (all agree)

**M:** Very nice. What lessons do you like most when you open up your tablets and what lesson you dislike when you are using tablets?

**KAR-G6-4:** We like Ubongo Kids. (all agree)

**M:** So all of you like Ubongo Kids?

**KAR-G6-4:** Yes. (all agree)

**M:** What are you learning from the Ubongo Kids.

**KAR-G6-1:** I get different skills.

**KAR-G6-2:** I like Wikipedia in the tablets.

**M:** Very nice. How do tablets help you in your personal life? For example, you have been given a tablet to use it. How is it helpful for you when you are at home or at school?

**KAR-G6-1:** It helps me to foster cooperation and love.

**M:** So through the use of tablets you get cooperation from your fellow students?

**KAR-G6-1:** Yes.

**M:** And another one? She says that she learns cooperation and love. Something different for you?

**KAR-G6-2:** Cooperation also.

**KAR-G6-3:** Taking care of my fellow colleagues.

**M:** How do tablets help you in caring your fellows?

**KAR-G6-3:** Through Civics subjects.

**M:** Is there something that you don't really like when you're studying? Meaning, that when you are using the tablets, maybe you're searching for Mathematics or Civics, you say that this I must tell to the teacher?

**KAR-G6-1:** Language.

**M:** Language? What is the problem with language? Everyone briefly explains about the language.

**KAR-G6-2:** We don't know the English language.

**M:** So, English language is the challenge for you? Thank you very much. Because you spoke the truth, so who tends to help you when the language is a challenge?

**KAR-G6-2:** The teacher.

**M:** What time do you study? And which days of the week?

**KAR-G6-2:** From 12:00am to 13:00pm on Monday, Wednesday and Friday.

**M:** So is the time enough for you to study the e learning subject or tablets?

**KAR-G6-3:** The time is not enough. (all agree)

**M:** So you need more time?

**KAR-G6-3:** Yes. (all agree)

**M:** Even if it's the whole week?

**KAR-G6-3:** Yes. (all agree)

**M:** That's good. So I believe that this year you are going to perform very well in your exams.

**KAR-G6-3:** Yes. (all agree)

**M:** Which one is better between leaning on tablets alone or learning together with the teacher?

**KAR-G6-2:** To learn alone.

**M:** Really?

**KAR-G6-4:** We like to learn together with the teachers because teachers correct us and give us guidance on how to use tablets. Also, we like to learn together with our fellow colleagues because they correct us in a polite language.

**M:** Can every one tell me why the teacher should be there? How does the teacher help you more in the use of tablets?

**KAR-G6-1:** Because he gives me directions.

**KAR-G6-2:** When I fail to use tablets, he helps me.

**M:** So you are happy when the teacher is in the room?

**KAR-G6-4:** If I fail to understand English language, he helps me.

**M:** What are the changes that you observed before and after the use of tablets?

**KAR-G6-3:** Before the use of tablets, our performance in the exams was very low. Also, before we did not know how to read and do Mathematics.

**M:** And after the use of tablets, what are the changes?

**KAR-G6-1:** After use of tablets, now we know how to write and how to count and our performance is also good.

**M:** Has the teacher ever used tablets in the classroom?

**KAR-G6-1:** No.

**M:** Would you like using tablets in the class?

**KAR-G6-5:** Yes.

**M:** Why?

**KAR-G6-5:** So that I can learn more.

**M:** My last question is what is your opinion or advice?

**KAR-G6-5:** Tablets should be added.

**SW:** [0:15:49] This is the girls Standard 6. Question number one: "What did you like mostly? What did you like in e-learning system?" Most of girls they say they like to learn Mathematics, especially in division. And another one she says she is interested in Civics. And the e-learning system has helped them to improve performance in the class.

**SW:** [0:16:36] And the second question was: "Which of the programs did you like most?" Most of them they say they like Ubongo Kids mostly. And another one says, she likes Wikipedia to know a variety of countries.

**SW:** [0:17:01] Number three: "How does it help you in your daily life?" They say learning through e-learning has helped them to learn in terms of cooperation and teamwork. As well as the knowledge from Civics studies. Here I can explain that they like because they expand their knowledge through Civics subject. In the Tanzanian curriculum Civics has many, many things. So as student, they learn many things through the tablets and e-learning helps them.

**SW:** [0:18:02] Question number four was –

**R:** [0:18:05] Maybe on the cooperation, that specific point in the group. Because before knowledge, they said they learned to cooperate?

**SW:** [0:18:18] Yes, they learned to cooperate between themselves. And also with the teacher.

**R:** [0:18:23] With teachers and among themselves, or?

**SW:** [0:18:27] Yes, among themselves. Because they are free (unintelligible) Ubongo Kids.

**SW:** [0:18:34] Question number four was: “What did you not like? Or what were the challenges?” They say most of them, for sure English language was the problem, because they don’t know that language. So that is the most challenging for them. Even if they want to search themselves they can’t. So teacher must be there to guide them. If you want to search for this and this you have to come here, here and here. So for them that is a challenge, English language.

**SW:** [0:19:17] Question number five was: “Was the time with the e-learning system sufficient?” And they say the time was not enough for them. Even if they study for three days per week it is not enough. They would like to study even the whole day. Those two days remaining they would like to study.

**SW:** [0:19:44] Also, question number six was: “How was it to learn independently without your teacher?” They say it was difficult to learn independently. And something difficult, they are not able to solve it in absence of teacher, because of language. So they can’t (learn?) independently themselves because language is a barrier for them.

**SW:** [0:20:20] And questions number seven was: “Did the tablets help you to learn together?” They say we learn together and independently. Teachers help us in difficult questions. So they like to learn independently, but most of the time teachers helped them.

**SW:** [0:20:49] Question number eight: “What (changes?) did you observe in the way you learn?” They say e-learning had given us extra time to learn, hence, improved our class performance. So, they observed that their performance in the class, it is a problem. So through e-learning they improve their performance in the class. So before, performance is the problem, but now, for them, performance is not a problem again.

**SW:** [0:21:35] Also, question number nine was: “How could you use the tablet within your classroom lesson?” They say in the normal classes they don’t use tablets in lessons unless special learning session only. So there, when the teacher was there, they didn’t use tablets. If they are here, it is the session for e-learning, they come and learn.

**SW:** [0:22:03] And the last question was: “Would you like to add any further comment or observation?” They say we would like to use the system with the other pupils, so that they can gain the knowledge and the benefits from the e-learning system. So they like to share with their friends in order they can share ideas. Today we look about Mathematics in division or addition, they like the others to know how did we do division or how did we do addition? So that is their comment.

**R:** [0:22:55] OK. Thank you very much.

**Focus Group Discussion with KAR-B6 (Standard 6, Boys)**

**(English Summary Transcript)**

**M:** Are you good children? So, we are proceeding with the session on how to use tablets in learning. Last time he came here and gave good instruction and guidance, and hope when he left, you continued learning with your teacher. So, today we will be asking you some interesting questions and hope you will enjoy the session. Don't be afraid to answer any question, when you're asked try to answer confidently with a high voice so that the audio recording is clear. So, please don't be afraid. We are not taking videos, pictures or your names. Just feel free. Are you okay? So, I am asking you: When you were learning with your teacher using tablets, what did you like the most?

**KAR-B6-1:** It has simplified learning, especially calculating Mathematics, division and subtraction.

**M:** So, the e-learning has helped you to be able to calculate Mathematics easily. Okay, the other thing you liked the most, please, in learning using tablets?

**KAR-B6-2:** To calculate whole numbers and Mathematics.

**M:** Another one who liked something different?

**KAR-B6-3:** To learn and answer Kiswahili questions.

**M:** Someone else who learned and liked other things?

**KAR-B6-4:** To learn and get to know different continents and regions easily.

**M:** Okay, so all of you were able to use the tablets. Was there any problem, difficulty, or anything challenging with you learning using the tablets? Don't be afraid to answer, just feel free as it is anonymous.

**KAR-B6-4:** The main problem we experienced was before you came, that it was very difficult to use the system. Turning on and off and general use of the tablets in learning. Before, most pupils were not able to close all windows before turning off. So, upon turning on the tablet in the other day, one could find big number of windows open. Hence, distractions and boring in learning.

**KAR-B6-1:** Some new pupils in the session were setting passwords in the tablets. So, upon using it, one could find difficulties.

**M:** Okay, that's nice, then what thing or program did you like the most? That every time you use the program you find it interesting?

**KAR-B6-3:** I mostly like the file on calculating questions though I have forgotten its name.

**KAR-B6-4:** I like the program on addition and subtraction of numbers.

**KAR-B6-5:** I like most to use Ubongo Kids.

**M:** Someone else?

**KAR-B6-2:** Always when I open the tablet I like going to Wikipedia dictionary.

**M:** And you?

**KAR-B6-3:** I like Akili Akili.

**KAR-B6-4:** Me, I like reading story books in the tablet.

**M:** Wow, that's okay. So, do you think using the tablet is helpful and the knowledge you get from learning is helping you in your daily life and in the future?

**KAR-B6-1:** YES! It is helpful and will help us in the future. (all agree)

**M:** Wow, good. So do you think the time frame for learning that you had been given was sufficient for you to learn effectively?

**KAR-B6-4:** Yes, the time was much enough.

**M:** How much time had you been given to learn?

**KAR-B6-2:** From 12:00am to 03:30pm.

**M:** Very good. So how was learning on your own? I mean learning independently without your teacher? Was it interesting or challenging?

**KAR-B6-2:** We mostly liked to learn on ourselves independently without teacher's supervision as we had already captured the skills on how to use and explore materials from the system.

**M:** OK. So, how was it learning independently?

**KAR-B6-2:** It was interesting. Though sometimes teacher's absence led to some pupils outside of the session to interfere and make distractions in the class. Hence, we sometimes had to ask for teacher's supervision for learning to be free from outside distraction.

**M:** So while learning using the system, were you learning on your own? Or were you forming some small groups and learn together? What did you like, learning on your own or together?

**KAR-B6-2:** When the teacher was in the class, he asked us to form small groups and learn together. And sometimes one on his or her own. But when teacher left us for independent learning, some preferred learning on their own and some with others in groups.



**M:** Very nice. Now back to the eight weeks trial. What changes have you observed? What do you see is the improvement or any change that you see? Don't be afraid to give your response please.

**KAR-B6-2:** We have gained greater knowledge than before for sure on how to use the e-learning system. Most of us were used to go to Ubongo Kids. We were not able to explore more in the system and try to find questions and books. But now we can explore a number of files and questions that are useful. And it has helped us increase class performance compared to before.

**M:** Wow, good children, don't get tired or bothered please. So, how did you use the e-learning system in the class sessions?

**KAR-B6-1:** Our teacher sometimes asked us to find the programs for addition and subtraction while learning Mathematics.

**KAR-B6-2:** Sometimes our teacher instructed us in normal class session and after the session he distributed tasks and questions to do using the tablets.

**M:** Is there anything, any observation you would like to tell us that you have observed in the last eight weeks trial? Don't be afraid, just state anything. Any observation you would like to tell us.

**KAR-B6-2:** We have not understood the question properly.

**M:** I said that you might have observed anything good or bad, or feedback you would like to let us know or be aware of concerning your use of the e-learning system. So, can you tell us what observation or feedback you would like to add?

**KAR-B6-3:** He says that he has something (pointing to his fellow).

**M:** Please, can you tell me your observation?

**KAR-B6-2:** Some days back, when the District Officer came here at our school, he wanted to see the demonstration on how the e-learning works. So upon the completion of the demonstration, one pupil was asked to carry the box and the solar panel back to its storage room. And he pulled the panel accidentally. We don't know if he blocked some wire as it was functioning properly before. We were not able to learn for some days due to lack of charge in the tablets.

**M:** Anyone else?

**KAR-B6-3:** We would like to request more tablets as the number of pupils is much greater than the tablets available.

**M:** Thank you very much, good children. You have given out good feedback and we appreciate it. We hope that you will continue enjoying and learning using the system in the future. Be blessed.

**SW:** [0:22:19] Here is the summary on the questions being asked during the focus group discussion with the Standard 6 boys. Question number one: „What did you like in the e-learning system that you used during the past eight weeks?“ A good number of pupils responded to this question that they like mostly to use the tablet and the system to calculate, division, subtraction and the whole of Mathematics. And the other stated that they like to learn on Kiswahili questions. The other liked that they were able to know the regions and the continents of the earth through the system.

**SW:** [0:23:18] The question number two was that „Which of the programs did you like mostly? And which ones did you use most frequently?“ The question that was mostly attractive to the pupils. A large number of pupils were mostly liking to go to Ubongo Kids and mostly Akili Akili. And mostly also went to read storybooks. And Wikipedia dictionaries to learn about verbs and a number of ways which were difficult for them so that they could understand them well.

**SW:** [0:24:12] And „How does it help you in your daily life? Or long term?“ Pupils were able to declare that the system was and is still usable and will help them in their daily life for the long term. The knowledge they will gain through the e-learning system helps them in their life, in their future as they are able and they are planning to continue studying. So, the knowledge they gain will help them in their school life in the future and in their daily life as well.

**SW:** [0:24:55] Question number four was: „What did you not like? Or what was challenging when using the system?“ The pupils stated that it was difficult for them to turn off and turn on the tablets. Sometimes those pupils who were not able to use the tablets were joining them and try to turn on, turn off. And also sometimes the power was a problem. Some tablets were turned on, some were not. And that was a problem for them. So, it was difficult for them to use the tablets. Also, some pupils were not able to delete some tabs they have opened. They had turned off the tablets while the tabs they opened were still not closed. While someone wanted to turn on the tablet and try to find out some tab, a great number of tabs were opened. So make it difficult to find a specific tab they were looking for. And also, some pupils who were not able to use properly the tablets, were setting passwords in some files. So the passwords were not known to all pupils and when the tablets were exchanged among these pupils these passwords were confusing them in opening the files (unintelligible).

**SW:** [0:27:01] Question number five was: „Was the time with the e-learning system sufficient? Or where would you like more time?“ Major number of pupils declared that the time for using the tablets and the whole e-learning system was much enough. As they are able to use the tablets from 12:00am to 3:30pm, so they had about three and a half hours using these tablets. So the time for using the system was much enough for them.

**R:** [0:27:49] And how often in the week did you use it?

**SW:** [0:28:05] So they are using the system three times a week, Monday, Wednesday and Friday.

**SW:** [0:28:17] And question number six was: „How was it to learn independent without your teacher?“ The pupils stated that when they were independently learning using the system they were able to explore much. Everyone was able to go to the file or program of his or her interest and try to learn something which was confusing. So it was much, much interesting to them on their own. They were able to explore much what they were trying to look for. And they stated that they would like to learn with their teachers, as teachers were mostly guiding them how to go for those who the system was difficult for them to explore. Also, sometimes learning independently was confusing some of them as some noises arose when they were learning. And that when the teacher was available was able to control them and the learning was calm and interesting for all of them. The teacher was providing good guidance.

**SW:** [0:29:56] And question number eight was: „What changes did you observe in the way you learn?“ Pupils stated that before, they were not able to use the tablet and the system, especially in solving questions. And they were only limited to Ubongo Kids. But in the eight weeks they have been using this system they are now able to explore much on different systems and programs. So this is most of the changes observed that they're now able to use the tablet sufficiently and explore different programs.

**SW:** [0:31:04] And question number nine is: „How could you use the tablets within your classroom lessons?“ And the pupils responded that teacher was able to direct them and teach them on different questions, different ideas and use the tablet and e-learning system to distribute questions and some tasks. And so that they would be able to answer and respond to the given task in time. Also, the teacher ask the pupils in their lessons to search for questions and try to respond to the given questions from the e-learning system.

**R:** [0:31:56] So what did you like more: using the tablets here, on your own, or using the tablet in the classroom when the teacher guides you?

**SW:** [0:30:30] They say that when they are learning on their own they use much time learning to use this system. And when the teacher is available that some questions they find being difficult for them. So when the teacher is available he can try to solve the question using this system. So they like learning on their own independently because they learn for a long time. And everyone can explore more. But also they like learning with their teacher because some question they find difficult, the teacher is able to explain more and try to solve these questions.

**SW:** [0:34:11] And the last question was: „Would you like to add any further comment or observation?“ The pupils were able to declare that the system is good. They observed that it was helpful for them and despite a limited number

of tablets compared to the number of pupils at school. And the power was the most challenging. So they are commenting that they would like the system to be improved, especially on the power system. And the number of tablets is limiting. So they find them difficult to learn for a long time and other pupils want (unintelligible) [0:35:11] through the system. Generally, they commenting that the system, learning from this system is much interesting and super.

**R:** [0:35:22] Thank you very much.